BUREAU OF INDIAN AFFAIRS

DAM MODIFICATIONS

Tsaile Dam Modifications
Navajo Nation, Arizona

SOLICITATION NO. A14PS00163

ATTACHMENT J

U.S. Department of the Interior
Bureau of Indian Affairs
Gallup, NM

November 2013

BUREAU OF INDIAN AFFAIRS
NAVAJO REGIONAL SAFETY OF DAMS PROGRAM
TSAILE, ARIZONA

TSAILE DAM MODIFICATIONS

TECHNICAL SPECIFICATIONS

EXPIRATION DATE: 0&-'JO..15

NOVEMBER 22, 2013

Engineers:

Cooper Zietz Engineers, Inc.
2780 SE Harrison Street, Suite #104
Milwaukie, OR 97222

KLEINFELDER
Bright People. Right Solutions
611 Corporate Circle, Suite C
Golden, CO 80401

Project No. CDll-17-Tl

SECTION B – SUPPLIES OR SERVICES AND PRICES

Tsaile Dam Modification
Navajo Nation, Arizona

B.1 SCHEDULE

(a) Offers will be considered for award on the following schedule, but no offer will be considered for award on only a part of the schedule

(b) All offers are subject to the terms and conditions of this solicitation.

(c) The quantities in the schedule are estimated quantities for comparison of offers only, and except as provided in the contract clause at FAR 52.211-18, Variation in Estimated Quantity, no claim shall be made against the Government for overruns or underruns.

(d) See the contract clause at WBR 1452.232-81, Payment for Mobilization and Demobilization, for CLIN 1.

(e) Definitions:

(1) CLIN – Contract Line Item Number

SCHEDULE

CLIN	Supplies or Services	Quantity and Unit	Unit Price	Amount
1	Mobilization and Demobilization	For the lump sum of		$
2	Clear and Grub	6 AC		$
3	Diversion and Care of Stream During Construction	For the lump sum of		$
4	Dewatering	For the lump sum of		$
5	Relocate and Reconstruct BIA Road 8077	For the lump sum of		$
6	Construct, Maintain and Remove Temporary Access Road	For the lump sum of		$
7	Foundation Cleanup and Preparation	28,300 yd^2	$	$
8	Drill Holes for Grouting	1,388 LF		$
9	Mobilize for Grouting	For the lump sum of		$
10	Mix and Inject Grout	690 Sacks	$	$
11	Remove Existing Dam to Stockpile	202,000 yd^3	$	$

SCHEDULE

CLIN	Supplies or Services	Quantity and Unit	Unit Price	Amount
12	Furnish and Place Zone 1 Core	26,300 yd^3	$	$
13	Furnish and Place Zone 2 Shell	129,700 yd^3	$	$
14	Furnish and Place Zone 3 Sand Filter	7,500 yd^3	$	$
15	Furnish and Place Zone 4 Gravel Drain	1,600 yd^3	$	$
16	Furnish and Place Type 1 Riprap	10,500 yd^3	$	$
17	Excavate for Structures	5,050 yd^3	$	$
18	Construct Outlet Works Structures	For the lump sum of		$
19	Furnish and Install Outlet Pipe	280 LF	$	$
20	Furnish and Install Outlet Gates, Bulkhead and Trashrack	For the lump sum of		$
21	Furnish and Place Precast Concrete Culverts, Wingwalls, Headwalls and Manholes	For the lump sum of		$
22	Furnish and Install Prefabricated Bridge	For the lump sum of		$
23	Furnish and Install Toe Drains	For the lump sum of		$
24	Water Pollution Control	For the lump sum of		$
25	Furnish and Install Miscellaneous Metalwork	For the lump sum of		$
26	Furnish and Install Geotechnical Instrumentation	For the lump sum of		$
27	Site Restoration	For the lump sum of		$
28	Bonding	For the lump sum of		$
29	Insurance	For the lump sum of		$
30	Taxes	For the lump sum of		$
31	Electrically Operated Hydraulic Power Units	For the lump sum of		$
	TOTAL FOR SCHEDULE	$		

END OF SCHEDULE

Tsaile Dam Modification

FOREWORD

Tsaile Dam is located in the Tsaile/Wheatfields Chapter of the Navajo Nation, approximately 21.5 miles northeast of Chinle, Arizona, in Apache County.

A. Work includes:

Excavation, realignment and reconstruction of the existing embankment dam; demolition of the existing outlet works, siphons and associated structures; construction of the new outlet works including inlet structure, slide gates and gate operating systems, new DIP outlet conduit and energy dissipation structure; construction of a toe drain system with instrumentation wells; realignment of BIA Road 8077 including spillway culvert installation; furnish and install new control building with associated utilities; furnish and install new prefabricated bridge.

TELEPHONE INQUIRIES REGARDING THIS SOLICITATION SHOULD BE MADE TO:

Contractual issues: Attn: Charmaine Williams, Contracting Officer, (CO),

_____

_____

Telephone (505) 863-8227

PRE-BID SITE VISIT: A PREBID SITE VISIT WILL BE HELD ON *{insert date}, {insert location}, beginning at {insert time}.* **PROSPECTIVE BIDDERS CONTACT {***insert contact person***} AT THE TELEPHONE NUMBER LISTED ABOVE**.

FOR DATE AND PLACE OF BID OPENING, SEE "SOLICITATION, OFFER, AND AWARD," STANDARD FORM 1442.

This page intentionally left blank.

SECTION C - SPECIFICATIONS

TABLE OF CONTENTS

END OF CONTENTS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 LOCATION

A. Work is located in the Tsaile/Wheatfields Chapter of the Navajo Nation, approximately 21.5 miles northeast of Chinle, Arizona, in Apache County.

1.2 PRINCIPAL COMPONENTS OF WORK

A. Obtain all required permits.

B. Provide COR's jobsite trailer with associated facilities and services.

C. Excavate materials as shown on the plans, or as directed by the COR.

D. Modifications to Dam

1. Constructing a temporary realignment of BIA Road 8077, acting as a temporary cofferdam, and diverting the stream.
2. Excavating most of the existing dam embankment and stockpiling materials separately in the borrow or staging area.
3. Excavating rock for dam foundation key trench.
4. Cleaning and grout treatment of rock exposed in the dam foundation.
5. Drilling and installing grout curtain in dam foundation.
6. Reconstructing dam by placing and compacting zoned embankment fill.
7. Installing geotechnical instrumentation.

E. Demolition of the Existing Outlet Works and Construction of the Outlet Works:

1. Demolition and removal of existing CMP outlet conduit and inlet gate structure.
2. Demolition and removal of the existing siphons. (To be salvaged by NNSOD.)
3. Furnishing and installing ductile iron pipe outlet pipe.
4. Constructing cast-in-place concrete intake tower structure with required trashracks, bulkhead, gates and valves and associated gate operators, hand-pump hydraulic system, instrumentation and photovoltaic power system.
5. Furnishing and installing prefabricated bridge from upstream crest of dam to the intake tower structure.

6. Constructing a cast-in-place concrete outlet works dissipation structure and riprap channel.

7. Excavating rock for the outlet conduit trench and outlet discharge channel.

F. Toe Drain:

1. Constructing sand blanket drain, zoned blanket drain with toe drain pipes and cleanouts.

2. Furnishing and installing a precast concrete inspection well with measurement weir and instrumentation.

G. Excavating spillway channel and installing precast concrete culverts.

H. Re-establish BIA Road 8077 across the spillway and along the downstream slope of the realigned dam and remove the temporary alignment of BIA Road 8077.

I. Furnishing and installing a control room structure, with associated utilities and features.

J. Demolish and dispose of upstream concrete ogee in the spillway.

K. Site restoration.

1.3 SPECIFICATIONS REQUIREMENTS

A. Requirements in Division 1, General Requirements, apply to Divisions 2 through 53.

B. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.

C. Where specifications are written in streamlined form, the words “shall be” are included by inference where a colon (:) is used within the sentence or phrase.

1.4 DEFINITIONS

A. When the specifications use a word or term defined in the Federal Acquisition Regulations (FAR), the definition of the word or term shall be in accordance with FAR sections in effect at the time the solicitation was issued.

1.5 ACRONYMS

A. The following acronyms apply to specifications Divisions 1 through 53:

1. CO: Contracting Officer

2. COR: Contracting Officer’s Representative

3. Tribe or Tribal: Navajo Nation

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This page intentionally left blank.

SECTION 01 14 10
USE OF SITE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for Site Restoration.

1.2 REFERENCE STANDARDS

A. Bureau of Reclamation (USBR)

1. USBR Cleaning Manual — Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (Technical Memorandum No. 86-68220-07-05) 2010 Edition
Available online at:
http://www.usbr.gov/mussels/prevention

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 14 10-1, Land use and landscape rehabilitation plan:

1. For each Contractor use site on Tribal land.

a. Show use location and extent of impact. Uses include but are not limited to the following:

1) Buildings and service areas including offices, shops, warehouses, storage areas, fuel and oil storage areas, and fabrication yards.

2) Parking areas, temporary roads, and haul routes.

3) Utilities including air, power, and water lines; fire hydrants; and compressor station.

4) First-aid and medical facilities.

5) Areas for processing, storing, and disposing of waste materials from construction operations.

6) Temporary fences.

b. Describe methods to preserve, protect, and repair if damaged, vegetation (such as trees, shrubs, and grass) and other landscape features on or adjacent to the jobsite, which are not to be removed and which do not

interfere with the work required under this contract. Include methods to mark work area limits, protect disturbed areas, and prevent erosion.

c. Describe methods to protect, and repair if damaged, existing improvements and utilities at or near the jobsite.

d. Describe methods for removing temporary structures and facilities, cleanup, and rehabilitating site after completion of construction activities.

2. Submit revised drawings of changes in use of Tribal land made during design and erection stages or after use of Tribal land is in operation.

1.4 PROJECT CONDITIONS

A. Project is located on Tribal land.

1. Use construction easement shown on drawings for required construction facilities.

2. Location, construction, operation, maintenance, and removal of construction facilities on Tribal land will be subject to approval of the COR.

B. Housing for construction personnel will not be permitted at jobsite, except temporary housing for guards or watchmen approved by the COR.

C. When private land is used for construction facilities, or other construction purposes, make necessary arrangements with landowner for use of land.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CLEANING

A. Construction equipment:

1. Before bringing on site, clean construction equipment to remove dirt, vegetation, and other organic material to prevent introduction of noxious weeds, and invasive plant and animal species.

2. Contractor cleaning procedures shall result in equipment being cleaned as well or better than the procedures described in USBR Cleaning Manual.

3. The COR will inspect construction equipment following procedures described in USBR Cleaning Manual before allowing the equipment onsite.

3.2 RESTORATION

A. Restore temporary construction roads to original contours and/or contours shown on the plans and make impassable to vehicular traffic when no longer required.

B. After completion of work, scarify and regrade land used for construction purposes and not required for completed installation so that surfaces blend with natural terrain and are in a condition that will provide proper drainage and prevent erosion.

C. Seed disturbed areas of land used for construction purposes and not required for completed installation in accordance with Section 32 92 20 - Seeding and Soil Supplements.

END OF SECTION

This page intentionally left blank.

SECTION 01 32 10
CONSTRUCTION PROGRAM

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Developing Baseline Schedule: Include in lump sum price offered in the schedule for mobilization and preparatory work.

2. Updating and Using Construction Program: Include as an element of Contractor's overhead.

1.2 REFERENCE STANDARDS

A. Associated General Contractors of America (AGC)

1. AGC Manual Construction Planning and Scheduling Manual, 2004

1.3 DEFINITIONS

A. Schedule: The Critical Path Method (CPM) of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the project.

B. Project Calendar: Cross reference of numerical work days with calendar days. The project calendar serves as the basis for the day/date conversion and assigns work days, rest days, and holidays.

C. Resources: Equipment, labor or crews, materials, subcontractors, fabricators, manufacturers, and consultants.

D. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

1. Furnish data on CD-ROM disc.

2. Furnish database files in format compatible with Primavera Project Planner, Version 3.0 or higher, or Microsoft Project, version current as of date of contract.

B. RSN 01 32 10-1, Baseline Schedule:

1. Include:
    a. Construction Program database with activity and milestone data.
    b. Definition of workday calendars.
    c. Bar chart for project or bar charts for each subnetwork.
    d. Activity report including all logic constraints.
    e. RSN submittal register.
    f. Table listing equipment, manpower, and material limitations used to produce baseline schedule. This listing may be independent of the schedule database.

C. RSN 01 32 10-2, Updated Schedule:
1. Include:
    a. Construction Program database with updated activity and milestone data.
    b. Definition of workday calendars.
    c. Bar chart for project or bar charts for each subnetwork.
    d. Narrative report specifically stating status of project in terms of total float.
        1) If negative float exists, cite specific actions and conditions which caused the "behind schedule" condition and provide proposed course of action to complete the project within the specified delivery time.
        2) List of Contractor-initiated changes to the current schedule stating the reason for the action taken and any unresolved issues relating to the Construction Program. Government reserves the right to reject Contractor-initiated changes to the current schedule which negatively impact any Government action which was initiated on the basis of the current schedule.

D. RSN 01 32 10-3, Time Impact Analysis:
1. Include:
    a. Construction Program database with proposed revised activity and milestone data.
    b. Proposed revised schedule due to the change or delay with added, changed, or deleted activities highlighted.
    c. Table comparing results of two mathematical analyses.

1.5 QUALIFICATIONS

A. Representative: Full-time, on site employee experienced in developing and maintaining construction schedules.

1.6 SCHEDULES AND TIME IMPACT ANALYSIS

A. Develop, maintain, and use approved Construction Program to plan, monitor, and evaluate, and report accomplishment of work.

B. Prepare Construction Program using Critical Path Method, under concepts and methods outlined in AGC Manual.

1. Use the Precedence Diagramming Method (PDM) in preparing the CPM networked schedule.
2. Prepare detailed activity network for accomplishing required work.
3. All activities except “Award” shall have predecessor activities and all activities except “Contract Complete” shall have successor activities.
4. Meet contract requirements; milestone(s) in accordance with the clause at FAR 52.211-10, Commencement, Prosecution, and Completion of Work.
5. Prepare schedule based on required sequence and interdependence of activities.
6. Include work of subcontractors, COR interfaces, and contract milestones.
7. Adjust Construction Program/Schedule for seasonal weather conditions.
8. Define activities to a level of detail resulting in their durations being no greater than 15 workdays or 20 shifts unless otherwise accepted by CO.
    a. Durations for administrative activities (e.g., submittals and reviews, fabrication, manufacturing), or other specific activities identified in the contract will not be subject to the 15-workday or 20-shift limitation.
    b. Include activities for COR reviews and approvals in accordance with Section 01 33 00 - Submittals.

C. Failure to include any element of the work will not release Contractor from completing all required work under the contract.

D. Performance will be evaluated by the COR using CPM schedules.

E. Upon request, provide all information and data used to develop and maintain the Construction Program to the COR.

F. Include contract title, contract number, and Contractor's name on each sheet.

G. Include table of abbreviations used in the schedule, listed and defined alphabetically.

H. Use a computer software program to perform a mathematical analysis of the scheduling data.

1. Use only finish to start logic relationships between activities. Do not use negative lead or lag times.

2. Use durations in units of whole workdays.

3. Provide best estimate of time required to complete the activity considering the quantity of work and planned resources for the activity.

4. Equate durations of COR reviews and other identified actions to the maximum number of calendar days specified in their respective paragraphs.

5. Establish workday calendar(s) and use these in the mathematical analysis to translate the activity's workday duration into calendar dates.

I. Baseline Schedule:

1. Represents Contractor’s as-planned approach to accomplishing the work. Do not include actual start dates, percent completes, or actual finish dates.

2. Include interim milestone dates, COR interface dates, contract completion date, and other time constraints specified in the contract documents.

3. For each activity, display identification number, description, duration, early start date, early finish date, total float, and calendar identification.

J. Updated Schedule:

1. Meet monthly with COR at Government’s project office to review progress made to the end date of the progress payment period.

   a. Establish dates that activities were started and completed and remaining duration for each activity started but not completed during the period.

   b. Discuss and mutually agree upon changes in logic and schedule.

   c. Update schedule and Construction Program database with mutually agreed upon changes.

2. Perform mathematical analysis on the updated database to determine current project status.

3. Following receipt of an executed contract modification, incorporate the activity data and logic relationships stipulated in the modification into the current schedule for inclusion in the next scheduled progress update.

K. Time Impact Evaluation:

1. Provide a time impact evaluation for any contract change, e.g., a change order, proposed modification, or value engineering proposal. Provide a time impact evaluation to support a claim or request for an equitable adjustment to the contract which involves a delay or accelerated schedule.

2. The COR may use time impact evaluation to determine if a time extension or reduction to the contract milestone dates is justified.

3. A time impact evaluation is applicable whether the Contractor's current schedule milestone dates are the same as, earlier, or later than, those required under the contract.

4. Changes, additions, or deletions to activities; activity durations; or activity time frames will not automatically mean that an extension or reduction of contract time is warranted or due the Contractor.

5. Time extensions for performance will be considered only to the extent that the Contractor's current scheduled milestone dates exceed the contract milestone dates.

6. For all activities directly affected by the change or delay, include the current and proposed items:

    a. Activity description.

    b. Types and quantities of major pieces of equipment, principal manpower, and pacing materials (materials that affect activity start, duration, or finish).

    c. Activity duration.

    d. Earnings.

    e. A narrative containing the rationale used in developing the proposed logic relationships and activity data.

7. Float is not for the exclusive use by or benefit of either the Government or the Contractor.

8. Prepare a single time impact evaluation for all modifications issued after Notice to Proceed (NTP) and prior to approval of the baseline schedule. Submit the time impact evaluation with the first progress update.

9. Perform time impact evaluations using data in the most recent approved schedule prior to change or delay event.

    a. Prepare proposed revised schedule and narrative description describing and highlighting where changes or delays will be included.

    b. Prepare table comparing the results of two mathematical analyses: One using current schedule data from the last approved schedule prior to event requiring evaluation, and one using proposed schedule data incorporating the changes or delays.

        1) Show contract milestones and activities whose periods of performance have shifted as a result of any change which affects production and/or manufacture schedules, material orders, construction seasons, and labor and/or equipment utilization.

        2) Base mathematical analyses on status of work and available float at the time the COR directs or proposes a change to the work, the

Contractor submits a value engineering proposal, or when a delay occurs.

1.7 REVIEW AND EVALUATION

A. Baseline Schedule:

1. Within 20 calendar days after receipt of baseline schedule:

   a. COR will accept or reject the proposed baseline schedule.

   b. Upon request from the COR, meet with COR for a joint review of the proposed baseline schedule.

   c. If schedule is rejected, revise and resubmit within 7 calendar days following the date of the rejection letter.

2. Do not proceed with onsite work, except mobilization and surveying, until baseline schedule has been approved by the COR.

B. Updated schedules:

1. The COR will require 7 calendar days after receipt of each monthly update to review and approve or reject the updated schedule.

2. If the updated schedule is rejected, revise and resubmit updated schedule within 7 calendar days following the date of the rejection letter.

1.8 FAILURE TO COMPLY

A. Failure to comply with the requirements of this Section shall be grounds for a determination by the COR that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the specified time.

B. The CO may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00 - SUBMITTALS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedules for other items of work.

1.2 DEFINITIONS

A. Days: Calendar days.

B. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.

C. Submittal Types, as listed in Table 01 33 00A – List of Submittals:

1. A – Approval:
    a. COR will approve or disapprove these submittals.
    b. Approval submittals are considered to be “shop drawings” within the terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction.
2. I – Informational:
    a. The COR will acknowledge receipt of these submittals.
    b. The COR may reject an Informational submittal when the submittal does not comply with the contract. The Contractor shall correct mistakes or deficiencies in rejected Informational submittals and resubmit.
    c. Informational submittals are considered to be “shop drawings” within the terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction, except that approval by the COR is not required.

1.3 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.
3. Measurement units: US Customary Units.

C. Drawings:

1. Minimum identification in title block:
    a. Contract number and title.
    b. Contractor's or supplier's title and drawing number.
    c. Date.
2. Provide space next to title block for review stamps.
3. Size: D size (22 inches by 34 inches).
4. Draw to scale with neat lettering using drafting equipment or computer drafting equipment.
5. Final drawings:
    a. AUTOCAD® format (.dwg), Version 2011.
    b. On CD-ROM disc.
    c. Original D size (22 inches by 34 inches) plots.
    d. Show as-built changes, including revision dates, made during installation.

D. Product Data:

1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets.
    a. Identify manufacturer's name, type, model, size, and characteristics.
    b. Illustrate that product or equipment meets requirements of specifications.
    c. Mark items to be furnished in a manner that will be clear and legible after photocopying. Do not use highlighter.
    d. Strike through items that do not apply.

E. Certifications:

1. Certifications by a registered professional: Signed and sealed by registered professional.
2. Manufacturer's certifications: Signed by authorized representative of manufacturer.

F. Manuals:

1. Copies:
    a. Printed copies: Bound and indexed.
    b. Electronic copies: Adobe PDF on CD-ROM discs.
2. Contents:
    a. Parts identification lists, lists of special tools, and accessories.

b. Schematics and wiring diagrams.

c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.

d. As-built drawings, photographs, and test records or reports if required by the specifications.

1.4 SUBMITTALS PROCEDURES

A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.

B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01 33 00A - List of Submittals. A complete set includes all listed items for RSNs with multiple parts.

C. Submit number of sets specified in "No. of sets to be sent to:" columns in Table 01 33 00A - List of Submittals.

D. Include the following information in transmittal letters:

1. Contract number and title.
2. RSN for each attached submittal.
3. Responsible code.
4. Number of sets for each RSN.
5. Identify submittal as initial or resubmittal.

E. More than one RSN may be submitted under a transmittal letter, provided the responsible code is the same.

1.5 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 10 business days for review of each submittal or resubmittal, unless otherwise specified.
2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through return mailing postmark date.

B. Time in Excess of Specified:

1. The CO may extend the contract completion date to allow additional time for completing work affected by excess review time.
    a. The time extension will be to the extent that excess review time caused delay to the contract completion date.

b. The time extension will not exceed the time used in excess of the specified number of days for review of submittals or resubmittals.

c. Concurrent days of excess review time resulting from review of two or more separate submittals or resubmittals will be counted only once in extending the contract completion date.

2. No time extension will be allowed if the Contractor fails to make complete approval submittals in sequence and within time periods specified.

3. Adjustment for delay will be made only to the extent that:

a. Approval was required under the contract, and

b. Requests for approval were properly and timely submitted and were approved.

4. Adjustment will be subject to terms of paragraphs (b) and (c) of the clause at FAR 52.242-14, Suspension of Work, however, no such delay shall be deemed to be a "suspension order" as the term is used in that clause.

C. Return of Submittals:

1. One set of submittals required for approval will be returned either approved, approved subject to identified changes, or not approved.

2. Submittals not approved:

a. Revise and resubmit for approval.

b. Show changes and revisions with revision date.

c. Describe reasons for significant changes in transmittal letter.

d. Resubmit returned submittals within 10 business days after receiving the comments, unless otherwise specified.

e. Requirements for initial submittals apply to resubmittals.

3. Do not change designs without approval of the COR after approval drawings, documentation, and technical data have been approved.

4. The COR will acknowledge Informational submittals.

a. Informational submittals will not be returned when they comply with the specifications.

b. Informational submittals that do not comply with the specifications may be returned for resubmittal or additional information may be requested.

1.6 TRANSMITTAL

A. Addresses for codes listed in Table 01 33 00A - List of Submittals:

1. CO: Contracting Officer, Attn: Lynelle Benallie, Bureau of Indian Affairs, Navajo Region, Branch of Contracts, P.O. Box 1060, Gallup, NM 87305.

(Express Mail to: Federal Building, 3rd Floor, 301 W. Hill Street, Gallup, NM 87301).

2. COR: Contracting Officer's Representative, Pearl Chamberlin, BIA IPSOD, 301 W. Hill Street, Gallup, NM, 87301

3. BIA CM: Construction Manager, Mike Vail, BIA, 13922 Denver West Pkwy, Bldg. 54, Lakewood, CO 80401

4. AE CMs: Construction Managers, Paul Kluvers, Cooper Zietz Engineers, 2780 SE Harrison Street, Suite 104, Milwaukie, OR 97222

   Rodney Eisenbraun, Kleinfelder, 611 Corporate Cir., Ste. C, Golden, CO 80401

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01 33 00A – List of Submittals.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not the responsible code, but show "No. of sets to be sent to" in Table 01 33 00A – List of Submittals.

D. Submittals required by the specifications, but not listed in Table 01 33 00A - List of Submittals:

1. Submit in accordance with this section.

2. Submit to COR unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 28 days before use of land	A	COR	1	3	2	
01 32 10-1	Construction Program	Baseline Schedule: 1. Blackline prints 2. Reports 3. Data uploaded to AE CM provided SharePoint site	Within 21 days after receipt of Notice to Proceed	A	COR	 0 0 0	 3 3 0	 2 2 0	 1
01 32 10-2	Construction Program	Updated Schedule: 1. Blackline prints 2. Reports 3. Data uploaded to AE CM provided SharePoint site	With monthly requests for progress payments	A	COR	 1 1 0	 3 3 0	 2 2 0	 1
01 32 10-3	Construction Program	Time Impact Analysis: 1. Blackline prints 2. Reports 3. Data uploaded to AE CM provided SharePoint site	Within 28 days after the CO directs a contract change, with any proposal for a future modification, with any value engineering proposal, or with any request or claim for an equitable adjustment to the contract	A	COR	 1 1 0	 3 3 0	 2 2 0	 1
01 33 26-1	Electrical Drawings and Data	Drawings, General	At least 28 days before start of related construction work	A	COR	1	3	2	1

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
01 33 26-2	Electrical Drawings and Data	Approval Drawings and Data in Manufacturer's Format	At least 28 days before start of related construction work	A	COR	1	3	2	1
01 33 26-3	Electrical Drawings and Data	Test Reports	Within 7 days of test	A	COR	1	3	1	1
01 35 10-1	Material Safety Data Sheets	Complete LHM and MSDS	At least 14 days before jobsite delivery of hazardous material	I	COR	1	3	0	0
01 35 10-2	Material Safety Data Sheets	Updated LHM and MSDS	At least 14 days before jobsite delivery of hazardous material not previously listed	I	COR	1	5	0	0
01 35 20-1	Safety and Health	Safety Program	Submitted and accepted before commencing onsite work. See Section 3 of RSHS	A	COR	1	5	0	0
01 35 20-2	Safety and Health	Monthly Accident Summary Report	See paragraph 3.8 of RSHS	I	COR	1	3	0	0
01 35 22-1	First Aid	Medical Facilities Plan	Submitted and approved before start of operations	A	COR	0	3	0	0
01 35 30-1	Contractor's Onsite Safety Personnel	Qualifications	Submitted and accepted before commencing onsite work	A	COR	0	3	0	0
01 35 30-2	Contractor's Onsite Safety Personnel	Safety Inspection Reports	At least once per week	I	COR	1	3	0	0
01 46 00-1	Quality Procedures	Quality Procedures Plan	Within 14 days of notice to proceed	A	COR	0	3	0	0
01 55 00-1	Vehicular Access	Preconstruction Video	At least 14 days before start of onsite construction work	A	COR	0	3	2	0
01 55 00-2	Vehicular Access	Access Plan and Traffic Control Plan	At least 14 days before start of onsite construction work	A	COR	0	3	2	0
01 55 20-1	Traffic Control	Traffic Control Plan	At least 14 days before start of onsite construction work	A	COR	1	1	1	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
01 55 20-2	Traffic Control	Product Data	At least 14 days before delivery to the site	A	COR	1	1	1	2
01 56 10-1	Protection of Existing Installations	Existing Installations Protection Plan: Plan for protecting all existing installations not otherwise specifically noted	At least 14 days before start of onsite construction work	A	COR	0	3	2	1
01 56 15-1	Protection of Existing Utilities	Locating Utility Lines Plans	At least 14 days before start of onsite construction work	A	COR	0	3	2	1
01 57 30-1	Water Pollution Control	Pollution Prevention Plan	At least 14 days before start of onsite construction work	A	COR	0	3	2	1
01 57 30-2	Water Pollution Control	Spill Prevention, Control, and Countermeasure (SPCC) Plan	At least 14 days before delivery or storage of oil	A	COR	0	3	0	0
01 72 20-1	Surveying	Surveying Plan	At least 14 days before beginning survey work	A	COR	0	3	2	1
01 72 20-2	Surveying	Resume	At least 14 days before beginning survey work; At least 28 days before personnel change	I	COR	0	3	0	0
01 72 20-3	Surveying	Accuracy Check Results	At least 14 days before beginning survey work	I	COR	0	3	1	1
01 72 20-4	Surveying	Completed and Reduced Survey Notes	Within 2 days of completing and reducing notes	I	COR	0	3	1	1
01 72 20-5	Surveying	Survey Books or Electronic Data	Within 2 days of completing book or data files	I	COR	0	1	0	0
01 72 20-6	Surveying	Quantity Survey Notes and Computations	Accompanying progress payment requests	I	COR	0	3	1	1
01 72 20-7	Surveying	Workday's Survey Notes	At conclusion of workday when requested by COR	I	COR	0	3	0	0

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7 days of waste disposal	I	COR	0	3	0	0
01 74 00-2	Cleaning and Waste Management	Hazardous Wastes Manifest	Within 7 days of hazardous waste disposal	I	COR	0	3	0	0
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	At least 28 days before beginning environmental assessment	I	COR	0	3	0	0
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	Within 14 days after completion of work	I	COR	0	3	0	0
01 78 30-1	Project Record Documents	Final As-Built Drawings	Within 28 days after completion of work	A	COR	2	2	2	2
02 41 07-1	Removal of Existing Structure	Concrete removal plan	At least 14 days before start of related construction work	A	COR	1	1	1	2
03 11 10-1	Concrete Formwork	Formwork Design and Drawings for Concrete Structures	At least 14 days before start of related construction work	A	COR	0	3	2	2
03 15 00-1	Concrete Joints and Waterstop	Shop Drawings	At least 14 days before start of related construction work	A	COR	0	3	2	1
03 15 00-2	Concrete Joints and Waterstop	Samples	At least 14 days before delivery of material to jobsite	A	COR	0	3	2	1
03 15 20-1	Sponge Rubber Joint Filler	Approval Data	At least 14 days before start of related construction work	A	COR	0	3	2	1
03 20 00-1	Concrete Reinforcement	Reinforcement Diagrams and Lists	At least 14 days before beginning fabrication of reinforcements	A	COR	0	3	2	1
03 20 00-2	Concrete Reinforcement	Mill Certificates	At least 7 days before start of onsite construction work	A	COR	1	1	1	1
03 30 00-1	Cast-In-Place Concrete	Material Approval Data	At least 14 days before beginning fabrication of reinforcements	A	COR	0	3	2	1
03 30 00-2	Cast-In-Place Concrete	Materials Certifications and Test Reports	At least 14 days before jobsite work begins	A	COR	0	3	2	1

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
03 30 00-3	Cast-In-Place Concrete	Concrete Placement Drawings	At least 14 days before jobsite work begins	A	COR	0	3	2	1
03 30 00-4	Cast-In-Place Concrete	Concrete Placement Schedule	At least 14 days before jobsite work begins	A	COR	0	3	2	1
03 30 00-5	Cast-In-Place Concrete	Instructions	At least 14 days before jobsite work begins	A	COR	0	3	2	1
03 37 52-1	Slush Grouting	Placing Plan	At least 14 days before start of related construction work	A	COR	0	3	2	1
03 37 55-1	Dental Concrete	Mix Design	At least 14 days before start of related construction work	A	COR	0	3	2	1
03 37 58-1	Foundation Grouting	Shop Drawings, Grouting Test Program Plans	At least 60 days before start of related construction work	A	COR	1	3	1	2
03 37 58-2	Foundation Grouting	Shop Drawings, Production Grouting Plan	At least 15 work days prior to start of production grouting	A	COR	1	3	1	2
03 37 58-3	Foundation Grouting	Administrative, Statement of Qualifications	At least 14 days before start of related construction work	A	COR	1	2	1	1
03 37 58-4	Foundation Grouting	Quality Control, Grouting Records	Submit within one day of completion of a stage or grout hole	I	COR	1	3	2	1
03 37 58-4	Foundation Grouting	Quality Control, Survey Records	Submit within one day of completion of a stage or grout hole	I	COR	1	3	2	1
03 62 20-1	Grouting Mortar for Equipment and Metalwork	Packaged nonshrink grout data	At least 14 days before start of related construction work	A	COR	0	3	2	1
05 50 00-1	Metal Fabrications	Shop Drawings	At least 14 days before installations	A	COR	1	1	1	2
05 50 00-2	Metal Fabrications	Quality Control Plan	At least 14 days before installations	A	COR	1	1	1	2
05 50 00-3	Metal Fabrications	Mill Certificates	At least 7 days before start of onsite construction work	A	COR	1	1	1	2
05 50 00-4	Metal Fabrications	Manufacturer's Certificate	At least 14 days before installations	A	COR	1	1	1	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
07 53 10-1	Single Ply Membrane Roofing	Product Data	At least 14 days before start of related construction work	A	COR	0	3	2	1
07 53 10-2	Single Ply Membrane Roofing	Manufacturer's Installation Instructions	At least 14 days before delivery of material to jobsite	A	COR	0	3	2	1
07 53 10-3	Single Ply Membrane Roofing	Shop Drawings	At least 14 days before start of related construction work	A	COR	0	3	2	1
07 72 33-1	Roof Hatches	Product Data	At least 14 days before start of related construction work	A	COR	0	3	2	1
07 72 33-2	Roof Hatches	Manufacturer's Installation Instructions	At least 14 days before delivery of material to jobsite	A	COR	0	3	2	1
26 05 20-1	Grounding and Bonding	Approval Drawing	Within 60 days after notice to proceed	A	COR	0	2	1	1
26 05 20-2	Grounding and Bonding	Test Report	Within 28 days after test	A	COR	0	2	1	1
26 05 33-1	Electrical Conduit	Approval Data	Within 60 days after notice to proceed	A	COR	1	1	1	1
26 05 90-1	Wiring Checkout and Operational Tests	Test reports	Within 28 days after test	A	COR	1	1	1	1
26 27 31-1	Interior Lighting	Approval Data	Within 60 days after notice to proceed	A	COR	1	1	1	1
26 28 00-1	Solar and Electrical Equipment	Approval Drawings and Data	At least 14 days before start of related construction work	A	COR	2	2	2	1
26 28 00-2	Solar and Electrical Equipment	Final Drawings and Data	At least 14 days before start of related construction work	I	COR	1	2	2	1
26 28 00-3	Solar and Electrical Equipment	Notice Prior to On-Site Test	At least 14 days before test	I	COR	1	1	1	1
26 28 00-4	Solar and Electrical Equipment	Operations and Maintenance Manuals	Within 14 days of completion of related work	I	COR		1	2	1
31 03 10-1	Diversion and Care of Stream During Construction	Water control plan	At least 14 days before start of related construction work	A	COR	1	3	2	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
31 03 33-1	Removal of Water from Excavation	Removal of Water Plan	At least 14 days before beginning water removal and control operations	A	COR	0	3	2	2
31 20 00-1	Structural Backfill	Test Result	4 days after test completion	I	COR	1	1	1	2
31 20 00-2	Structural Backfill	Materials Data	At least 14 days before delivery to the site	A	COR	1	1	1	2
31 20 00-3	Structural Backfill	Product Data	At least 14 days before delivery to the site	A	COR	1	1	1	2
31 23 21-1	Excavation for Dam Embankment and Structure Foundations	Excavation Plan	At least 14 days before beginning excavation	A	COR	1	3	2	2
31 24 00-1	Embankments	Embankment Construction Plan	At least 14 days before beginning embankment construction	A	COR	1	3	2	2
31 24 12-1	Sand Filter	Certification and Laboratory Test Results	At least 14 days before beginning placement of sand filter	I	COR	0	3	2	2
31 24 16-1	Gravel Drain	Certification and Laboratory Test Results	At least 14 days before beginning placement of gravel drain	A	COR	0	3	2	2
31 25 00-1	Geotechnical Instrumentation	Shop Drawings	At least 14 days before start of related construction work	A	COR	0	3	2	2
31 25 00-2	Geotechnical Instrumentation	Administrative	Within 7 days after completion of work	A	COR	0	3	2	2
31 25 00-3	Geotechnical Instrumentation	Quality Control	At least 14 days before jobsite work begins	A	COR	0	3	2	2
31 32 32-1	Geotextile	Certifications and Data	At delivery of geotextile to jobsite	A	COR	0	3	2	2
31 37 00-1	Riprap	Materials Data and Test Results	At least 14 days before beginning placement of riprap	A	COR	0	3	2	2
32 15 10-1	Gravel Surfacing	Compaction Test Result	4 days after test completion	I	COR	1	1	1	2
32 15 10-2	Gravel Surfacing	Materials Source Data	At least 14 days before start of related construction work	A	COR	0	3	2	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
32 15 10-3	Gravel Surfacing	Manufacturer's Certificate	At least 14 days before start of related construction work	A	COR	0	3	2	2
32 15 10-4	Gravel Surfacing	Product Cost Data	At least 14 days before start of related construction work	A	COR	0	3	2	2
32 15 10-5	Gravel Surfacing	Product Data	At least 14 days before delivery to the site	A	COR	1	1	1	2
32 31 10-1	Chain Link Fence	Certifications	At delivery of fence to jobsite	A	COR	0	3	2	1
32 34 00-1	Prefabricated Bridge	Shop Drawings and Calculations	At least 14 days before start of related construction work	A	COR	0	3	2	1
32 34 00-2	Prefabricated Bridge	Mill Certificates	At delivery of materials to jobsite	I	COR	0	3	2	1
32 34 00-3	Prefabricated Bridge	Welder's Certifications	At least 14 days before start of related construction work	I	COR	0	3	2	1
32 34 00-4	Prefabricated Bridge	Welding test records	Within 7 days after completion of work	I	COR	0	3	2	1
32 34 00-5	Prefabricated Bridge	Qualifications	At least 14 days before start of related construction work	I	COR	0	3	2	1
32 34 00-6	Prefabricated Bridge	Certification, Product Data, Installation Instructions	At least 14 days before start of related construction work	A	COR	0	3	2	1
32 34 00-7	Prefabricated Bridge	Erection Drawings and Installation Instructions	At least 14 days before start of related construction work	A	COR	0	3	2	1
32 92 20-1	Seeding and Soil Supplements	Seeding Plan	At least 28 days before beginning seeding	A	COR	0	3	0	1
32 92 20-2	Seeding and Soil Supplements	Certifications	At delivery of seed to jobsite	A	COR	0	3	0	1
33 05 16-1	Precast Components	Shop Drawings	At least 28 days before beginning installation of components	A	COR	0	3	2	2
33 05 16-2	Precast Components	Manufacturer's Certificate	At least 28 days before beginning installation of components	A	COR	0	3	2	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
33 11 01-1	Ductile Iron Pipe	Approval Plans	At least 28 days before beginning installation of pipe	A	COR	1	3	2	2
33 11 01-2	Ductile Iron Pipe	Certificates	At least 28 days before beginning installation of pipes	A	COR	1	3	2	2
33 11 01-3	Ductile Iron Pipe	Installation and Sequencing Plan	At least 28 days before beginning installation of pipe	A	COR	1	3	2	2
33 11 18-1	HDPE Pipes for Intake Air Vent, and Hydraulic Lines	Approval Plans	At least 28 days before beginning installation of pipes	A	COR	1	3	2	2
33 11 18-2	HDPE Pipes for Intake Air Vent, and Hydraulic Lines	Certifications	At least 28 days before beginning installation of pipes	A	COR	0	3	2	2
33 42 13-1	Pipe Culvert	Product Data	At least 14 days before delivery to the site	A	COR	1	1	1	2
33 42 13-2	Pipe Culvert	Manufacturer's Certificate	At least 7 days before start of onsite construction work	A	COR	1	1	1	2
33 42 13-3	Pipe Culvert	Manufacturer's Installation Instructions	At least 7 days before start of onsite construction work	A	COR	1	1	1	2
33 46 36-1	Toe Drains and Inspection Wells	Approval Data	At least 28 days before beginning installation of pipes	A	COR	1	3	2	2
33 46 36-2	Toe Drains and Inspection Wells	Certifications	At delivery of pipe to jobsite	A	COR	0	3	2	2
33 46 36-3	Toe Drains and Inspection Wells	Samples	At least 14 days before beginning installation of pipes	A	COR	0	3	2	2
33 46 36-4	Toe Drains and Inspection Wells	Survey Reports	Within 7 days after survey	A	COR	0	3	1	2
33 46 36-5	Toe Drains and Inspection Wells	Final Inspection Video	At delivery of manholes to jobsite	A	COR	1	3	0	1
34 71 13-1	Guardrail	Shop Drawings	At least 14 days before installations	A	COR	1	1	1	2
34 71 13-2	Guardrail	Product Data	At least 14 days before delivery to the site	A	COR	1	1	1	2

Table 01 33 00A - List of Submittals

* Submittal types: A – Approval, I – Information

** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, BIA CM indicates BIA Construction Manager, and AE CM indicates Architect/Engineer Construction Manager.

RSN	Section Title	Submittals Required	Due Date or Delivery Time	Type*	Respon-sible Code	No. of sets to be sent to:**			
						CO	COR	BIA CM	AE CM
34 71 13-3	Guardrail	Manufacturer's Installation Instructions	At least 7 days before start of onsite construction work	A	COR	1	1	1	2
34 71 13-4	Guardrail	Manufacturer's Certificate	At least 7 days before start of onsite construction work	A	COR	1	1	1	2
35 21 10-1	Trashrack	Shop Drawings and Calculations	At least 21 days before installation	A	COR	0	2	2	2
35 22 15-1	Stainless Steel Slide Gate	Shop drawings and data	At least 28 days before installation	A	COR	0	3	2	2
35 22 15-2	Stainless Steel Slide Gate	Quality Control Submittals	Within 14 days before installation	A	COR	0	3	2	2
35 22 15-3	Stainless Steel Slide Gate	Operations and Maintenance Manual	At delivery of gates to jobsite	A	COR	1	3	2	2
35 22 15-4	Stainless Steel Slide Gate	Warranties	At delivery of gates to jobsite	A	COR	1	3	2	2
35 22 16-1	Stainless Steel Bulkhead Gate	Shop drawings and data	At least 28 days before installation	A	COR	0	3	2	2
35 22 16-2	Stainless Steel Bulkhead Gate	Quality Control Submittals	Within 14 days before installation	A	COR	0	3	2	2
35 22 16-3	Stainless Steel Bulkhead Gate	Operations and Maintenance Manual	At delivery of gate to jobsite	A	COR	1	3	2	2
35 22 16-4	Stainless Steel Bulkhead Gate	Warranties	At delivery of gate to jobsite	A	COR	1	3	2	2

END OF SECTION

This page intentionally left blank.

SECTION 01 33 26
ELECTRICAL DRAWINGS AND DATA

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Lump sum price offered in schedule for other items of work.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME Y14.1 - 2005	Decimal Inch Drawing Sheet Size And Format

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 315 -1975(1993)	Graphic Symbols For Electrical And Electronics Diagrams (Including Reference Designation Class Designation Letters)

1.3 SUBMITTAL PROCEDURES

A. Submit items listed in Table 01 33 0A - List of Submittals in Section 01 33 00 - Submittals, in the format listed below.

B. RSN 01 33 26-1, Drawings, General:

1. Title block:
   a. Include name of Project feature.
   b. Include name of equipment being represented.
   c. Type of drawing, such as schematic diagram, wiring diagram, single-line, equipment layout.
2. Device designations and symbols: As shown
3. Size: D-size prints (22 inches by 34 inches) as defined in ASME Y14.1 made from original drawings, unless specified otherwise.
4. Indicate changes on revised drawings to distinguish them from previous submittals. Describe reasons for significant changes in submittal letters.

C. RSN 01 33 26-2, Approval Drawings and Data in Manufacturer's Format:

1. General:
    a. Furnish with manufacturer's standard format.
2. Wiring Diagrams:
    a. Show equipment as mounted on each back panel, side panel, and door. Each panel shall be shown as viewed from the wiring side of the panel.
    b. Identify each item of equipment with the device designation shown on the schematic diagrams.
    c. Show cables, cable and individual wire designations, and connections to all external circuits.
3. Schematic Diagrams:
    a. Identify each item of equipment with the device designation shown on the wiring diagrams.
    b. Show the functional operation of each device with any unusual or nonstandard operation fully described.
    c. Show cables, cable and individual wire designations, and connections to all external circuits.
    d. Show terminal or pin number for devices and items of equipment.
4. Equipment Layout Diagrams:
    a. Show dimensions of all equipment.
    b. Show location of all devices and items of equipment including nameplates, terminal blocks, wiring ducts, bus, conduit entries, and other features in their relative physical location.
    c. Identify each device and item of equipment with a bill of material reference number.
5. Bill of Material:
    a. Provide information on the manufacturer, style, type, rating, quantity, and other identifying information for each device or item of equipment.
    b. Provide a unique reference number for each device or item of equipment listed on the bill of material.
6. Nameplate Lists: Provide information on type of material, size, and engraved lettering, and method of attachment.

7. Manufacturer's Technical Data:
   a. Provide technical data for each device or item of equipment including manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions. Where several items are listed on same sheet, data submitted for approval shall be clearly marked.
   b. Demonstrate proposed device or item of equipment meets requirements of these specifications.
8. As-Built Drawings:
   a. Mark prints of electrical specifications drawings to indicate as-built changes made to equipment and systems during construction.
   b. Include revision dates.
   c. Mark the drawings in the following color:
      1) Red: Additions to original drawings.
      2) Green: Deletions to original drawings.
      3) Blue: Notations necessary for explanation of as-built markings.
9. Final Drawings:
   a. Revised to reflect approval comments and as-built condition of installed equipment at time of contract completion.
   b. Provide original plot of schematic and wiring diagrams, equipment layout drawings, bill of materials, and nameplate drawings/lists.
   c. Provide AutoCAD (*.dwg) computer drawing files on CD-ROM disc.

D. RSN 01 33 26-3, Test Reports:
1. Typed 8 1/2- by 11-inch sheets bound in a folder or 3-ring binder.
2. Certified as complete and accurate by person or organization performing the tests.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 10
MATERIAL SAFETY DATA SHEETS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 DEFINITIONS

A. LHM: List of Hazardous Materials

B. MSDS: Material Safety Data Sheet.

1.3 APPLICATION

A. For the purposes of this contract, the definition of "materials delivered under this contract" in the clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1, includes materials delivered to the COR and all materials expected to be used during contract performance at the jobsite.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 35 10-1, Complete LHM and MSDS.

C. RSN 01 35 10-2, Updated LHM and MSDS:

1. Comply with paragraph (e) of clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1.

1.5 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on the original or previously updated LHM and MSDS before receipt of updated LHM and MSDS by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 20
SAFETY AND HEALTH

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. Bureau of Reclamation (USBR)

1. RSHS-2009 Reclamation Safety and Health Standards

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 35 20-1, Safety program:

1. Written safety program in accordance with Section 3 of RSHS.

C. RSN 01 35 20-2, Monthly accident summary report:

1. Form 7-2077 or other acceptable form in accordance with paragraph 3.8 of RSHS.

1.4 PROJECT CONDITIONS

A. Comply with RSHS.

B. Comply with Navajo Nation OSHA.

C. Provide and maintain a work environment and procedures that will:

1. Safeguard the public, Government's personnel, and Construction Manager staff exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

D. Do not require persons employed in performance of this contract, including subcontracts, to work under conditions which are unsanitary, hazardous, or dangerous to the employee’s health or safety.

E. Provide appropriate safety barricades, signs, and signal lights.

F. Maintain accurate record of and report to the COR the following occurrences during performance of this contract:

1. Death.
2. Occupational disease.
3. Traumatic injury to employees or the public.
4. Property damage in excess of $2,500.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 22
FIRST AID

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedules for other items of work.

1.2 REFERENCE STANDARDS

A. RSHS-2009 Reclamation Safety and Health Standards

1.3 SERVICE

A. Provide a medical first aid station and attendant (if required due to shift size) in accordance with RSHS Section 5.2.1. a and b.

B. Provide first aid and CPR training for onsite construction personnel in accordance with RSHS Section 5.2.2.

C. Do not perform onsite work until first aid plans have been submitted, approved by the COR and implemented on site.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 35 22-1, Medical Facilities Plan:

1. Describe facilities for providing medical attention for injured or disabled employees.
2. Plans for providing medical attention for injured or disabled employees, and provisions for arranging dependable ambulance service.
3. Qualifications of the proposed attendant (registered nurse, emergency medical technician, first aid and CPR trained construction personnel, or a paramedic).

1.5 AMBULANCE SERVICE

A. Arrange for dependable ambulance service in accordance with RSHS, paragraph 5.4.

1. On site ambulance not required.

1.6 AVAILABILITY

A. Make facilities and services available for providing emergency aid to employees, subcontractor employees, Construction Manager employees, Government employees, and public.

B. Provide services free of charge to Government employees injured on job.

C. Government employees not injured on job and public may be charged fees for rendered services based on reasonable and established fee rates.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 30
CONTRACTOR'S ONSITE SAFETY PERSONNEL

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 35 30-1, Qualifications:

1. Contractor's Onsite Safety Representative

C. RSN 01 35 30-2, Safety Inspection Reports:

1. Include a list of noted deficiencies, their abatement dates, and follow-up action for all jobsite activities.
2. Base inspection report on findings of jobsite walk-through with COR and/or Construction Manager personnel.

1.3 QUALIFICATIONS

A. Contractor's Onsite Safety Representative(s):

1. Competent supervisory employee(s) with appropriate level of safety related training and experience.

1.4 APPLICATION

A. Designate an employee as the Contractor's Onsite Safety Representative prior to start of construction.

B. Contractor's Onsite Safety Representative(s) authorities, duties, and responsibilities:

1. Review and approve the Contractor's Safety Program prior to submittal.
2. Responsible for effectively implementing the Contractor's Safety Program.
3. Full authorization to correct unsafe acts on the spot.
4. Prepare safety inspection reports.
5. Onsite during any and all construction activities.

1.5 QUALITY ASSURANCE

A. Contractor's Onsite Safety Representative(s):

1. The effectiveness of the Contractor's Onsite Safety Representative in prosecuting the safety program will be subject to continued review and approval by the COR.

2. Should the Contractor's safety effort be considered inadequate, the COR has the option to require the Contractor to assign a new Onsite Safety Representative or to employ a qualified Safety Professional at the expense of the Contractor.

B. Safety Program:

1. The effectiveness of the Contractor's Safety Program will be subject to continued review and approval by the COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 42 10

REFERENCE STANDARDS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. Referenced editions of standard specifications, codes, and manuals form a part of this specification to the extent referenced.

B. These specifications take precedence when conflicting requirements occur between specifications and referenced standard.

1.3 JOBSITE REFERENCE STANDARDS

A. Maintain at fabrication site, a copy of referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by the COR and/or other Tribal representatives.

B. Maintain onsite, a copy of referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by the COR and/or other Tribal representatives.

1.4 AVAILABILITY

A. Code of Federal Regulation (CFR):

1. Available online, authorized by the National Archives and Records Administration (NARA) and the Government Printing Office (GPO), at www.gpoaccess.gov/cfr/index.html.

B. Federal Specifications, Standards, and Commercial Item Descriptions; and Military Specifications:

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service, see the provision at FAR 52.211-1, Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29.
2. Copies of Military Specifications may be obtained from Department of Defense, see the provision at FAR 52.211-2, Availability of Specifications, Standards, and

Data Item Descriptions Listed in the Acquisition Streamlining and Standardization Information System (ASSIST).

C. Bureau of Reclamation Documents:

1. Reclamation Safety and Health Standards (RSHS), 2009 edition, may be downloaded at http://www.usbr.gov/ssle/safety/RSHS/rshs.html.

2. Bureau of Reclamation Standard Specifications are designated with an M-number. Copies of individual standards may be obtained from Bureau of Reclamation, Attn 86-68170, PO Box 25007, Denver CO 80225-0007. Specify which standard(s) is needed when requesting a copy.

3. Bureau of Reclamation manuals and other publications including significant scientific, technical, and engineering works are available from the National Technical Information Service (NTIS). Information regarding availability and pricing may be obtained by contacting NTIS at the following address:

United States Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161
Telephone: (703)487-4650 or 1-800-553-6847

D. Industrial and Governmental Documents

1. When a reference has a joint designation (e.g. ANSI/IEEE) these specifications generally cite the proponent organization (e.g. IEEE).

2. Addresses for obtaining industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in table 01 42 10A - Addresses for Specifications, Standards, and Codes.

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AA	The Aluminum Association Inc. 1525 Wilson Blvd. Suite 600 Arlington, VA 22209	Phone: (703) 358-2960 Fax: (703) 358-2961
ABMA	American Bearing Manufacturers Association 2025 M Street, NW Suite 800 Washington, DC 20036	202-367-1155

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW, Suite 249 Washington, DC 20001 www.aashto.org	(202) 624-5800 (800) 231-3475
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331 USA	(248) 848-3700
AGC	Associated General Contractors of America 2300 Wilson Blvd., Suite 400 Arlington, VA 22201	(800) 242-1767
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001 www.aisc.org	(312) 670-2400
APA	The Engineered Wood Association 7011 S. 19th Street Tacoma, WA 98466-5333	(253) 565-6600
ASME	American Society of Mechanical Engineers 3 Park Ave. New York, NY 10016-5990 www.asme.org	(800) 843-2763
ASTM	ASTM International PO Box C700 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(610) 832-9585
AWPA	American Wood Protection Association P.O. Box 361784 Birmingham, AL 35236-1784 www.awpa.com	(817) 326-6300
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	(303) 794-7711
CID	Commercial Item Description http://apps.fas.gsa.gov/pub/fedspecs/	
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 www.chainlinkinfo.org	(301) 596-2583
IBC	International Building Code developed by International Code Council 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001	(888) 422-7233
ICC	International Code Council 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001 www.iccsafe.org	(888)- 422-7233
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave.,17th Floor New York, NY 10016-5997 www.ieee.org	(212) 419-7900
ISO	International Organization for Standardization 1, ch. de la Voie-Creuse Case postale 56 CH-1211 Geneva 20 Switzerland www.standardsinfo.net	Tel.: +41 22 749 01 11
MUTCD	Manual on Uniform Traffic Control Devices http://mutcd.fhwa.dot.gov/kno_2009.htm	
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd. Bldg. C, Suite 312 Glen Ellyn, IL 60137	(630)-942-6591

Table 01 42 10A - Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
NACE	NACE International 1440 South Creek Drive Houston, TX 77084-4906 webmaster@nace.org	(281)-228-6200
NCHRP	National Cooperative Highway Research Program	(202)-334-2379
NRMCA	National Ready Mix Concrete Association 900 Spring Street, Silver Spring, MD, 20910	(301) 587-1400
SAE	Society of Automotive Engineers SAE World Headquarters 400 Commonwealth Drive Warrendale, PA 15096-0001 USA	1-724-776-0790
SDI	Steel Door Institute 30200 Detroit Road Westlake, Ohio 44145	(440)-899-0010
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association4201 Lafayette Center Drive Chantilly, Virginia 20151-1219	(703) 803-2980
SSPC	The Society of Protective Coating 40 24th St. Pittsburg, PA 15222	(877) 281-7772
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062-2096 www.ul.com	(847) 272-8800
WWPA	Western Wood Products Association 522 SW Fifth Ave., Suite 500 Portland, OR 97204-2122	(503)-224-3930

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 46 00
QUALITY PROCEDURES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 46 00-1, Quality Procedures Plan.

1.3 DEFINITIONS

A. Quality Assurance: Inspection and tests performed by COR and/or Construction Manager Representative to ensure compliance with the terms of the contract.

B. Quality Control: Activities performed by Contractor to ensure work conforms to contract requirements.

1. The clause at FAR 52.246-12 - Inspection of Construction, requires the Contractor to establish an inspection system to ensure quality.

C. Contractor Quality Testing: Specified tests to be performed by the Contractor.

1. The Government or Construction Manager may use the test results for Quality Assurance.
2. The Contractor may use the test results as part of Contractor quality control.
   a. The COR anticipates that these tests will be part of the Contractor's quality control program, however the tests do not relieve the Contractor of providing adequate quality control measures in accordance with the clause at FAR 52.246-12 - Inspection of Construction.
   b. Quality Control also includes other Contractor activities to ensure work conforms to contract requirements.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)

1.3 TEMPORARY ELECTRICITY

A. Provide required electric power for construction.

B. Provide generators, and other electrical equipment and facilities required for obtaining power and distributing power at the required circuit load to points of use.

C. Comply with IEEE C2 clearances and spacing for temporary communications and supply lines.

D. Remove temporary equipment and facilities upon completion of work under this contract.

1.4 TEMPORARY WATER

A. Provide water for construction purposes.

B. Water from the Tsaile Creek will be available from within the reservoir for construction purposes.

1. A limited record of historic Tsaile Creek flow information is available in Section 51 00 00 - Information Available to Offerors.

2. Obtain water use permit required for use of water source on Navajo Nation from Navajo Nation Department of Water Resources.

3. Pay fees required for permit and use of water.

C. Use water which meets specified requirements for water used in concrete, grout, soil conditioning, dust control, and other work. For purposes of bid, assume water from Tsaile Creek is suitable for any construction purpose. Prior to initiating construction Contractor shall test Tsaile Creek water to determine suitability of for any construction purpose.

D. Provide means of conveying water to and storing at points of use.

E. Remove temporary equipment and facilities upon completion of work under this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 52 10
FIELD OFFICE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Field Office:

1. Payment: Include in prices offered in the schedule for other items of work.

   a. Includes cost of providing and hooking up a field office trailer and a laboratory trailer; furnishing, installing, and servicing portable toilets; furnishing trash receptacles and removal service; all utilities; and other work required by this section.

1.2 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 10-2007 Portable Fire Extinguishers

1.3 PROJECT CONDITIONS

A. Locate facilities where directed by the COR.

PART 2 PRODUCTS

2.1 GOVERNMENT FIELD OFFICE

A. Furnish field office facility consisting of an office trailer, toilet facilities, and parking area for exclusive use by COR and Construction Manager personnel.

B. Field office shall be completely set up with all items operational within 20 days of initiation of Contractor mobilization activities and at least 15 days prior to commencement of onsite work.

2.2 OFFICE AND LABORATORY TRAILERS

A. Mobile office trailer:

1. Minimum dimensions (nominal): 12 feet wide by 40 feet long.
2. Space shall be divided into at least two rooms with doors.
3. Two entrance/exit doors.
4. Minimum 6 windows, at least 32 square feet total.

B. Mobile laboratory trailer

1. Minimum dimensions (nominal): 12 feet wide by 40 feet long.

C. Level trailer on site.

D. Provide sturdy entrance stairs and landings at doors.

E. Electrical:

1. 110-VAC power from either a generator or existing transmission lines and furnished with ample cords and proper connections.
2. Wiring system: Complete including service entrance, one duplex convenient outlet for each 120 square feet of floor space and additional outlets and circuits for heating, ventilating, and air-conditioning units as required.
3. Lighting: Fluorescent lighting suitable for tasks, based on 3-watts-per-square-foot uniform distribution.
4. Smoke detector: At least 2.

F. Furnishings for Office Trailer:

1. Desks: 2.
2. Tables: One, at least 8-foot by 3-foot in size.
3. Chairs: 6 heavy-duty folding type.
4. Book cases: Two, with 6 shelves each, at least 3-foot wide by 6-foot high by 12-inch deep.
5. Four-drawer lockable file cabinet.
6. Water cooler: 5-gallon.

G. HVAC:

1. Heater units: Adequate capacity to maintain comfortable office temperature up to 75 degrees F.
2. Air conditioning units: Adequate capacity to maintain comfortable office temperature down to 65 degrees F.

H. Fire Extinguishers:

1. ABC fire extinguishers.
2. Number, location, and extinguisher rating: In accordance with NFPA 10.
3. Listed or approved by a nationally recognized testing laboratory.

I. Security:

1. Security light.
2. Door locks.

a. Deadbolt-type locking devices.

b. All doors keyed alike.

c. Furnish 4 sets of keys.

2.3 PORTABLE TOILET FACILITIES

A. Locate one near office facility.

B. Self-Contained Toilet Units:

1. Single-occupant units.
2. Chemical, aerated recirculation or combustion type.
3. Vented.
4. Fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

C. Place on a level surface and fasten to the ground to prevent tipping or blowing over.

D. Provide bi-weekly servicing of self-contained toilet units throughout the contract period.

2.4 PARKING AREA

A. Provide safe access between parking area and office facility and safe parking for Government, Tribal, or Construction Manager vehicles near office trailer and Laboratory Trailer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Government/Construction Manager field office and laboratory trailer at locations directed by the COR.

B. Set up, level, and block.

C. Install access steps with handrails for each exit door.

3.2 CONNECT UTILITIES

A. Connect temporary electricity and other required services.

1. Adequately size and correctly place to perform their function without damage or interruption of service.

B. Electrical Power:

1. Provide electrical power in accordance with Section 01 51 00 - Temporary Utilities.
2. Supply electrical power during all working hours and during periods when Government, or Construction Manager staff are at the field office and/or laboratory trailer and as necessary to prevent freezing inside the office trailer and laboratory trailer during non-working days.

3.3 MAINTENANCE

A. Provide trash removal service and utilities including lights, heat, and air conditioning.

B. Keep water cooler supplied with commercially-supplied fresh water.

3.4 REMOVAL AND CLEANUP

A. Promptly remove field office including utility services and debris upon written direction from the COR. Field office becomes Contractor property and shall be removed from the site.

B. Restore areas: Comply with Section 01 14 10 – Use of Site.

END OF SECTION

SECTION 01 55 00
VEHICULAR ACCESS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REGULATORY REQUIREMENTS

A. Meet requirements established by jurisdictional authority for use of existing roadways and haul routes; including seasonal or other limitations or restrictions, payment of excess size and weight fees, and posting of bonds conditioned upon repair of damage.

B. Comply with applicable regulations for haul routes over public highways, roads, or bridges.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 55 00-1, Preconstruction Video.

1. Video of preconstruction conditions:
    a. All roads possibly impacted by the project.
    b. Road shoulders and related side slopes.
    c. Borrow areas.
    d. Areas used for haul.
    e. Temporary access roadways.

C. RSN 01 55 00-2, Access and Traffic Control Plan.

1. Detailed plan of traffic controls, temporary one-way access, barricading, signage, and operation scheduling.

1.4 SITE CONDITIONS

A. Rights-of-way for access to work from existing roads will be established by the Tribe.

1. In accordance with the clause at FAR 52.236-10, Operations and Storage Areas, use only established roadways, and haul routes; or temporary roadways, or haul routes constructed by the Contractor when and as authorized by the COR.

2. Subject to the clause at FAR 52.249-10, Default (Fixed-Price Construction), unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.

B. Access Roads:

1. Route construction traffic to and from jobsite over the required access road as shown on Sheet G-1 from Indian Route 64.
2. Do not use the Dine College Circle for construction traffic.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to maintain and repair existing roadways, and haul routes: In accordance with requirements of jurisdictional authority.

B. Materials to construct, maintain, and repair temporary roadways, and haul routes: As approved by the COR.

C. Materials to maintain roadways constructed under this contract and used by the Contractor for construction work: In accordance with specified requirements for construction of those roadways.

PART 3 EXECUTION

3.1 EXAMINATION

A. Investigate condition of available public or private roads for clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect access and transportation operations to and from the jobsite.

3.2 RECORDS

A. Make preconstruction video of surface conditions:

1. DVD format.
2. Label:
    a. Contract number and title.
    b. Contractor’s name.
    c. Date the video is made.
    d. Preface video with this information.

B. Make camera movement speed for video such that areas can be readily identified and located as approved by COR.

3.3 ESTABLISHED ROADWAYS

A. Established roadways are available for the Contractor's use subject to existing restrictions and approval of the COR.

B. Only designated roadways maybe used for construction traffic.

3.4 TEMPORARY ACCESS

A. Temporary access road across the dam shall be open at all times. Access road crossing the dam shall be a two way road.

1. The double lane road shall be located in accordance with the plans.
2. Provide barricades, flaggers and signage.
3. Access plan and flagging operations shall be approved by COR before being put into operation.

3.5 TEMPORARY ROADWAYS

A. Roadways:

1. Construct temporary roadways for access from existing roads to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.
2. Construct temporary bridges or culverts at stream crossings or cross-drainage channels to allow for unimpeded surface drainage.

3.6 ROADWAYS CONSTRUCTED UNDER THE CONTRACT

A. Roadways constructed under this contract will be available for the Contractor's use in accordance with requirements of this section.

B. Prior to placing final surfacing permanent roads may be used for construction traffic.

1. Avoid traffic loading beyond design capacity.
2. Tracked vehicles not allowed after final surfacing material is placed.
3. Contractor is responsible for damage caused by construction operations.

C. After completion, roadways constructed under the contract will be accepted by the COR and will be available for use by the public and by the Contractor in the Contractor's construction operations for the remaining work under the contract.

D. Acceptance of roadway as provided above will not require a release of the percentages withheld from progress payments under the clause at FAR 52.232-5, Payment Under Fixed-Price Construction Contracts.

3.7 HAUL ROUTES

A. Perform work on rights-of-way established by the Government as necessary to construct and maintain any roads, bridges, or drainage structures required for establishment and use of haul routes for construction operations.

B. Use existing available public highways, roads, or bridges as haul routes subject to applicable local regulations.

C. Shall not use Dine College Circle for routing of vehicles hauling sand, gravel, or earth materials. No intra job hauling on Dine College Circle.

D. Minimize interference with or congestion of local traffic.

E. Provide barricades, flaggers, and other necessary precautions for safety of the public where haul routes cross public highways or roads.

3.8 MAINTENANCE

A. Maintain roadways, and haul routes in a sound, smooth condition.

B. Maintain roadbed, side slopes, embankment, drainage structures, and surfacing of roads until completion and acceptance of all work under this contract. As approved by the COR, defer until latest practicable date within specified completion period, placement of surfacing on roads subject to heavy and deteriorating use by the Contractor's construction operations or equipment.

C. Maintain surfacing of gravel-surfaced roads in a smooth condition until completion and acceptance of all work under this contract.

D. Snow removal for convenience of the Contractor or to facilitate work operations of the Contractor is considered to be normal required maintenance.

3.9 REPAIR

A. Promptly repair ruts, broken pavement, potholes, low areas with standing water, and other deficiencies to maintain road surfacing and drainage in original or specified condition.

3.10 REMOVAL

A. Remove materials used to construct temporary roadways, and haul routes prior to contract completion. Recycle salvageable materials as approved by the COR.

B. Remove temporary underground work and compacted materials to a depth of 2 feet, fill and regrade site as specified.

C. Place two to three foot diameter boulders across temporary access road entry and exit points at project completion to prevent local vehicular traffic from accessing those roads.

END OF SECTION

This page intentionally left blank.

SECTION 01 55 20
TRAFFIC CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Permanent Traffic Control Signs:
    a. Signs.
2. Temporary Traffic Control:
    a. Signs.
    b. Type III Barricade.
    c. Traffic Control Management.
3. Temporary Access Road:
    a. Construction of a temporary all-weather road to relocate vehicular access and provide detours as necessary while BIA Road 8077 is under construction.

B. Locations as indicated on the Drawing.

C. Related Sections:

1. Section 01 55 00 – Vehicular Access.
2. Section 32 15 10 – Gravel Surfacing.

1.2 MEASUREMENT AND PAYMENT

A. Payments:

1. Permanent Traffic Control Signs: Lump sum item incidental to the "Relocate and Reconstruct BIA Road 8077" Bid Item.
2. Temporary Traffic Control items: Lump sum item incidental to the "Construct, Maintain and Remove Temporary Road" Bid Item.
3. Temporary Access Road: Lump sum item incidental to the "Construct, Maintain and Remove Temporary Road" Bid Item.

1.3 REFERENCE STANDARDS

A. Federal Highway Administration, Department of Transportation.

1.	MUTCD, Part 5	Part 5, Traffic Control Devices for Low-Volume Roads, Manual on Uniform Traffic Control Devices, 2009 Edition, (http://mutcd.fhwa.dot.gov/kno_2009.htm)
2.	MUTCD, Part 6	Part 6, Temporary Traffic Control, Manual on Uniform Traffic Control Devices, 2009 Edition, (http://mutcd.fhwa.dot.gov/kno_2009.htm)

B. State of Arizona Department of Transportation, 2008 Standard Specification.

1.4 REGULATION

A. Contractor shall comply with the requirements of Section 701 of the 2008 Standard Specifications of Arizona Department of Transportation and Part 6 of MUTCD, 2009 Edition for traffic control managements.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 55 20-1, Traffic Control Plan.

1. Detailed plan of traffic controls, temporary access, barricading, signage and operation scheduling.

C. RSN 01 55 20-2, Product Data: For each type of traffic sign and traffic control devices indicated.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment, procedures used by workers, devices and facilities shall conform to the requirements of the MUTCD and associated ADOT Supplement as stated under Subsection 701-2 of the 2008 Standard Specifications of Arizona Department of Transportation..

PART 3 EXECUTION

3.01 TRAFFIC CONTROL

A. Provide cones, delineators, concrete safety barriers, barricades, flasher lights, danger signals, signs, and other temporary traffic control devices as required to protect work and public safety.

B. Provide flaggers and guards as required to prevent accidents and damage or injury to passing traffic.

C. Do not begin work along public or private roads until proper traffic control devices for warning, channeling, and protecting motorists are in place in accordance with approved traffic control plan.

D. Maintain traffic flow and conduct construction operations to minimize obstruction and inconvenience to public traffic.

E. Provide unobstructed, smooth, and dustless passageway for two lanes of traffic through construction operations.

F. Construct temporary connections for traffic between existing roadway and new access road or temporary detour route(s).

G. Protect roads closed to traffic with effective barricades and warning signs. Illuminate barricades and obstructions from sunset to sunrise.

H. Remove traffic control devices when no longer needed.

END OF SECTION

This page intentionally left blank.

SECTION 01 56 10

PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work, except as specified.

2. Costs for repair of installations damaged by the Contractor's operations are the Contractor's responsibility.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals:

B. RSN 01 56 10-1, Existing Installations Protection Plan

1.3 PROJECT CONDITIONS

A. Drawings included in these specifications show items of existing materials and equipment but may not show all equipment and materials existing at the jobsite.

B. Obtain the location of embedded conduit, pipe, cable, ground mat, and other buried items before performing any construction.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROTECTION

A. Provide protection for personnel and existing facilities from harm due to the Contractor's operations. Protection shall be subject to approval of the COR.

B. Arrange protective installations to permit operation of existing equipment and facilities by the COR while work is in progress.

3.2 REMOVAL OF PROTECTIVE INSTALLATIONS

A. Remove protective installations after purpose has been served. Materials furnished by the Contractor to provide protection remain property of the Contractor.

3.3 REPAIR

A. Repair, at Contractor's expense, damage to existing installations due to Contractor's operations or Contractor's failure to provide proper protection. At the COR's option, damage may be repaired by the COR, and the Contractor will be backcharged repair costs.

END OF SECTION

SECTION 01 56 15
PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 56 15-1, Locating Utility Lines Plans:

1. Plans and procedures for locating known and unknown existing utility lines.

1.3 PROJECT CONDITIONS

A. Drawings included in these specifications show existing known utilities, but may not show all utilities existing at the jobsite.

B. Obtain location of buried conduit, pipe, cable, ground mat, and other buried items before excavating. Contractor to investigate utility locations with Navajo Tribal Utility Authority (NTUA) and with Arizona Blue Stake prior to excavating. Failure of NTUA or Arizona Blue Stake to correctly locate all underground utilities does not absolve Contractor from the responsibility to avoid and protect all buried utilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. Do not interfere with operation or maintenance service on those utilities existing on date offers are received.

1. Provide for access to utilities in a manner satisfactory to owners and operators and the COR.

B. Provide required temporary structures; make necessary repairs, replacements, or similar operations; and furnish indemnity or other bonds.

C. Remove required temporary structures after purpose has been served. Materials provided by Contractor to provide temporary protection of utilities remain property of Contractor.

END OF SECTION

SECTION 01 56 20
EXISTING FENCES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Replacement materials:

1. new
2. similar size, class, type, gauge, and weight

PART 3 EXECUTION

3.1 FENCE REMOVAL

A. Remove existing fences and gates where necessary for performance of the work, Government will locate fences and gates. The time schedule for removal of fences shall be approved in advance by the COR.

3.2 TEMPORARY FENCES

A. Where fences and gates are removed, provide temporary fence protection for adjacent lands to prevent agricultural stock crossing, access to potentially steep side slopes, vertical drop offs and other harmful areas.

B. If the Contractor does not provide necessary temporary fencing or protection within a reasonable time after need for fencing or protection arises, the COR will cause the work to be performed and backcharge the Contractor for such work.

C. Remove temporary fencing and protection as a part of cleanup operations prior to final acceptance of completed work.

3.3 FENCE REBUILDING

A. Where fences and gates are removed to accommodate construction, rebuild at original locations and as directed by the COR.

B. Construct rebuilt fencing and gates with new materials. The new fencing and gates shall be similar in design to the original fencing. New fence and gate designs shall be approved by the COR.

3.4 MAINTENANCE AND REMOVAL

A. Maintain fence until work in area is complete and accepted by the COR.

B. Obtain permission from COR to remove fence.

C. Remove and dispose of fence in accordance with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

SECTION 01 56 32

TEMPORARY SAFETY FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Lump sum price offered in schedule for other items of work.

PART 2 PRODUCTS

2.01 SAFETY FENCE

A. Fence:

1. High-density polyethylene grid
2. Minimum height: 48-inch.
3. Color: Safety orange.

B. Posts: Steel fence posts.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect fence around work areas or to protect restricted areas as directed by the COR.

B. Space posts 10 feet, maximum, on center.

C. Secure grid to posts.

3.2 MAINTENANCE AND REMOVAL

A. Maintain fence until work in area is complete and accepted by the COR.

B. Obtain permission from COR to remove fence.

C. Fence materials will remain the property of the Contractor.

D. Remove and dispose of fence in accordance with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

This page intentionally left blank.

SECTION 01 57 20

ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the prices offered in the schedule for other items of work, except as specified.
2. Costs for damages and work stoppage are the Contractor's responsibility.

1.2 REFERENCE STANDARDS

A. Bureau of Reclamation (USBR)

1. RSHS-2009 Reclamation Safety and Health Standards

1.3 REGULATORY REQUIREMENTS

A. Comply with Federal, State, Tribal, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

D. Contractor shall be responsible for damages resulting from dust originating from Contractor operations in accordance with clause at FAR 52.236-7, Permits and Responsibilities.

E. The CO may stop any construction activity in violation of Federal, State, Tribal, or local laws and additional expenses resulting from work stoppage will be responsibility of Contractor.

1.4 DUST CONTROL

A. Provide dust control and abatement during performance of work.

B. Prevent, control, and abate dust pollution on rights-of-way provided by Government or elsewhere during performance of work.

C. Provide labor, equipment, and materials, and use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, crops, orchards, cultivated fields, wildlife habitats,

dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

1.5 AIR POLLUTION CONTROL

A. Use reasonably available methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

B. Do not operate equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels.

1.6 NOISE CONTROL

A. Only construction activities approved by COR will be allowed during the hours of 10:00 p.m. to 6:00 a.m. COR may grant permission to work additional hours.

B. Equipment mufflers required.

1.7 LIGHT CONTROL

A. Direct stationary floodlights to shine downward at an angle less than horizontal.

B. Shield floodlights so that floodlights will not be a nuisance to surrounding areas.

C. Direct lighting so that residences are not in direct beam of light.

D. Correct lighting control problems when they occur as approved by the COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 30
WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the lump sum price offered in the schedule for Water Pollution Control.

1.2 REFERENCE STANDARDS

A. Bureau of Reclamation (USBR)

1. RSHS-2009 Reclamation Safety and Health Standards

B. Code of Federal Regulations (CFR)

1. 40 CFR, Part 112 Oil Pollution Prevention

C. Public Law

1. Sections 311, 402, and 404 Clean Water Act (Public Law 92-500, as amended)

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 57 30-1. Pollution Prevention Plan:

1. As required by the stormwater permit for discharges from construction sites.
2. Include copy of permit[s].

C. RSN 01 57 30-2, Spill Prevention, Control, and Countermeasure (SPCC) Plan:

1. Submit when SPCC Plan is required in accordance with 40 CFR, Part 112.
    a. SPCC Plan is required where release of oil and oil products could reasonably be expected to enter into or upon navigable waters of the United States or adjoining shorelines in quantities that may be harmful (40 CFR, Part 110), and aggregate on site oil storage capacity is over 1,320 gallons. Only containers with capacity of 55 gallons and greater are included in determining on site aggregate storage capacity.
2. Reviewed and certified by a registered professional engineer in accordance with 40 CFR, Part 112, as required by section 311 of the Clean Water Act (Public Law 92-500 as amended).

1.4 REGULATORY REQUIREMENTS

A. Construction Safety Standards:

1. Comply with sanitation and potable water requirements of section 7 of RSHS.

B. Laws, Regulations, and Permits:

1. Perform construction operations to comply, and ensure subcontractors comply, with:

a. Applicable Federal, State, and local laws, orders, regulations, and Water Quality Standards concerning control and abatement of water pollution; and terms and conditions of applicable permits issued by permit issuing authority.

b. If conflict occurs between Federal, State, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, immediately (verbally) report noncompliance to the COR. Submit specific written information within 2 days.

2. Violation of applicable Federal, State, or local laws, orders, regulations, or Water Quality Standards may result in the COR stopping site activity until compliance is ensured.

3. The Contractor shall not be entitled to extension of time, claim for damage, or additional compensation by reason of such a work stoppage.

4. Corrective measures required to bring activities into compliance shall be at the Contractor's expense.

1.5 REQUIRED PERMITS

A. Wastewater Discharge Permit:

1. Permit:

a. Prior to discharging wastewater or other pollutants, secure a permit to discharge pollutants as required under section 402 of the Clean Water Act (Public Law 92-500 as amended).

2. Terms and Conditions: Comply with terms and conditions as stated in the permit.

3. Monitoring and Treatment:

a. Provide monitoring and water treatment, if necessary, to achieve compliance with permit conditions

b. Provide recordkeeping required of the section 402 permittee, as stated in the section 402 permit.

4. Sampling: Include sampling in monitoring required of the Contractor to meet section 402 requirements, as well as required laboratory tests to determine effluent characteristics.

5. Monitoring Results:

   a. Provide monitoring results to the COR 2 weeks prior to submittal deadline to appropriate State and/or Environmental Protection Agency (EPA) Regional Administrator.

   b. Send copies of all information transmitted to EPA and/or the State to the CO and COR.

B. Dredge and Fill Permit:

1. Government has made application for a permit to discharge dredged or fill material into waters of the United States (including wetlands) as required under section 404 of the Clean Water Act (Public Law 92-500 as amended).

2. If the Bureau of Indian Affairs (BIA) is the section 404 dredge and fill permit holder (permittee), BIA will make known the conditions of permit to the Contractor.

C. Stormwater Discharge Permit Associated With a Construction Site:

1. Notice of Intent (NOI):

   a. The Contractor shall sign the NOI to obtain coverage under a stormwater general permit to control stormwater discharges from the construction site as required under section 402 of the Clean Water Act (Public Law 92-500, as amended).

2. Pollution Prevention Plan:

   a. The Contractor shall prepare a Pollution Prevention Plan as required by the permit.

   b. Comply with terms and conditions to obtain and maintain this stormwater discharge permit.

3. Monitoring and Water Treatment:

   a. Provide monitoring and water treatment, if necessary, to achieve compliance with applicable Water Quality Standards.

   b. Provide the recordkeeping required by the stormwater discharge permit associated with construction activity.

1.6 CONTRACTOR RESPONSIBILITIES

A. Permits:

1. Any permits obtained by the Bureau of Indian Affairs are exceptions to the clause at FAR 52.236-7, Permits and Responsibilities, which requires the Contractor to obtain necessary licenses and permits.

B. Monitoring:

1. Conduct monitoring in order to meet the requirements of the permits which may include:

a. Sampling,

b. Site inspections, and

c. Required laboratory tests to determine effluent characteristics.

C. Reporting Results:

1. The Government will report required monitoring results to appropriate agencies. The section 402 wastewater discharge permit has specific reporting requirements for the permittee for noncompliance when effluent limitations are exceeded.

D. Recordkeeping:

1. Retain records and data required by permits.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Control pollutants by use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls including State and local control requirements.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion which address vegetative practices, structural control, silt fences, straw dikes, sediment controls, and operator controls as appropriate.

2. Institute stormwater management measures as required, including velocity dissipators, and solid waste controls which address controls for building materials and offsite tracking of sediment.

C. Wastewater and Stormwater Management Controls:

1. Pollution prevention measures:

    a. Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and erosion, and which will intercept and settle any runoff of sediment-ladened waters.

    b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.

    c. Divert stormwater runoff from upslope areas away from disturbed areas.

2. Turbidity prevention measures:

    a. Use methods for prevention of excess turbidity which include, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life.

    b. Wastewaters discharged into surface waters shall meet conditions of section 402, the National Pollutant Discharge Elimination System (NPDES) permit.

    c. Do not operate mechanized equipment in waterbodies without having first obtained a section 404 permit, and then only as necessary to construct crossings or cofferdams to perform the required construction.

D. Construction Site Management:

1. Contractor construction operations:

    a. Perform construction activities by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources.

        1) Pollutants and wastes include, but are not restricted to: refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

2. Stockpiled or deposited materials:

    a. Do not stockpile or deposit excavated materials or other construction materials, near or on, stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse.

3. Petroleum product storage tanks management:

a. Place oil or other petroleum product storage tanks at least 20 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source.

b. Do not use underground storage tanks.

c. Construct storage area dikes at least 12 inches high or graded and sloped to permit safe containment of leaks and spills equal to storage tank capacity located in the area plus sufficient freeboard to contain the 25-year rainstorm.

1) Line diked areas with an impermeable barrier at least 50 mils thick.

d. Areas for refueling operations: Lined with impermeable barrier at least 10 mils thick covered with 2 to 4 inches of soil.

END OF SECTION

SECTION 01 57 60
PROTECTED SPECIES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 PROJECT CONDITIONS

A. Certain native species in the State of Arizona located on private and public land and within the Navajo Nation are species of special concern. These species are protected under Federal, State and Tribal statutes such as the Endangered Species Act, Migratory Bird Treaty Act, Arizona Game and Fish Department regulations, Navajo Endangered Species List, and the Navajo Sensitive Species List.

B. The Final Environmental Assessment (EA) for the proposed project area resulted in negative findings for species as noted in the EA.

C. The Government has ascertained that two active Bald Eagle nests are located approximately 0.7 kilometers (Nest 1) and 1.4 kilometers (Nest 2) from the project site.

1. Excavation in the borrow area will be restricted to before Feb 1 and after Jul 15 if the bald eagles are occupying Nest 1.

D. Contractor activities shall not harass these eagles, any owls, or other migratory birds.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This page intentionally left blank.

SECTION 01 57 90

PRESERVATION OF HISTORICAL AND ARCHAEOLOGICAL DATA

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 DEFINITIONS

A. Cultural resources: Includes prehistoric, historic, architectural, and traditional cultural properties. These include, but are not limited to, human skeletal remains, archaeological artifacts, records, and material remains related to such property.

B. Cultural items: Native American cultural items (i.e., funerary objects, sacred objects, objects of cultural patrimony, or human remains) for which protection is prescribed under the Native American Graves Protection and Repatriation Act (NAGPRA) - Public Law 101-601; 104 Stat. 3042, Section 3(d); and 43 CFR Part 10.4.

C. Human remains: Physical remains of the body of a person.

D. Funerary objects: Native American items that, as part of the death rite or ceremony of a culture, are reasonably believed to have been placed intentionally at the time of death or later with or near individual human remains.

E. Native American: Of, or relating to, a tribe, people, or culture that is indigenous to the United States.

F. Sacred Objects: Native American items that are specific ceremonial objects needed by traditional Native American religious leaders for the practice of traditional Native American religions by their present-day adherents. These items are specifically limited to objects that were devoted to a traditional Native American religious ceremony or ritual and which have religious significance or function in the continued observance or renewal of such ceremony.

G. Objects of cultural patrimony: Native American items having ongoing historical, traditional, or cultural importance central to the Indian tribe itself, rather than property owned by an individual tribal member. These objects are of such central importance that they may not be alienated, appropriated, or conveyed by any individual tribal member.

1.3 PROJECT CONDITIONS

A. Federal legislation provides for protection, preservation, and collection of scientific, prehistorical, historical, and archeological data, including relics and specimens, which might otherwise be lost due to alteration of terrain as a result of any Federal construction project.

B. Any person who, without permission, injures, destroys, excavates, appropriates, or removes any historical or prehistorical artifact, object of antiquity, or archeological resource on public lands of the United States is subject to arrest and penalty of law.

C. Discovery of Resources:

1. When the Contractor, or any of the Contractor's employees, or parties operating or associated with the Contractor, in performance of this contract discover cultural resources on any lands:

    a. Immediately cease work at that location.

    b. Immediately notify the COR orally, giving the location and nature of the findings.

    c. Follow with written confirmation to the COR within 2 days.

2. In addition to notifying the COR:

    a. Immediately notify Navajo Nation Historic Preservation Department by telephone at 928-871-7198. Follow with written confirmation to Navajo Nation Historic Preservation Department, P.O. Box 4950, Window Rock, AZ 86515; Fax number 928-871-7886, within 2 days.

3. Exercise care so as not to disturb or damage cultural resources uncovered during construction activities and provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition by the CO.

4. Do not resume work in the area of discovery until receipt of written notice to proceed from the COR.

D. If human remains are found, work must stop immediately in the area where the remains are located and the area shall be protected. The COR must be contacted immediately as well the Navajo Historic Preservation Department (NHPD). Until the remains can be definitely confirmed as human, all work in the immediate area must cease. If the remains are human, work in the area shall not proceed until the remains have been removed by a qualified archaeologist or personnel from the NHPD.

E. Where appropriate by reason of discovery, the COR may order delays in time of performance or changes in work, or both. When such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

F. Insert this section in subcontracts which involve performance of work on jobsite terrain.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This page intentionally left blank.

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. When the schedule includes a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in the price offered in the schedule for the item.

2. When the schedule does not included a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in the price offered in the schedule for work for which the material is required.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2003(2008)	Unified Inch Screw Threads, (UN and UNR Thread Form)
2.	ASME B1.20.1-1983(2006)	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (USBR)

1.	RSHS-2009	Reclamation Safety and Health Standards

1.3 DEFINITIONS

A. Essential Characteristics: As used in these specifications, the term "essential characteristics" is synonymous with the term "salient characteristics."

B. Salient Characteristics: Those qualities of an item that are essential to ensure that the intended use of the item can be satisfactorily realized.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle manufactured products in accordance with manufacturer's instructions.

B. Store and protect manufactured products in accordance with manufacturer's instructions and RSHS. Obtain instructions from the manufacturer before delivery of materials to jobsite. Maintain a copy of instructions at jobsite.

C. Remove and replace damaged items with new items.

D. Protect materials subject to adverse effects from moisture, sunlight, ultraviolet light, or weather during storage at jobsite.

E. Store curing compounds, sealants, adhesives, paints, coatings, sealers, joint compounds, grouts, and similar products at the temperature and environmental conditions recommended by manufacturer.

1.5 MAINTENANCE

A. Extra Materials:

1. Furnish additional maintenance materials specified as "extra materials" in the specifications. Provide maintenance material identical to installed material and provide from the same manufacturer's production lot as installed material.

2. Package extra materials for storage and label with complete product identification on packaging.

3. Deliver extra materials to the jobsite and place in storage as directed by the COR.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials required for completion of work.

B. Provide type and quality described in these specifications. Make diligent effort to procure specified materials from any and all sources.

C. Furnish new materials conforming to referenced standards unless otherwise specified.

1. References to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the COR, is equal to that named in the specifications, unless otherwise specified.

D. For materials not covered by these or referenced specifications, furnish materials of standard commercial quality.

E. If materials to be used deviate from or are not covered by recognized specifications and standards, submit, for approval, justification for and exact nature of the deviation, and complete specifications for materials proposed for use.

F. Make parts accurately to standard gauge where possible.

1. Use unified screw threads conforming to ASME B1.1 or B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipe fittings.

2. For internal connections only, the Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

G. Permanently mark fasteners with a symbol identifying the manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standard.

2.2 SUBSTITUTIONS

A. If materials required by these specifications become unavailable, because of Government priorities or other causes, substitute materials may be used.

B. Obtain written approval to use substitute materials from the COR. State in the request for approval the amount of the adjustment, if any, to be made in favor of the Government.

C. The COR's determination as to whether substitution will be permitted and as to what substitute materials may be used, shall be final and conclusive.

D. If approved substitute materials are of less value to the Government or involve less cost to the Contractor than specified material, a contract adjustment will be made in favor of the Government. Where the amount involved or the importance of substitution warrants, a deductive modification to the contract will be issued.

E. No payments in excess of prices offered in the schedule will be made because of substitution of one material for another or because of use of one alternate material in place of another.

2.3 WORKMANSHIP

A. Accurately manufacture and fabricate materials in accordance with best modern practice and requirements of these specifications, notwithstanding minor errors or omissions therein.

B. Use liberal factors of safety and adequate shock-absorbing features in designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock.

C. Include provisions which prevent components from loosening for shock-absorbing features and parts subject to vibration.

D. For rotating parts of motors and exciters, maximum unit stress due to runaway speed shall not exceed 2/3 of the yield point.

2.4 SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause at FAR 52.246-12 "Inspection of Construction" at any one or more of the following locations, as determined by the COR:

1. At place of production or manufacture.
2. At shipping point.
3. At jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, copies of purchase orders, including drawings and other pertinent information, covering material on which inspection will be made as advised by the COR, or submit other evidence if such purchase orders are issued verbally or by letter.

C. Inspection of materials at any location specified above or waiving of inspection shall not be construed as being conclusive as to whether materials and equipment conform to contract requirements under the clause at FAR 52.246-12 "Inspection of Construction," nor shall the Contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications.

D. Acceptance of materials will be made only at the jobsite.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer’s recommendations unless otherwise specified.

3.2 FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at the jobsite after installation and testing.

END OF SECTION

SECTION 01 72 20
SURVEYING

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedules for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 72 20-1, Surveying Plan:

1. Describe work layout and survey methods.
2. Include surveying schedule.

C. RSN 01 72 20-2, Resume:

1. Qualifications of surveyor responsible for supervising and directing survey work.

D. RSN 01 72 20-3, Accuracy Check Results:

1. Accuracy check of Government-established primary control.

E. RSN 01 72 20-4, Completed and Reduced Survey Notes:

1. Copy of completed and reduced survey notes for a survey or portion of survey.

F. RSN 01 72 20-5, Survey Books or Electronic Data:

1. Original field survey books or electronic data files.

G. RSN 01 72 20-6, Quantity Survey Notes and Computations:

1. Copies required for progress payment. Include itemized statement for work covered by notes and computations.

H. RSN 01 72 20-7, Workday's Survey Notes:

1. Copies when requested by the COR.

1.3 PRIMARY CONTROL

A. The Government has established primary control to be used for establishing work lines and grades.

B. Primary control consists of bench marks and horizontal control points in work vicinity.

C. The Government will provide complete listing and identification of primary control within 10 days after issuance of Notice to Proceed.

D. Check and verify primary control and resolve discrepancies with the COR before beginning work.

E. Preserve and maintain primary control points until otherwise authorized. Government may reestablish damaged or destroyed primary control points and backcharge reestablishment cost to the Contractor.

1.4 QUALIFICATIONS

A. Surveyor: Professional Land Surveyor licensed in Arizona with minimum of 2 years experience in charge of construction surveys for construction similar in nature to that required by this contract.

PART 2 PRODUCTS

2.01 SURVEYING MATERIALS AND EQUIPMENT

A. Provide materials and equipment required for surveying work, including, but not limited to, instruments, stakes, spikes, steel pins, templates, platforms, and tools.

B. Except as required to be incorporated in work or left in place, surveying materials and equipment will remain property of Contractor.

PART 3 EXECUTION

3.1 LAYOUT OF WORK SURVEYS

A. Establish lines and grades for work layout from Government-established primary control points.

B. Establish measurements required for work execution to specified tolerances.

C. Provide stakes, markers, and other survey controls necessary to control, check, and guide construction.

3.2 QUANTITY SURVEYS

A. Perform surveys and computations to determine quantities of work performed or placed during each progress payment period.

B. Perform surveys necessary for the CO to determine final quantities of work in place. Final payment quantities will be based on the Government's original terrain data and submitted survey notes and computations.

C. Perform quantity surveys in presence of the COR, unless specifically waived. Notify the COR at least 24 hours before performing a quantity survey.

3.3 SURVEY REQUIREMENTS

A. Alignment Staking: Each 50 feet on tangent and each 25 feet on curves.

B. Slope Staking: Each 50 feet on tangent and each 25 feet on curves, restake every 10 feet in elevation.

C. Structures: Stake out of structures and checkouts before and during construction.

D. Roads: Blue tops each 50 feet on tangent and each 25 feet on curves.

E. Cross-sections: Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys. Survey borrow areas before and after removal of materials, but before final shaping.

F. As-builts: Perform for all phases of the work.

G. Other: Benchmarks, control points, grout hole locations, and instrument locations and elevations including survey monitoring points on the dam embankment and structure.

3.4 ACCURACY

A. Degree of Accuracy

1. Alignment of Tangents and Curves: Within 0.01 foot.
2. Structure Points: Set within 0.01 foot, except where installation or operation considerations require tighter tolerances.
3. Grade Stakes (Blue Tops): Set within 0.01 foot.
4. Cross-Section Points: Locate within 0.10 foot, horizontally and vertically.
5. Vertical Elevation Surveys: Close within 0.05 foot times the square root of the circuit length in miles.
6. Coordinates and elevations of new survey monitoring points: Set within 0.01 foot.

3.5 FIELD RECORDS

A. Record original field notes, computations, and other surveying data in fieldbooks.

B. Record survey data in accordance with recognized professional surveying standards.

1. Notes or data not in accordance with standard formats will be rejected.
2. Illegible notes or data or erasures on any page of a fieldbook will be sufficient cause for rejection of part or all of fieldbook.
3. Corrections by ruling or lining out errors will be permitted.
4. Copied notes or data will not be permitted.
5. Rejection of part or all of a fieldbook may necessitate resurveying.

C. Data and notes may be collected on electronic data collection devices with prior approval of the COR.

1. Electronic files of notes: In approved format.
2. Include electronic files and paper copies of notes in submittals.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work except as specified.
2. Cost of environmental site assessments are the Contractor's responsibility.

1.2 REFERENCE STANDARDS

A. Bureau of Reclamation (USBR)

1. RSHS-2009 Reclamation Safety and Health Standards

B. Code of Federal Regulations (CFR)

1. 40 CFR 261.3 Definition of Hazardous Waste
2. 49 CFR 171-179 Transportation - Hazardous Waste Regulations

1.3 DEFINITIONS

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, State, or local laws or regulations.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 74 00-1, Waste production and disposal records.

1. Include certifications that waste was properly disposed.

C. RSN 01 74 00-2, Hazardous wastes manifest.

D. RSN 01 74 00-3, Environmental consultant resume:

1. Describe experience on similar project.

E. RSN 01 74 00-4, Environmental site assessment.

1.5 QUALIFICATIONS

A. Environmental consultant: Minimum 2 years experience in conducting environmental site assessments for similar construction.

1.6 REGULATORY REQUIREMENTS

A. Comply with Federal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

1.7 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR.

1. Cease work in areas where waste may be hazardous until waste materials are investigated by the COR.
2. If waste is hazardous, the COR may order delays in time of performance or changes in work, or both.
3. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. Keep work and storage areas free from accumulations of waste materials and rubbish.

3.2 FINAL CLEANUP

A. Remove temporary plant facilities, buildings, concrete footings and slabs, rubbish, unused materials, concrete forms, and other similar materials which are not part of permanent work.

B. Clean debris from drainage systems.

3.3 DISPOSAL

A. Nonhazardous Waste Disposal:

1. Dispose by removal from jobsite.
2. Recycle waste materials whenever possible.
3. Dispose of nonhazardous waste materials that are not recycled at appropriately permitted disposal facilities.

B. Hazardous Waste Disposal:

1. Dispose by removal from jobsite.
2. Recycle hazardous waste whenever possible.
3. Dispose of hazardous waste materials at appropriately permitted treatment or disposal facilities.
4. Transport hazardous waste in accordance with 49 CFR 171-179.

C. Certification: Certify that wastes are disposed of in accordance with Federal, State, and local regulations.

3.4 SITE ASSESSMENT

A. Upon completion of work, perform site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation areas.
2. Petroleum dispensing and storage areas where aggregate storage of petroleum at jobsite was over 110 gallons.
3. Hazardous material storage areas.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels.

3.5 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

This page intentionally left blank.

SECTION 01 78 30
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 78 30-1, Final As-built Drawings:

1. Certified marked sets.

1.3 RECORD DRAWINGS

A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of as-built conditions. Keep drawings at the jobsite and mark as work progresses.

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.

a. Include buried or concealed construction and utilities.

b. Include existing items, topographic features, and utility lines revealed during construction which differ from those shown on contract drawings.

2. Mark to define construction actually provided where choice of materials or methods is permitted in specifications, or where variations in scope or character of work from that of the original contract are authorized.

B. Use standard drafting practice to represent changes and include supplementary notes, legends, and details necessary to clearly portray as-built construction.

C. Mark as-built drawings in the following colors:

1. Red - Additions to original drawings.

2. Green - Deletions to original drawings.

3. Blue - Notations necessary for explanation of as-built markings.

D. Allow the COR to review the drawings at all times.

E. Upon completion of work, sign marked prints as certified correct.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 41 07

REMOVAL AND DISPOSAL OF EXISTING STRUCTURES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

   a. Excavation, removal and disposal of existing intake structure, gate control box, pipe and downstream headwall.

   b. Removal and disposal of existing failed gabions baskets.

   c. Removal and disposal of existing concrete (EWS) building pad.

   d. Removal and relocation of existing siphons to the construction staging area. Siphons may be incorporated as part of a temporary outflow conveyance system during construction, but must be returned to the staging area upon completion of the work. Navajo Nation Safety of Dams will pick up the salvaged siphon pipe.

   e. Remove and disposal of upstream concrete ogee.

   f. Removal and disposal of toe drains.

   g. Removal and disposal of existing fence, pipe guardrail and piezometers.

   h. Remove and salvage of existing riprap.

1.2 PROJECT CONDITIONS

A. Concrete to be removed consists of reinforcement, cement, sand, and broken rock or gravel.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 41 07-1, Concrete removal plan:

1. Describe methods and equipment to be used to locate embedded metalwork and reinforcement within concrete to be removed.

2. Describe methods, equipment, and sequence to be used for cutting and removing concrete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

A. Locate and mark exact locations of embedded reinforcement, pipe, conduit, and metalwork within concrete removal areas before beginning concrete removal.

B. Cease operations immediately if concrete removal operations cause cracking of remaining concrete structure and notify COR. Do not resume operations until directed by COR.

C. Repair concrete and reinforcement outside of prescribed removal lines which is damaged or loosened during cutting and removal operations.

1. Repair or replace as directed by COR.
2. Repair or replace in accordance with applicable sections of these specifications.

3.2 REMOVAL AND DISPOSAL OF GABION WIRE BASKETS

A. Remove riprap from wire baskets and store for future reuse.

B. Place removed riprap to locations shown on the Drawings and as directed by the COR.

C. Dispose of wire baskets.

3.3 DISPOSAL.

A. Dispose of removed materials in accordance with Section 01 74 00 – Cleaning and Waste Management.

3.4 REMOVAL AND SALVAGE OF EXISTING RIPRAP

A. Remove existing riprap and stockpile for reuse.

END OF SECTION

SECTION 03 11 10
CONCRETE FORMWORK

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and constructing forms in applicable prices offered in schedule for concrete items for which forms are required.

1.2 REFERENCE STANDARDS

A. APA – The Engineered Wood Association (APA)

1. APA PS 1-09 Structural Plywood

B. Bureau of Reclamation (USBR)

1. RSHS-2009 Reclamation Safety and Health Standards

C. Western Wood Products Association (WWPA)

1. WWPA G5 2011 Western Lumber Grading Rules 2011

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00-Submittals.

B. RSN 03 11 10-1, Formwork Design and Drawings for Concrete Structures:

1. Designs and drawings of formwork for concrete structures performed by and stamped by a registered professional engineer.

PART 2 PRODUCTS

A. Biodegradable concrete form release agent shall be as manufactured by Strong Products LLC, P.O. Box 1023, Battle Creek, Michigan, 888-959-9539 or equal approved by COR, having the following essential characteristics:

1. Low odor.
2. Designed for all concrete mixes.
3. Slow evaporation rate, zero solvents.
4. High flash point, 300 degrees F.
5. Auto ignition, 455 degree F.
6. Minimal atmospheric mist characteristics at proper air pressures.

7. Contains no waxes or silicones.

2.02 FORM MATERIALS

A. Sheathing or Lining: Conform to Table 03 11 10A - Form Sheathing or Lining Materials, or provide other materials which will produce equivalent results as approved by the COR.

Table 03 11 10A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common or better, shiplap, or plywood	Steel sheathing permitted Steel lining permitted if approved

B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.

C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.

D. Plywood: APA PS 1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

E. Softwood Lumber:

1. Meet requirements of WWPA G5 for dressed lumber or worked lumber of specified grade.
2. Use common boards surfaced on both edges (S2E) in accordance with WWPA G5.
3. Use 6- or 8-inch wide lumber for shiplap forms.
4. Use same lumber width in forms for F2 finishes.

PART 3 EXECUTION

3.1 DESIGN

A. Design formwork as required for structures shown on the plans. Design formwork in accordance with RSHS.

B. Designs and drawings performed by and stamped by a registered professional engineer.

3.2 INSTALLATION

A. Construct forms to confine and shape concrete to required lines so that completed work meets specified structural deviations, surface tolerances, and finish requirements.

B. Construct forms with sufficient strength to withstand pressure from placing and vibrating concrete. Maintain in proper position.

C. Adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.

D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.

E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.

F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.

G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.

H. F2 Finish:

1. Use one type of form sheathing or lining material for exposed F2 surfaces.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.
5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.

I. Form Ties and Anchors for other Concrete:

1. Embed ties for holding forms.
2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.
3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.

4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.

J. Cleaning and Oiling Forms:

1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.
2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3.3 REMOVAL

A. Remove forms within 24 hours after concrete has hardened sufficiently to prevent damage by form removal. Begin required repair and curing immediately after form removal.

B. Remove forms on upper sloping faces of concrete, such as forms on waterside of warped transitions, as soon as concrete has attained sufficient stiffness to prevent sagging.

C. Loosen wood forms for wall openings as soon as loosening can be accomplished without damage to concrete to prevent excessive stress in concrete from swelling of forms. Construct forms for openings to facilitate loosening.

D. Do not remove forms until concrete strength is such that form removal will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete.

E. Remove forms in a manner which prevents damage to concrete.

F. Repair damaged concrete in accordance with Section 03 30 00 – Cast-In-Place Concrete.

END OF SECTION

SECTION 03 15 00

CONCRETE JOINTS AND WATERSTOPS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Payment: Lump sum, incidental to the related structure.

1.2 SUMMARY

A. Construction, expansion, and contraction joints in concrete.

B. Tooling or chamfering edges of concrete.

C. Furnishing and installing waterstops.

1.3 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):
    a. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
    b. ASTM D 1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
2. U.S. Army Corps of Engineers Specifications (COE):
    a. CRD-C572-PVC Waterstop

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 03 15 00-1, Shop Drawings:

1. Waterstops:
    a. Manufacturer's product data and installation instructions
    b. Details of splices, including joint preparation; welding procedures; methods of securing and supporting waterstops in forms
2. Joint Filler Materials: Manufacturer's product data and installation instructions.

3. Concrete Joints:

    a. Layout and location for each type of joint

C. RSN 03 15 00-2, Samples:

1. 12-inch-long sample of each waterstop material to be used in construction of the Work.

2. 12-inch-long sample of each joint filler material to be used in construction of the Work.

PART 2 PRODUCTS

2.1 JOINT FILLER MATERIAL

A. Conforming to ASTM D 1752; pre-molded sponge rubber fully compressible with recovery rate of minimum 95 percent.

2.2 PVC WATERSTOP

A. Fabricated from a compound of which the basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

B. Conform to performance requirements of CRD-C572.

C. Type: Center bulb with parallel ribs or protrusions on each side of strip center. Constant thickness from bulb edge to outside stop edge. Corrugated- or tapered-type waterstops will not be accepted.

D. Specific Gravity: Not more than 1.4.

E. Shore Durometer Type A Hardness: Not less than 60.

F. PVC waterstops shall be designated as follows:

1. WSA: 6-inches wide, 1/8-inch thick, with a 1/4-inch inside diameter center bulb.

2. WSB: 9-inches wide, 3/8-inch thick, with a 7/8-inch inside diameter center bulb.

3. WSC: 12-inches wide, 1/2-inch thick, with a 7/8-inch inside diameter center bulb.

2.3 HYDROPHILIC WATERSTOP

A. Flexible, rubber-based joint sealant that swells upon contact with water.

B. Minimum 3/4-inch-wide by 3/8-inch-thick.

C. Products:

1. Adeka Ultra Seal MC-2010M, JLM Associates, Spearfish, SD; with 3M 2141 adhesive and P-201 sealant.

2. Hydrotite CJ-1020-2K, Greenstreak Plastic Products, St. Louis, MO; with Leakmaster LV-1 adhesive and sealant.

2.4 PLAIN DOWELS

A. Conforming to Section 03 30 00: Cast-In-Place Concrete

PART 3 EXECUTION

3.1 WATERSTOPS

A. Installed to form a continuous watertight diaphragm in the joint unless otherwise shown.

B. Installed PVC waterstop with one-half of the width of the waterstop embedded in the concrete on each side of the joint.

C. Provide a minimum of 2 1/2 inches of concrete cover over hydrophilic waterstop. When structure has 2 layers of reinforcing steel, locate centered between layers of steel or as otherwise shown on the Drawings.

D. Secure waterstop in correct position. Tie PVC waterstop to reinforcing steel using grommets, "hog rings," or tie wire at maximum spacing of 12-inches. Attach hydrophilic waterstop in accordance with manufacturer's instructions.

E. Do not displace waterstop during placement of concrete.

F. Ensure that concrete around waterstop is properly consolidated to ensure complete embedment of the waterstop in the concrete.

G. Splice in accordance with manufacturer's recommendations.

H. Only straight butt splices using heat welding shall be permitted in the field for PVC waterstop. All intersections, transitions, and changes of direction shall be factory fabricated.

3.2 CONSTRUCTION JOINT (CJ)

A. Locate construction joints at the locations shown on the Drawings and as otherwise determined by CONTRACTOR and approved by COR to facilitate construction of the Work. Relocation, addition, or elimination of any construction joint shall be subject to written approval of COR.

B. Bond is required at construction joints regardless of whether or not reinforcing steel is continuous across the joint.

C. Continue reinforcing steel across construction joints, unless otherwise shown on the Drawings.

D. Surface preparation:

1. Remove laitance and spillage from reinforcing steel and plain dowels.

2. Thoroughly clean surface to remove loose or defective concrete, coatings, sand, curing compound, and other foreign material.

3. Roughen surface to minimum of 1/4-inch amplitude:

a. Sandblast if concrete is fully cured.

b. Water blast if concrete is partially cured.

4. Do not damage waterstop or other embedded items, if present.

3.3 CONTRACTION JOINT (CTJ)

A. Locate contraction joints at the locations shown on the Drawings or as otherwise required by COR.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean abutting concrete surface of laitance, dirt and debris.

F. Coat abutting surface with curing compound. Curing compound shall conform to requirements of Section 03 30 00: Cast-In-Place Concrete. Do not coat waterstop with curing compound.

G. Place abutting concrete.

3.4 EXPANSION JOINTS (EJ)

A. Locate expansion joints at the locations shown on the Drawings or as otherwise required by COR.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean abutting concrete surface of laitance, dirt and debris.

F. Place joint filler material in accordance with manufacturer's instructions.

G. Place abutting concrete.

3.5 TOOLED EDGES

A. Tool or chamfer edges of concrete as shown on the Drawings or required by COR.

B. Where shown on the Drawings, outside edges of concrete shall be neatly finished with an edging tool. The radius of the tooled edges shall not be greater than 1/4-inch.

END OF SECTION

This page intentionally left blank.

SECTION 03 15 20
SPONGE RUBBER JOINT FILLER

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in the schedule for other cast-in-place structural concrete.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D 1752-04a(2008)	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 03 15 20-1, Approval Data:

1. Manufacturer’s product data for filler and adhesive.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store filler in protected area at temperature of 70 degrees Fahrenheit (21 degrees Celsius) or less.

B. Do not expose to sunlight.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sponge Rubber Joint Filler:

1. ASTM D 1752, Type I, except as specified.
2. Test specimen compression load: 50 to 150 pounds per square inch.

B. Adhesive: Nonbituminous adhesive recommended by filler manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean and prepare concrete contact surface in accordance with adhesive manufacturer's recommendations.

3.2 INSTALLATION

A. Cut filler to size and shape of joint surface to receive filler.

B. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.

C. Butt sections of filler with tight-fitting butt joints.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of concrete reinforcement in applicable prices offered in the schedule for concrete items for which concrete reinforcement is required.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A 497/A 497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
2.	ASTM A 615/A 615M-09	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
3.	ASTM A 996/A 996M-09	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 03 20 00-1, Reinforcement Diagrams and Lists:

1. Bar-placing diagrams, bar lists, and bar-bending diagrams required for reinforcement fabrication and placement.

    a. Prepare bar-placing diagrams, bar lists, and bar-bending diagrams in accordance with drawings.

C. RSN 03 20 00-2, Mill Certificates: Mill certificates for reinforcing steel.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid rusting.

B. Protect from contaminants such as grease, oil, and dirt.

C. Provide for identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars:

1. ASTM A 615, Grade 60; or ASTM A 996, Type A, Grade 60.
2. Deformed steel bar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.

B. Accurately place and secure in position so that reinforcement will not be displaced during concrete placement.

C. Field bending not allowed unless approved by COR.

D. Do not weld or tack weld reinforcing bars.

E. Place reinforcement with a clear distance of 1 inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.

F. Tolerances:

1. Maintain concrete cover over reinforcement within 1/2 inch of specified cover where specified cover is greater than 2-1/2 inches.
2. Maintain concrete cover over reinforcement within 1/4 inch of specified cover where specified cover is 2-1/2 inches or less.
3. Maintain spacing of reinforcing bars within 1 inch of required spacing.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cast-In-Place Concrete:

1. Measurement and Payment: Lump-sum price as offered in the schedule including Intake Tower, Bridge Support Structure, and Outlet Dissipation Structure, complete.
    a. Includes cost of work and materials for concrete except as specified.
    b. Includes cost of reinforcing steel.

1.2 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 117-06	Tolerances for Concrete Construction and Materials and Commentary
2.	ACI 301-05	Structural Concrete
3.	ACI 305R-99	Hot Weather Concreting
4.	ACI 306.1-90(2002)	Cold Weather Concreting

B. ASTM International (ASTM)

1.	ASTM C 31/C 31M-08b	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C 33/C 33M-08	Concrete Aggregates
3.	ASTM C 39/C 39M-05	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C 94/C 94M-09	Ready-Mixed Concrete
5.	ASTM C 114-09	Chemical Analysis of Hydraulic Cement
6.	ASTM C 143/C 143M-08	Slump of Hydraulic-Cement Concrete
7.	ASTM C 117-04	Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
8.	ASTM C 136-06	Sieve Analysis of Fine and Coarse Aggregates

9.	ASTM C 138/C 138M-08	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
10.	ASTM C 143/C 143M-08	Slump of Hydraulic-Cement Concrete
11.	ASTM C 150-07	Portland Cement
12.	ASTM C 171-07	Sheet Materials for Curing Concrete
13.	ASTM C 231-08c	Air Content of Freshly Mixed Concrete by he Pressure Method
14.	ASTM C 260-06	Air-Entraining Admixtures for Concrete
15.	ASTM C 309-07	Liquid Membrane-Forming Compounds for Curing Concrete
16.	ASTM C 494/C 494M-08a	Chemical Admixtures for Concrete
17.	ASTM C595 / C595M - 11	Standard Specification for Blended Hydraulic Cements
18.	ASTM C 618-08a	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
19.	ASTM C 979-05	Pigments for Integrally Colored Concrete
20.	ASTM C 989-09a	Slag Cement for Use in Concrete and Mortars
21.	ASTM C 1017/C 1017M-07	Chemical Admixtures for Use in Producing Flowing Concrete
22.	ASTM C 1260-07	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
23.	ASTM C 1293-06	Determination of Length Change of Concrete Due to Alkali-Silica Reaction
24.	ASTM C 1567 -04	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
25.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic Cement Concrete
26.	ASTM D 1751-04(2008)	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
27.	ASTM D 1752-04a(2008)	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

C. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specifications for Repair of Concrete, August 1996 (Appendix A of "Guide to Concrete Repair" available at http://www.usbr.gov/pmts/materials_lab/repairs/guide.pdf)
2.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

D. National Ready Mixed Concrete Association

1.	NRMCA	Certification of Production Facilities

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 0 - Submittals.

B. RSN 03 30 00-1, Material Approval Data:

1. Mix Design: For each concrete mix design.
    a. Mixture proportions, materials sources, and physical properties.
        1) Field test data meeting requirements of ACI 301 4.2.3.2.a, within 12 months or
        2) Compressive strength results from trial batches made within 6 months.
            a) Trial mix test results, three six-inch diameter cylinders each at 7, 28, and days.
            b) Average compressive strength of trial batch cylinders at designated design age at least design strength plus 1200 lbs/in^2.
    b. All admixtures to be used in the mix shall be incorporated into the mix design submitted for approval.
    c. Identify all admixtures to be used in mix by manufacturer and product name.
    d. Re-submit mix design for any change in material source or type.
    e. Concrete color additive selection and written approval from the concrete color additive manufacturer of acceptability of submitted concrete mix design.
2. Name and manufacturer of each cementitious material, and aggregate source.

a. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications.

b. The Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

3. Manufacturer's product data for each admixture, curing compound, form release agent, and joint filler material.

4. Written plan describing location, sequence, and date of concrete placements scheduled.

C. RSN 03 31 00-2, Materials Certifications and Test Reports:

1. Cementitious certification:

a. Manufacturer's certification and test reports for each lot from which shipments are drawn.

b. Certify materials were tested during production or transfer in accordance with specified reference specification.

2. Aggregate certification:

a. Producer's physical property, gradation and ASR testing reports for each aggregate source, less than 6 months old.

3. Submittal of certification and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements

D. RSN 03 30 00-3, Concrete Placement Drawings:

1. For approval.

2. Drawings for each individual concrete placement. An individual concrete placement is defined as a portion of concrete work placed in one continuous operation between specified lines or joints.

3. Show locations, dimensions, blockouts, openings, recesses, waterstops, and finishes.

4. Show details of items embedded in or associated with placement except reinforcing steel.

5. Include a separate drawing showing placement sequence.

6. Place a title block with Contractor's name, contract title and number, placement identification, and identifying drawing number in lower right hand corner of each drawing.

7. List reference drawings from which details shown on placement drawing were obtained on each drawing.

8. Reference related steel reinforcement drawings associated with placement on each drawing.

E. RSN 03 30 00-4, Concrete Placement Schedule:

1. Complete, detailed concrete placement schedule showing the Contractor's plan for placement of individual features, units, and other elements of concrete work.

2. Detail as necessary to show location, sequence, and date of concrete placements scheduled for each item of concrete work.

3. Show submittal of detail drawings and placement of reinforcement and embedded items.

4. Cast-in-Place Colored Architectural Concrete Placement Schedule:

a. Schedule identifying all cast-in-place colored concrete placements.

F. RSN 03 30 00-5, Instructions:

1. Manufacturer's application instructions for curing compounds.

G. Concrete Repair: In accordance with USBR M-47. ICRI

H. The Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

1.4 PERFORMANCE

A. Perform work in accordance with ACI 301.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of concrete in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

B. Sponge Rubber Joint Filler Storage:

1. Store in protected area at temperature of 70 degrees F (21 degrees C) or less.

2. Do not expose to direct sun.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

A. Cementitious materials options:

1. Specified portland cement plus 20 percent plus or minus 5 percent by weight specified pozzolan.

2. Blended Hydraulic Cement meeting ASTM C 595 and the percent replacement of pozzolan above.

B. Portland Cement:

1. ASTM C 150, Type.
2. Meet equivalent alkalies requirements of ASTM C 150 - Table 2.
3. Meet false-set requirements of ASTM C 150 - Table 4.

C. Pozzolan:

1. ASTM C 618, Class F, except as specified.
   a. Sulfur trioxide, maximum: 4.0 percent.
   b. Loss on ignition, maximum: 2.5 percent.
   c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C 618. Use low-alkali cement for test.
   d. Does not decrease sulfate resistance of concrete by use of pozzolan.
      1) Demonstrate pozzolan will have an "R" factor less than 2.5.
      2) R = (C-5)/F
      3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C 114.
      4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C 114.

2.2 WATER

A. ASTM C 1602, including optional requirements of Table 2.

2.3 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C 33. except allowable fines content (material passing No. 200 sieve) less than 3 percent.

B. Coarse aggregate:

1. Drilled shaft: ASTM C 33, Size No. 57.
2. Placements other than drilled shafts that are greater than 3-feet in the smallest direction: ASTM C 33, Size No. 467
3. Other concrete: ASTM C 33, Size No. 57

C. Assure aggregates are not deleteriously alkali-silica reactive (ASR).

1. Test for the potential for deleterious alkali-silica reaction of coarse and fine aggregate shall be made in accordance with ASTM C 1260.
    a. Expansion at 16 days does not exceed 0.10 percent: the coarse or fine aggregates will be acceptable.
    b. Expansion at 16 days is greater than 0.10 percent, but less than 0.20 percent, aggregates are acceptable if petrographic examination shows the expansion is not due to ASR.
        1) Otherwise, test specimens according to ASTM C 1567 using all components (e.g. coarse aggregate, fine aggregate, cementitious materials, and/or specific reactivity reducing chemicals) in the proportions proposed for the mixture design and retest.
            a) Expansion of the proposed mixture design test specimens, tested in accordance with ASTM C 1567 does not exceed 0.10 percent at 16 days from casting, the aggregates will be acceptable.
            b) Expansion of the proposed mixture design test specimens is greater than 0.10 percent at 16 days, the aggregates will not be acceptable unless adjustments to the mixture design can reduce the expansion to less than 0.10 percent at 16 days, or new aggregates shall be evaluated and tested, or testing by ASTM C 1293 indicates the aggregates will not experience deleterious expansion.
    c. Expansion at 16 days is greater than 0.20 percent
        1) Aggregate will not be acceptable, unless a combination of cement, aggregate, and supplemental cementitious materials is found to effectively mitigate the expansion using ASTM C 1567.
2. Substitution of ASTM C 1293 test results for ASTM C 1260 test results
    a. Acceptable but the average concrete prism expansion shall be less than 0.40 percent at one year.

2.4 ADMIXTURES

A. Air-Entraining Admixture:
    1. ASTM C 260.
    2. Unless otherwise recommended by manufacturer, use a neutralized vinsol resin formulation for air-entraining admixture used with ASTM C 494, Type F or G; and ASTM C 1017, Type I or II chemical admixtures.

B. Chemical Admixtures:
    1. Allowable Chemical Admixtures:

a. ASTM C 494, Type A, D, F, or G.

b. ASTM C 1017, Type I or II.

c. ASTM C 494, Type C and E, provided they do not contain chlorides.

2. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2.5 CURING MATERIALS

A. Water: ASTM C 1602, including optional requirements of Table 2.

B. Curing Compounds: ASTM C 309 and combatable with colored concrete additive.

C. Polyethylene Film: ASTM C 171, white opaque or clear. Use white opaque film where film is exposed to sunlight.

2.6 ACCESSORIES

A. Form Release Agents: Colorless biobased material which will not soften or stain concrete, absorb moisture, cause dusting of concrete surface, or impair concrete bonding and combatable with colored concrete additive.

B. Bituminous Joint Filler: ASTM D 1751.

C. Sponge Rubber Joint Filler:

1. ASTM D 1752, Type I, except as specified.

2. Test Specimen Compression Load: 50 to 150 lb/in^2.

D. Joint Filler Adhesive: Nonbituminous adhesive recommended by filler manufacturer.

2.7 MIX PROPORTIONS

A. Concrete:

1. Use specified cementitious materials.

2. Net water-cementitious materials ratio: 0.45, maximum, by weight.

3. Slump: In accordance with ASTM C 143.

a. Concrete in Drilled Shafts: 5 to 8 inches at placement, except as specified.

b. Concrete in Slabs: 1 to 3 inches at placement, except as specified.

c. Other Concrete: 2 to 4 inches at placement, except as specified, or prior to addition of high-range water-reducing admixtures

d. Concrete with ASTM C 1017, Type I or II plasticizing admixtures or ASTM C 494 Type F, high-range water-reducing, admixtures Type G,

high-range water-reducing and retarding admixtures: Use slump appropriate for placing conditions. Maximum 8 inches.

e. OPTION: Colored concrete at a slump not to exceed 4 inches at the time of placement.

4. Air Entrainment: 4.5 to 6.5 percent air by volume of concrete as discharged at placement, in accordance with ASTM C 231.

5. Compressive strength: At 28 days, minimum: 4500 lb/in^2

B. The Contractor shall design concrete mix. The Government reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.

1. When required, adjustment of mix proportions by the Government will be in accordance with USBR Concrete Manual.

C. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field performance methods as specified in ACI 301. For the trial batch method, mix must be proportioned and stamped by a professional engineer.

D. Acceptance criteria:

1. In accordance with ASTM C 94, plus the following

a. 90 Percent of test cylinders exceed specified compressive strength at 28 days.

b. Average compressive strength of any six consecutive test cylinders exceeds specified compressive strength at 28 days.

c. No individual strength test falls below specified compressive strength by more than 500 lbs/sq. in.

E. When air temperature has fallen to or is expected to fall below 40 degrees F: Prepare ingredients and mix in accordance with ACI 306.1

1. Uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees and not more than 90 degrees F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

F. If Hot Weather precautions are necessary: Prepare ingredients and mix in accordance with ACI 305R

1. Cool ingredients before mixing to maintain specified maximum concrete temperature at time of placement

2. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

3. All ice replacing batch water must be melted prior to discharge.

2.8 BATCHING, MIXING, AND TRANSPORTING

A. Manufacture and deliver concrete in accordance with ASTM C 94.

B. Prevent appreciable segregation of ingredients and slump loss exceeding 2 inches in concrete delivered to work.

C. Batch plant must be NRMCA certified

2.9 CONCRETE TEMPERATURE

A. Concrete temperature at placing: 50 to 90 degrees F (10 to 32 degrees C).

B. For placements other than drilled shafts that are greater than 3-feet in the smallest direction: 50 to 70 degrees F. (10 to 21 degrees C).

PART 3 EXECUTION

3.1 QUALITY CONTROL

A. Testing:

1. Independent testing laboratory shall perform sampling, testing, and reporting as required in Table 03 30 00A - Contractor Materials Testing Requirements and Frequency.

    a. Independent testing laboratory shall meet requirements specified in Section 01 43 20 - Testing Laboratory Services.

Table 03 30 00A - Contractor Materials Testing Requirements and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	STANDARD REQUIREMENT	MINIMUM FREQUENCY OF TESTING
Fresh Concrete	ASTM C 31	Making and Curing Concrete Test Specimens in the Field	Unit weight and yield not required but will	1 test per each day of placement. Provided that a minimum of 5 samples for strength testing of each class used shall be taken.
	ASTM C143	Slump of Hydraulic-Cement Concrete		

Table 03 30 00A - Contractor Materials Testing Requirements and Frequency

PROCEDURE	TEST STANDARD	STANDARD TITLE	STANDARD REQUIREMENT	MINIMUM FREQUENCY OF TESTING
	ASTM C 138	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete	be accepted for information only	
	ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method (alternative to ASTM C 138 gravimetric method)		
	ASTM C 1064	Temperature of Freshly Mixed Concrete		
Compressive Strength, Cylinders	ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens	90 percent exceed specified compressive strength at 28 days.	1 test per each day of placement of each class. Provided that a minimum of 5 samples for strength testing of each class used shall be taken.
Compressive Strength, Cylinders	ASTM C 42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	Average strength of 3 cores exceed 85 percent of the design 28 day compressive strength and no core is less than 75 percent of the design 28 day compressive strength.	At discretion of the Government when cylinder strengths fail to meet minimum requirements.

3.2 QUALITY ASSURANCE

A. In addition to required contractor quality testing, the Government may test concrete.

B. In addition to the Contractors quality control program, the Government will test compressive strength in accordance with ASTM C 31 and ASTM C 39 for 6- by 12-inch cast cylinders.

C. Compressive strength may also be determined by Government in accordance with ASTM C 42 for concrete cores.

3.3 PREPARATION

A. Do not place concrete until formwork, installation of embedded items, and preparation of surfaces involved in placement have been approved by COR.

B. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

C. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with an air-water jet and dry to a uniform surface-dry condition.

D. Prepare earth foundations free from frost or ice.

E. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete.

F. Clean, roughen, and surface dry surfaces of existing concrete and construction joints to be covered with fresh concrete.

1. Remove laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material.
2. Wet sandblast or bushhammer surface, wash thoroughly, and surface dry immediately before placement of adjoining concrete.
3. Do not use a mortar layer on construction joints.

G. Contraction and Control Joints:

1. Clean joint surface of dirt, accretions of concrete, and foreign material by scraping, chipping, or other methods approved by COR before application of curing compound.
2. Do not remove curing compound. Keep curing compound intact on joint surface until adjoining concrete is placed.
3. Keep reinforcing bars and other embedded items free of curing compound until adjoining concrete is placed.

H. Prepare surfaces of forms and embedded materials free of curing compound, dried mortar from previous placements, dirt, and foreign substances before placing adjacent or surrounding concrete.

I. Before beginning concrete placement, make ready a sufficient number of properly operating vibrators and operators and make readily available additional vibrators to replace defective vibrators during progress of placement. COR may delay concrete placement until number of available working vibrators is acceptable.

3.4 PLACING

A. Notify COR at least 24 hours before placing concrete.

B. Do not use aluminum pipes and chutes for placing or pumping concrete.

C. Do not retemper concrete.

D. Do not use concrete which has become so stiff that concrete cannot be properly placed.

E. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20 inches in depth of layers.

F. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.

3.5 FINISHING

A. Formed Surfaces:

1. Surfaces to be Concealed by Fill: ACI 301 rough-form finish.
2. Formed Surfaces to Remain Exposed: ACI 301 smooth-form smooth-rubbed finish.

B. Unformed Surfaces:

1. Indoor Floors to be Covered with Ceramic Tile: Finish as recommended by tile manufacturer.
2. Other Indoor Floors: ACI 301 troweled finish.
3. Outdoor Flatwork: ACI 301 float broom finish.
4. Outdoor Equipment Slabs or Pads: ACI 301 float finish.

3.6 JOINTS GROOVES AND EDGES

A. Construction Joints:

1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.
2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.
3. Locate construction joints where shown on drawings or approved by COR.
4. Relocation, addition, or elimination of construction joints will be subject to approval by COR.

B. Contraction Joints:

1. Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units.
2. Construct contraction joints so no bond exists between concrete surfaces forming the joint.
    a. Construct contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.
    b. Coat surface of concrete first placed at contraction joint with curing compound before placing concrete on other side of joint.
3. Except as provided for dowels, reinforcement is not continuous across a contraction joint.

C. Control Joints:

1. Control joints are joints placed in concrete to provide for control of initial shrinkage stresses and cracks of monolithic units.
2. Construct control joints same as specified for contraction joints, except make reinforcement continuous across control joints.

D. Expansion Joints:

1. Form joint in concrete. Do not saw cut joint.
2. Fill joint with bituminous joint filler.
3. Butt sections of filler with tight-fitting butt joints.

E. Expansion Joints:

1. Form joint in concrete. Do not saw cut joint.
2. Cut sponge rubber joint filler to size and shape of joint surface to receive filler.
3. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.

4. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

F. Tooled Grooves: Construct 1/2-inch-deep, 1/4-inch-wide, tooled grooves in outdoor flatwork where indicated on drawings.

G. Tooled Edges:

1. Tool exposed edges of slabs; top edges of curbs; edges of contraction control and expansion joints; and other edges where required to prevent chipping.

2. Radius: 1/4 inch.

3.7 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effects that permissible variations may have upon a structure. COR reserves the right to diminish specified structural deviations and surface tolerances where such variations impair structural action, operational function, or architectural appearance of a structure or portion of structure.

D. Construct concrete within stated variations even though more than one may be specified.

1. Specified variation for one element of a structure will not apply when it will permit another element of same structure to exceed its allowable variation.

2. Where variations are not specified or shown on drawings for a particular structure, variations shall be those specified for similar work. As an exception to clause at FAR 52.236-21 “Specifications and Drawings for Construction,” specific tolerances shown on drawings in connection with any dimension shall govern.

E. Structural deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03 30 00B - Deviations from Specified Lines, Grades, and Dimensions.

2. Variation is distance between actual position of structure or any element of structure and specified position in plan for structure or particular element.

a. Plus or minus variations, shown as (∀), indicate a permitted actual position up or down and in or out from specified position in plan.

b. Variations not designated as (+) or (-) indicate maximum deviation permitted between designated successive points on completed element of construction.

3. Specified position in plan is defined as lines, grades, and dimensions described in these specifications, shown on drawings, or prescribed by COR.

Table 03 30 00B - Deviations from specified lines, grades, and dimensions

A. DAM STRUCTURES		
1.	Footings for columns, piers, walls, buttresses, and similar members:	
	(a) Variation in length and width of dimensions from those specified	-1/2 inch +2 inches
	(b) Horizontal misplacement or eccentricity	2 percent of footing width indirection of misplacement but not more than 2 inches
	(c) Reduction in thickness from that specified	5 percent of specified thickness not to exceed 1 inch
2.	Variation of controlling dimensions for each structure from specified position in plan with reference to dam axis:	
	(a) Overall dimensions	Exposed: ±1 inch Buried: ±2-1/2 inches
3.	Variation from centerline specified in plan for intake tower and outlet structures, walls, end sections, and parapets:	
	(a) For overall length, except for buried construction	±1 inch
	(b) For buried construction	± 2 inches
	(c) For any span less than 20 feet except for buried construction	±1/2 inch

Table 03 30 00B - Deviations from specified lines, grades, and dimensions

4.	Variation from specified grade for intake tower and outlet structures, walls, end sections, and parapets:	
	(a) For hydraulic structures	±1/2 inch
	(b) For all other surfaces	±1 inch
	(c) For any span less than 10 feet	1/2 inch
5.	Variation from plumb, specified batter, or specified curved profile for lines and surfaces of columns, walls, piers, buttresses, arch sections, vertical joint grooves, and arrises:	
	(a) Exposed construction, when overall height of line or surface is:	
	Less than 10 feet	±1/2 inch
	10 feet or more	±3/4 inch
	(b) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/2 inch
	More than 20 feet	3/4 inch
	(c) Buried construction:	
	(1) When overall height of line or surface is:	
	Less than 10 feet	±1 inch
	10 feet or more	±1-1/2 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	1 inch
	More than 20 feet	1-1/2 inch

Table 03 30 00B - Deviations from specified lines, grades, and dimensions

6.	Variation from level or specified grades for slabs, beams, soffits, horizontal joint grooves, and arrises:	
	(a) Exposed construction:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	±1/4 inch
	10 feet or more	±1/2 inch
	(2) For any two successive points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/4 inch
	More than 20 feet	1/2 inch
	(b) Buried construction:	
	(1) When the overall length of line or surface is:	
	Less than 10 feet	±1/2 inch
	10 feet or more	±1 inch
	(2) For any two successive points on the line or surface separated by:	
	10 to 20 feet, inclusive	1/2 inch
	More than 20 feet	1 inch
7.	Variation in cross-sectional dimensions from those specified for columns, beams, buttresses, piers, and similar members	-1/4 inch +1/2 inch
8.	Variation in the thickness of slabs, walls, arch sections, and similar members from that specified	-1/4 inch +1/2 inch
9.	Variation in location from specified position in plan of sleeves, floor openings, and wall openings	±1/2 inch
10.	Variation in sizes from those specified for sleeves, floor openings, and wall openings	±1/4 inch

F. Surface irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.

2. Surface irregularities are classified as “abrupt” or “gradual” and allowable tolerances are specified in Table 03 30 00C - Surface Tolerances.

   a. A surface tolerance is designated by a capital “T” followed by a number 1 through 5.

b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt surface irregularities:

a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

b. Abrupt surface irregularities include all incidences of isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual surface irregularities:

a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Surface tolerances:

Table 03 30 00C - Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1 inch	1/4 inch/inch
T2	1/2 inch	1/8 inch/inch
T3	1/4 inch	1/16 inch/inch
T4	1/8 inch	1/32 inch/inch
T5	1/32 inch	1/120 inch/inch

H. Repair of hardened concrete not within specified tolerances:

1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.

2. Perform repair after consultation with a Government inspector regarding method of repair. Notify COR as to time when repair will be performed.

3. Repair concrete which will be exposed to view in a manner which will result in a concrete surface with uniform appearance.

a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16 inch in cross section at finished surface.

b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16 inch in cross section at finished surface, repair concrete by excavating and replacing concrete.

I. Field verification of surface tolerances:

1. Determine compliance of a surface with specified surface tolerances.

2. Evaluate surface roughness.

a. Measure roughness height or depth and check for compliance with values specified in Table 03 30 00C - Surface Tolerances and Table 03 30 00B - Deviations from Specified Lines, Grades, and Dimensions.

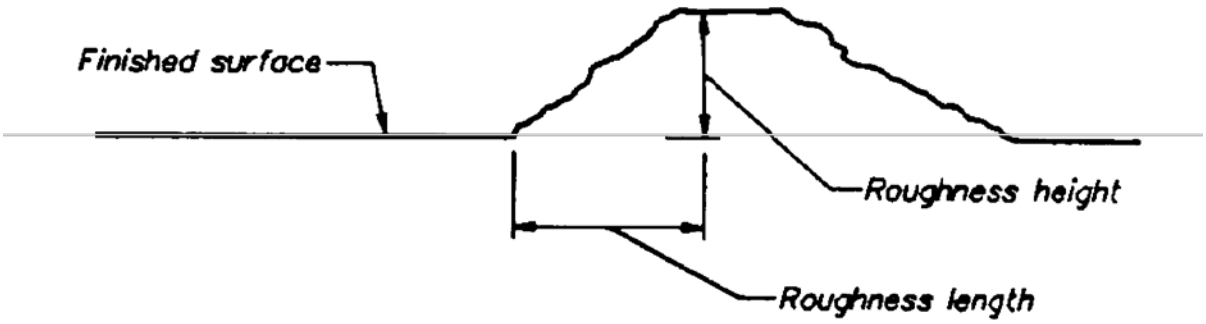
b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed any applicable value specified in Table 03 30 00B - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification.

1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

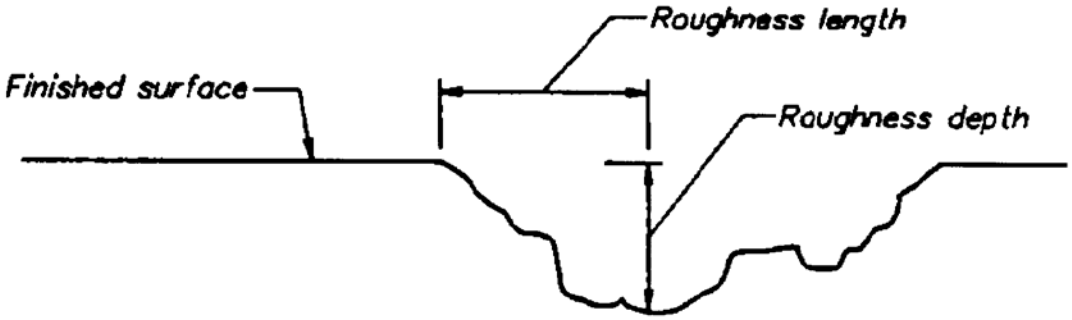
2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

J. Measuring surface roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. A roughness protruding above the surface should be measured with a straightedge that is at least 20 times longer than the roughness height being measured.

   b. Position the straightedge with one end resting on top of the roughness, as shown in Figure 1 (case 1).

   c. Determine the roughness height by measuring the maximum gap that occurs normal to the straight edge.

   d. Also, note the position on the straightedge from which the normal distance is measured.

   e. To determine the roughness length, measure the distance along the straightedge from the point where the height was measured to the point of contact between the straightedge and the top of the roughness.

   f. The roughness slope is defined as the ratio of the roughness height to the roughness length.

   g. As roughness is seldom symmetric, moving the position of the straightedge about the roughness may be necessary to locate the point where the maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

   a. A roughness occurring as an indentation to the surface is measured by placing the straightedge across the indentation, as shown in Figure 1 (case 2).

   b. Measure the maximum gap between the straightedge and the surface and note the location of the measurement on the straightedge.

   c. From the point of the depth measurement, measure along the straightedge in both directions to the point of contact with the surface.

   d. The shortest length measured is used as the roughness length.

   e. Divide the roughness depth by the roughness length to determine the roughness slope.

K. Prevention of repeated failure to meet tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different

finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.8 REPAIR

A. Repair tie holes and surface defects in accordance with ACI 301 and USBR M-47.

B. Obtain approval of each repair material and method from COR before proceeding with repairs.

3.9 CURING

A. Cure concrete in accordance with ACI 301.

B. Obtain approval of each curing method from COR before proceeding with each curing application.

C. Formed Surfaces:

1. Surfaces to be Concealed by Fill: Form cure or cure by application of white wax-base or white water-emulsified, resin-base curing compound.

2. Formed Surfaces to Remain Exposed: Form cure or cure by application of clear water-emulsified curing compound.

D. Unformed Surfaces:

1. Indoor Floors: Cure by covering with polyethylene film. Do not use curing compounds or sealers.

2. Outdoor Flatwork: Cure by covering with polyethylene film or application of clear water-emulsified curing compound.

3. Outdoor Equipment Slabs or Pads: Cure by covering with polyethylene film.

E. Water Curing:

1. Keep concrete surface wet for 14 days, minimum, from time concrete has attained sufficient set to prevent detrimental effects to surface.

2. Cure methods:

a. Water-saturated material.

b. System of perforated pipes, mechanical sprinklers, or porous hose.

c. Other methods which will keep surfaces wet.

d. Subject to approval by COR.

F. Curing with Curing Compound:

1. Mix and apply compound in accordance with manufacturer's instructions
2. Apply to concrete surface to provide a water-retaining film. Reapply as necessary to maintain a continuous, water-retaining film on surface for 28 days.
3. Thoroughly mix compound and spray apply in one coat to provide a continuous, uniform film over surface.
4. Do not exceed coverage rate of 150 square feet per gallon. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.
5. Ensure ample coverage on edges, corners, and rough surfaces.
6. Spray equipment and equipment performance will be subject to approval by COR. Repair or replace equipment when directed by COR.
7. Use personnel qualified in using specified spray technique, as determined by COR, to perform application.

G. Polyethylene Film Curing:

1. Thoroughly moisten concrete surface by lightly spraying with water as soon as concrete has hardened sufficiently to prevent damage.
2. Completely cover concrete surface with polyethylene film to provide an airtight, water-retaining film over entire surface.
3. Lap edges of polyethylene sheets to seal adjacent sheets.
4. Place tightly against concrete surface at extreme edge of curing area.
5. Secure film to withstand wind and prevent circulation of air inside curing film.
6. Keep surface covered for 14 days, minimum.

3.10 PROTECTION

A. Protect concrete from damage until final acceptance by Government.

1. Do not load, remove forms or shoring, or backfill against concrete until concrete has gained sufficient strength to safely support its weight and imposed loads.
2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.
3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

B. Protect concrete when freezing temperatures are imminent:

1. Maintain concrete at a temperature of 50 degrees F (10 degrees C) or greater for 72 hours, minimum, after placement. Vent heater and prevent concrete from drying where artificial heat is employed.
2. Protect concrete from freezing during water curing. After discontinuance of water curing, maintain at a temperature of 50 degrees F (10 degrees C) or greater for next 72 hours.
3. Discontinue protection against cold weather such that the drop in temperature of the concrete will be gradual and will not exceed 5 degrees F per hour and 40 degrees F in 24 hours for thin sections and 5 degrees R per hour and 20 degrees F in 24 hours for massive sections greater than 36 inches.

3.11 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03 30 00D – Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	Water White wax-base, or white water-emulsified resin-base curing compound
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	Water White wax-base, or white water-emulsified resin-base curing compound
Structures appurtenant to earth dams	F2	T3	Water White water-emulsified resin-base curing compound
Surfaces exposed prominently to view or where appearance is important	F3	T5	Clear curing compounds, water-emulsified resin-base if outdoors
Parapets	F3	T5	Clear curing compound, water-emulsified resin-base if outdoors
Construction joints and surfaces to be covered by grout	F1	T2	Water White wax-base curing compound

Table 03 30 00D – Formed Surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Expansion joints	F2	T3	Water White wax-base or white water-emulsified resin-base curing compound
Contraction joints	F3	T4	White wax-base curing compound

Table 03 30 00E - Unformed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by fill material or concrete	U1	T1	Water White wax-base or white water-emulsified resin-base curing compound Polyethylene film
Surfaces of concrete slab	Screed plus roller tamp finish	T1	Water Dissipating curing compound
Surfaces to be covered by grout	U1	T3	Water White wax-base or white water-emulsified resin-base curing compound
Tops of walls not prominently exposed to public view	U2	T4	Water Polyethylene film
Tops of walls prominently exposed to public view	U2	T5	Polyethylene film Clear water-emulsified, resin-base curing compound
Floors: spillways	U3	T3	Water Polyethylene film

END OF SECTION

This page intentionally left blank.

SECTION 03 37 52
SLUSH GROUTING

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Slush Grouting:

1. Measurement: Area of slush grout treatment in square feet as directed by the COR.
    a. Area is exposed rock foundation for dam embankment.
    b. Wasted, spilled, or excess slush grout will not be included.
2. Payment: Square yard price offered in the Schedule for Foundation Cleanup and Preparation.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C 33/C 33M-08	Concrete Aggregates
2.	ASTM C 150/C 150M-09	Portland Cement

1.3 DEFINITIONS

A. Crack: Includes cracks, joints, crevices, voids, and fractures in rock foundations.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 03 37 52-1, Placing Plan:

1. Techniques and equipment for surface preparation, grout mixing, grout placing, and clean up.

PART 2 PRODUCTS

2.01 SLUSH GROUT

A. Portland cement: ASTM C 150, Type V conforming to Section 03 30 00 – Cast-In-Place Concrete.

B. Sand: ASTM C 33, fine aggregate; except use sand with maximum particle size not exceeding 1/3 crack width.

C. Water: In accordance with Section 03 30 00 – Cast-In-Place Concrete.

D. Mix:

1. Proportions: 1 part cement to 2 parts of sand to 1 part water by volume.
2. Adjust proportion of water as directed by COR.
3. Mix in mechanical mixer as directed by COR.

E. Dispose of any grout not used within 1/2 hour of mixing.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate with Section 31 23 21- Excavation for Dam Embankment and Structural Foundations.

B. The COR will direct areas to receive slush grouting, once foundations are excavated and cleaned as described in Section 31 23 16 – Excavation of Existing Embankment and Foundation, prior to any work being performed.

1. Slush grouting shall be used on foundations for cracks with widths of 2 inches or less.
2. Use slush grout only to fill cracks within rock, not as a cover for exposed foundation surfaces.

C. Thoroughly clean cracks to be treated of loose material to a depth at least 3 times the crack width.

D. All rock services shall be cleaned by air jet, water jet, a combination of both, brooming, and hand removal as directed by the COR to achieve the desired results. Only the minimum amount of air or water pressure to achieve the desired results as directed by the COR. Desired results are a clean sound foundation.

3.2 PLACING

A. Thoroughly moisten the crack and remove any standing water immediately prior to placement of slush grout and as approved by COR.

B. Confine slush grout to the crack being treated. Avoid grout spillage or feather edging of slush grout.

C. Place slush grout by pouring or funneling into individual cracks; rodding to consolidate; brooming with a stiff-bristled broom over surfaces containing closely spaced cracks; or other method approved by the COR.

D. Immediately clean spilled or excess slush grout.

E. Leave finished surfaces of slush grouting in a roughened, broomed finish to provide satisfactory bonding surface.

F. Place earthfill or concrete over slush grout immediately after approval by COR. Place earthfill or concrete to cover slush grout while slush grout is still plastic.

END OF SECTION

This page intentionally left blank.

SECTION 03 37 55
DENTAL CONCRETE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Dental Concrete:

B. Slush Grouting:

1. Measurement: Area of slush grout treatment in square feet as directed by the COR.
    a. Area is exposed rock foundation for dam embankment.
    b. Wasted, spilled, or excess slush grout will not be included.
2. Payment: Square yard price offered in the Schedule for Foundation Cleanup and Preparation.

1.2 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 31/C 31-03a	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C 33-03	Concrete Aggregates
3.	ASTM C 39/C 39M-04	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C 94/C 94M-04a	Ready-Mixed Concrete
5.	ASTM C 114-10	Chemical Analysis of Hydraulic Cement
6.	ASTM C 143/C 143M-10a	Slump of Hydraulic-Cement Concrete
7.	ASTM C 150/C 150M-09	Portland Cement
8.	ASTM C 231/C 231M-10	Air Content of Freshly Mixed Concrete by the Pressure Method
9.	ASTM C 260-01	Air-Entraining Admixtures for Concrete
10.	ASTM C 494/C 494M-05a	Chemical Admixtures for Concrete
11.	ASTM C 1017/C 1017M-03	Chemical Admixtures for Use in Producing Flowing Concrete
12.	ASTM C 1260-07	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
13.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic

Cement Concrete

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 03 37 55-1, Mix Design: Dental concrete mix design for approval.

1. Mixture proportions, materials sources, and physical properties.

a. Field test data meeting requirements of ACI 301 4.2.3.2.a, within 12 months or

b. Compressive strength results from trial batches made within 1 year.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch tickets with each batch of concrete in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

A. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

2.2 WATER

A. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

2.3 AGGREGATE MATERIALS

A. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

B. Fine aggregate: ASTM C 33.

C. Coarse aggregate: ASTM C 33, No. 467.

2.4 ADMIXTURES

A. Chemical Admixtures:

B. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

C. Other admixtures only as directed by the COR.

D. Air Entrainment: ASTM C 260, 4 to 6 percent air by volume of dental concrete as discharged at placement.

2.5 MIX

A. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

B. Design and adjust concrete mix.

C. Mix proportions will be adjusted by COR during work whenever need for adjustment is indicated by results of materials testing and based on field conditions.

D. Compressive Strength:

1. 4,000 psi, minimum, at 28 days. Compressive strength will be determined by COR in accordance with ASTM C 31 and ASTM C 39 for 6- by 12-inch cast cylinders.

2.6 BATCHING, MIXING, AND TRANSPORTING

A. Manufacture and deliver in accordance with ASTM C 94.

2.7 CONCRETE TEMPERATURE

A. Concrete temperature at placing: 50 to 85 degrees F.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform to details indicated contract documents.

B. Excavate and clean designated open joints, shear zones, and fractured areas of all loose materials before placing dental concrete as approved by COR.

C. Clean designated open joints, shear zones, and fractured areas to a depth of at least three times their width.

3.2 PLACING

A. The foundation surface shall be approved by the COR prior to dental concrete placement.

B. Use dental concrete in areas where placement and compaction of embankment materials is not feasible, as determined by COR.

C. Place dental concrete in exposed areas of broken, fractured, or sheared portions of foundation surfaces as directed by COR.

D. Place dental concrete in areas of over hanging rock faces or rock faces steeper than 0.5H:1V (Horizontal:Vertical). Form dental concrete in these areas to provide abutment contact slopes of not steeper than 0.5H:1V.

E. Excavate soft areas of formation surfaces and fill with dental concrete as directed by COR.

F. Use formwork at locations directed by COR.

G. Leave finished surfaces of dental concrete in a roughened, broomed finish to provide a satisfactory bonding surface for embankment materials.

H. Cure with polyethylene film or water for 24 hours prior to placing embankment.

END OF SECTION

SECTION 03 37 58
FOUNDATION GROUTING

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Drill holes for grouting:

1. Measurement: Length of hole drilled for test program or foundation grouting program, including:

   a. Mobilize and set up all equipment needed for drilling (drill, compressor, pumps, drill rods, bits and accessories);

   b. Move and set up equipment to drill at locations shown or directed by the COR;

   c. Drill holes at the angles, directions, and lengths shown or directed by the COR;

   d. Circulate water to wash drill cuttings from the hole until clean.

2. Payment: At the unit price per foot of hole actually drilled and available for grouting.

B. Mobilize for grouting:

1. Measurement: Lump sum to bring all equipment, accessories, personnel, incidentals and materials to the site including:

   a. Mixers, tanks, pumps, pipes, fittings, hoses, packers, valves, gauges, meters, cement, and accessories;

   b. Specialist personnel for the grouting program;

   c. Admixtures for the grouting program.

2. Payment: At the lump sum bid after receipt of submittals and satisfactory demonstration that the system operates in accordance with this specification section.

C. Foundation grouting:

1. Measurement: Volume of cement grout injected during the foundation grouting program, and including:

   a. Test program to evaluate equipment, materials, mix design, mixing and grouting procedures and to develop stage lengths, maximum grouting pressures, refusal criteria and closure criteria;

   b. Grouting of foundation defects such as joints;

c. Water pressure testing by stages in each drill hole;

d. Mixing and injecting Portland cement grout by stages into each drill hole;

e. Monitoring the foundation for uplift during grouting.

2. Payment: At the unit price per sack of cement grout as measured by the number of 94 lb. sacks of cement actually injected, and excluding waste.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):

a. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

b. ASTM A197 – Specification for Cupola Malleable Iron

c. ASTM A234 – Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

d. ASTM C150 – Specification for Portland Cement

e. ASTM D2113 – Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation

f. ASTM D4380 – Standard Test Method for Density of Bentonitic Slurries

2. American Petroleum Institute (API):

a. API RP 13B-2 – Recommended Practice for Field Testing Oil-Based Drilling Fluids

1.3 DEFINITIONS

A. Cement Grout Batch – any quantity of grout that is proportionally mixed at any time and containing all the materials in the mix.

B. Frozen Rock: rock of sedimentary formation which has a temperature of 32 degree F or less, as measured at a depth of 6 inches with instruments approved by COR.

C. Geologic Imperfection: Cracks, joints, fissures, voids, or other defects in sedimentary formation.

1.4 SUBMITTALS

A. Shop Drawings:

1. RSN 03 37 58-1, Grouting test program plans:

a. Submit at least 60 calendar days prior to start of grouting test program.

b. Include:

i. Details of proposed mixer and pumping equipment, including manufacturer's literature
ii. Layout of the test grouting program
iii. Details of instrumentation for data collection and presentation and calibration certification
iv. Pump rating curves
v. Grout plant piping schematic including return lines and manifold.
vi. Details of packer, packer pressurization system, and calibration certification.
vii. Specification data on all proposed products including brand names, ASTM and type and certification of compliance.
viii. Details of High Range Water Reducer Admixture, (super-plasticizer) herein referred to as HRWRA, including manufacturer's product description, instructions, recommended dosage, chloride content and precautions to be followed when using the plasticizer.
ix. Grout mix design, including any admixtures.

2. RSN 03 37 58-2, Production grouting plan.
   a. Submit at least 15 work days prior to start of production grouting.
   b. Include:
      i. A proposed sequence of grouting based on data from the grouting test program and consistent with the planned excavation sequence.
      ii. Details of instrumentation for data collection and presentation
      iii. Pump rating curves
      iv. Grout plant piping schematic including return lines and manifold.
      v. Details of packer and packer pressurization system.
      vi. Specification data on all proposed products including brand names, ASTM and type and certification of compliance.
      vii. Grout mix design, including any admixtures

B. Administrative:

1. RSN 03 37 58-3, Statement of Qualifications for individual who will be responsible for the supervision and direction of CONTRACTOR's grouting work.

C. Quality Control:

1. RSN 03 37 58-4, Grouting records

   a. Submit within one calendar day of completion of a stage or grout hole.

   b. Include for each stage:
      i. Hole number, date, and stage depth interval.
      ii. Results of water pressure tests by stage including water pressure at top of hole, packer depth, length of hole tested, and take in gallons per minute for each minute of test.
      iii. Grout pressure data including maximum pressure (pounds per square inch) at collar for each stage.

iv. Total time hole injected with grout (minutes) for each water/cement ratio.
v. Refusal pressure and back pressure.
vi. Total bags of cement injected in each stage.

c. Grout hole data summary records and a graphic profile plot along the grout curtain for each grout hole that defines:
i. Angle and direction of each hole
ii. Take in bags of cement by stage
iii. Water pressure test results by stage
iv. Total hours grouted
v. Date grouted

2. RSN 03 37 58-5, Submit survey records from grouting monitoring points within one day of completion of a stage or grout hole.

1.5 QUALIFICATIONS

A. Provide experienced grouting personnel in all positions supervising grouting work.

1. Lead Supervisor: minimum of 5 years in responsible charge of grouting sedimentary formation for construction similar in nature to that required by this Work.

2. All other supervisory personnel: minimum of 2 years similar experience.

1.6 QUALITY CONTROL

A. Test the water meters, pressure gauges, and volume meters a minimum of once each week.

B. Calibrate pressure gauges, water meters, and volume meters when equipment does not meet Specifications, but not less than once per week.

C. COR may require CONTRACTOR to change equipment as necessary to achieve specified performance during grouting operations at no additional cost to OWNER.

D. Survey grouting monitoring points by a surveyor meeting qualifications listed in Section 01 71 23 – Construction Surveying.

PART 2 PRODUCTS

2.1 GROUT CONSTITUENTS

A. Cement

1. Portland
a. In accordance with ASTM C150
b. Portland Type III cement or approved equivalent

c. Gray color
d. Provided in sacks or bulk
e. Each 94-pound sack will be considered equivalent to one cubic foot volume, or a one cubic foot volume measurement device will be used for bulk cement.

B. Water

1. Conform to Section 03 05 00 – Basic Concrete Materials.

C. High Range Water Reducer Admixture (HRWRA)

1. Conform to Section 03 05 00 – Basic Concrete Materials.

2. Use alternative brands if HRWRA chosen by CONTRACTOR results in abnormal setting on grout that does not perform in accordance with these Specifications.

D. Density of cement grout slurry

1. In accordance with ASTM D 4380

2. Use the "mud-balance" method using the Model 140 mud-balance as manufactured by Baroid Testing Equipment, or equivalent.

E. Viscosity of cement grout slurry

1. In accordance with API RP 13B-2, Section 2, Viscosity and Gel Strength.

F. Cement grout mix

1. Cement-water mix and be within the following proportions:
   a. Water-cement ratio: Within 3:1 to 0.5:1 by volume
   b. HRWRA: 1 to 1.5 percent of total weight of cement
   c. Bentonite percentage: 0
   d. Set time: not to exceed 4 hours

2.2 PIPE FOR GROUTING

A. Grout Pipe:

1. Standard weight
2. Schedule 40 black steel
3. Conforming to ASTM A53

B. Fittings:

1. Malleable iron or steel
2. Conforming to ASTM A197 or A234, respectively

C. Pipe from grout plant to manifold and return lines 1. Minimum 1-inch diameter

D. Down hole pipe

1. Flexible pipe
2. Minimum 3/4-inch-diameter.

E. Pipes shall be capable of withstanding twice the maximum pump and/or grouting pressure.

2.3 PRESSURE PACKERS

A. Minimum 2 feet long

B. Consist of pneumatic tubes or expandable rings of rubber, leather, or other suitable material attached to the end of the grout supply pipes.

C. Designed to seal drill holes at the specified depths under maximum specified grout pressure without leakage.

D. Grout pipe through the packer shall be minimum 3/4-inch-diameter.

2.4 GROUT PLANT

A. Capable of effectively mixing grout and forcing grout into grout holes or grout connections in a continuous, uninterrupted flow at any specified pressure up to a maximum of 250 psi.

B. Capable of producing grout at the rates required by the hole or holes being grouted without interruption.

C. Mixing tank

D. Minimum volume of 17 cubic feet

E. High-speed, colloidal-type

F. Equipped with a high-speed, diffuser-type centrifugal mixing pump operating at 1,500 to 2,000 revolutions per minute during mixing.

G. Water pumps

H. Accurate water meter reading cubic feet to tenths of a cubic foot for controlling the amount of mixing water used in the grout.

I. Provide a holdover mechanical agitator tank with a minimum volume of 17 cubic feet to supply the grout pumps.

J. Pump grout with a helical-screw rotor-type pump that produces uniform flow without pulsation.

K. Minimum capacity of 30 gallons per minute at a pressure of 250 psi.

L. Provide a standby grout pump, capable of being placed in operation with no more than a 15 minute notice.

M. Provide a U.S. Standard No. 16 screen to screen grout discharged from the mixer and from the reserve line to the holdover tank.

2.5 GAUGES

A. Provide valves and pressure gauges to permit continuous circulation, accurate control, and monitoring of grouting pressure, bleeding, and regulation of flow into the grout holes.

B. Pressure gauges

1. Accuracy: within 2-percent over the full range of the gauge, indicated in psi.
2. Pressure gauge rating: No more than 3 times the pressure at which the grout is anticipated to be pumped for the stage being grouted.
3. Replace defective or broken gauges immediately.

C. Provide an accurately calibrated gauge test apparatus for periodic checking of the accuracy of all gauges used in the grouting operations.

D. Accuracy of master gauge set: within 1-percent of full-scale reading over full range of the gauge indicated in psi.

2.6 WATER PRESSURE TEST EQUIPMENT

A. Pumps:

1. Positive displacement type
2. Capacity: not less than 50-gpm at a discharge pressure of 1.0-psi per foot of depth.

B. Maximum pressure required: 150-psi.

C. Provide packers and associated equipment to perform double packer tests in boreholes.

1. Minimum length: 12-inches
2. Maximum distance between packers: 15-feet

3. May be expanded pneumatically or mechanically.

4. Capable of withstanding maximum specified water pressures without leakage for a period of 5 minutes.

D. Flowmeters

1. Read in gallons or cubic feet, reading to tenths of a cubic foot or 1 gallon

2. Factory or shop calibrated immediately prior to Work.

2.7 GROUTING MONITORING POINTS

A. Steel rod grouted into drill hole min 2 foot depth into top of rock. Top of steel rod shall be cut square and stamped with a survey mark.

PART 3 EXECUTION

3.1 GENERAL

A. Location, spacing, direction, sequence, and depths of each grout hole may be changed in the field by COR.

B. Grout geologic imperfections in the foundation rock using Portland cement grout.

C. Grout holes using the split spacing method.

1. If grouting refusal does not occur on the primary row, add split spaced holes, as shown on the Drawings or as required by COR.

2. Drill lower level grout holes (split or secondary) only after higher level holes on both sides are drilled and grouted.

3. Balance the number and level of split spacing curtain grout holes on each side of a primary hole.

4. Drill and grout supplementary holes, as required by Engineer, only after primary grout holes and any primary split-spacing grout holes are drilled and grouted.

D. Do not perform grouting if sedimentary formation in the stage being grouted is frozen and if frozen material is present in the rock joints, cracks, and fissures in the stage being grouted.

3.2 PREPARATION

A. Install grouting monitoring points a minimum of 7 days prior to the start of grouting.

B. Perform all pressure grouting operations in the presence of COR.

1. Notify COR 48 hours prior to the proposed grouting schedule and 48-hour prior to change of a shift schedule.

3.3 GROUTING TEST PROGRAM

A. Perform minimum three test holes in the following locations:

1. Central valley between stations 14+00 and 15+50 as directed by the COR.

B. Perform test holes to depths shown on Drawings for production grout holes.

3.4 DRILLING GROUT HOLES

A. Use rotary coring or plug bit drilling methods in conformance with ASTM D2113.

1. Tricone bits or percussion drilling are not allowed.
2. Use water for drilling fluid.

B. Monitor and measure the rate of drilling water injection and return from the hole.

1. If 20-percent or greater loss of drilling fluid occurs:
   a. Terminate drilling the hole 0.5 to 2.0 feet below the location of the imperfection,
   b. Notify COR
   c. Clean the hole, and
   d. Grout the hole with Portland cement grout.

C. Circulate clean water through the hole when drilling is completed until the water is clear and free of drill cuttings.

D. Temporarily cap or otherwise protect the hole to prevent the hole from becoming clogged or obstructed until it is grouted.

3.5 WATER PRESSURE TESTING

A. After completion of drilling, in each hole and prior to pressure grouting, perform water pressure test.

B. Perform double packer tests for the entire length of hole below the top of bedrock.

C. Flush the borehole with clean water for at least 2 minutes before inflating the packers.

D. Use clean water under continuous pressure equal to the greater of 15 psi or 1 psi per foot of hole depth, measured and calculated at the point of injection.

E. Perform each test for a minimum of 5 minutes or until a constant flow rate is achieved or until the hole is determined to have zero take by COR.

1. Test 25 percent of the stages for 20 minutes.
2. COR will determine the holes and stages for the 20-minute test concurrent with testing.

3.6 HOOKUPS FOR GROUTING

A. Anchor and hold connection pipes and fittings firmly in position until after the grout has set.

3.7 MIXING GROUT

A. HRWRA

1. Adjust the quantities of HRWRA or eliminate its use if design objectives are not met.
2. When first adding plasticizer to a grout mix, circulate grout through the circulating line system for a minimum of 5 minutes prior to down-hole injection.
3. Do not use plasticizer for any stage of grout hole on which grouting is begun without the use of plasticizer.

B. Thoroughly mix grout to eliminate small clumps of dry cement or entrapped air.

3.8 PRESSURE GROUTING

A. Prepare drilling schedule and procedures for drilling and grouting, grout mix, and pressures based on the results of the test grouting program.

B. Arrange stages of grouting based on water pressure tests to treat geologic imperfections of the foundation as determined by COR.

C. Place grout in stages and a stop (ascending stage) grouting technique.

1. Attach a packer to the end of the grout supply pipe; lower the grout supply pipe into the hole to the top of stage 1.
2. Grout the hole until refusal is achieved. Keep the packer in place until there is no back pressure.
3. Remove the packer and flush water through the packer rods to remove excess grout. Flush until the return water is clean.
4. Raise the packer to the top of the next higher stage and repeat the process until the entire hole is completely grouted to the top of bedrock.

D. Locations of the packer for each stage shall be at the top of each stage as shown on Table 1 for angle holes, or as adjusted by COR.

Table 1
Grout Stage Depths

Grout Stage Number	Grout Stage Depth (feet) From top of bedrock along hole
1	30 – 50
2	0 - 30

1. Grout at a pressure equal to the greater of 15 psi or 1 psi per foot of hole depth or pressures determined based on the results of the test grouting program.
2. Measure grout pressures at the collar of the grout hole with adjustments to account for losses in the grout pipe to the point of injection.

E. Pump at rates less than 2 cubic feet per minute.

F. Grout at the start of each stage shall have a volumetric mix ratio of 3 parts water to 1 part cement (3:1).

1. If grout take exceeds 10 cubic feet, then a thicker mix shall be used.
2. Progressively thicken the grout with a volumetric mix ratio 3:1 to 2:1 then to 1:1 after 10 cubic feet of grout for each mix ratio is used, or as directed by COR.

G. Continue grouting until refusal with the thinnest possible mix.

3. Refusal for a particular grout mix is no grout take at the maximum specified pressure over a period of 15 minutes, or as determined by COR based on the results of the test grouting program.

H. When refusal for a particular mix is achieved, COR may require thinning the mix and to re-attempt pumping with the next thinnest mix (i.e., refusal reached with a 1:1, then thin to a 2:1 mix).

I. Stop grouting for 24 hours if grout take at one stage exceeds 30 bags. Resume grouting and repeat this procedure until refusal is achieved.

J. Continue grouting each stage until completed, unless otherwise required or approved by COR.

K. Maintain grout pressure in holes until the grout has set sufficiently so that it will be retained in the holes or connections being grouted.

1. Backfill holes to ground surface after completing pressure grouting with a thick, zero bleed mixture.
   a. Backfill grout using tremie pipe from the bottom of the last stage to the top of bedrock.
   b. Repeat as required to completely fill the hole to the top of bedrock.

2. Waste grout not injected into the foundation within 2 hours after mixing. Waste grout that has a temperature of 80ºF or higher.

3.9 GROUTING MONITORING POINTS

A. Locations:

1. 10 feet downstream of the primary grout row
2. 50 feet on center along the grout curtain.

B. Monitor at least three monitoring points for each grout hole being grouted.

1. Monitor the point closest to the grout hole and the point on each side (before and after) of that monitoring point.

C. Survey grouting monitoring points to within 0.01 foot.

D. Survey grouting monitoring points at the end of each grout stage.

3.10 QUALITY CONTROL

A. Foundation grout quality control testing for Portland cement

1. Frequency: Minimum of one test per batch of grout mixed, or at the discretion of COR.
2. Tests:
   a. Density
   b. Viscosity

B. COR will perform testing and observations during drilling, water testing, and foundation grouting. Observations will be performed for the purposes of evaluating the quality of CONTRACTOR's work for general compliance with Specification requirements, confirming grouting refusal, and directing supplemental grouting or additional grout holes.

C. Immediately waste grout materials not meeting the appropriate product requirements or mix proportions.

1. Thoroughly clean all grouting equipment and obtain COR approval prior to the resumption of grouting work.
   a. If unacceptable materials have been injected into grout holes:
2. Terminate work in that hole(s),
   a. Offset as required by COR, and
   b. Drill and grout the new hole(s) in compliance with Specification requirements.

END OF SECTION

SECTION 03 62 20

GROUTING MORTAR FOR EQUIPMENT AND METALWORK

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring nonshrink grout or grouting mortar.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C 33/C 33M-08	Concrete Aggregates
2.	ASTM C 150-07	Portland Cement
3.	ASTM C 1107/C 1107M-08	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 03 62 20-1, Packaged nonshrink grout data:

1. Manufacturer’s product data.
2. Manufacturer’s certification that product meets specifications.
3. Manufacturer’s surface preparation, mixing, installation, and curing instructions.

PART 2 PRODUCTS

2.01 PACKAGED NONSHRINK GROUT

A. Pre-mixed commercial grout mixture:

1. ASTM C 1107.
2. Cement in mixture: ASTM C 150, Type II

B. Water:

1. Clean.
2. Free of detrimental quantities of silt, organic matters, salts, or other impurities.

3. As recommended by grout manufacturer.

C. Mix: In accordance with manufacturer's instructions to consistency recommended by manufacturer for application.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean and prepare base concrete surface to which nonshrink grout or grouting mortar will be bonded in accordance with manufacturer's instructions or as directed by COR:

1. Roughen surface.
2. Remove dirt, laitance, loose or defective concrete, curing compound, coatings, and other foreign material.
3. Wash with water.

B. Lubricate concrete surface by washing with water immediately before placing nonshrink grout or grouting mortar when delay occurs between washing and placing nonshrink grout or grouting mortar.

3.2 PLACING

A. Place nonshrink grout in accordance with manufacturer's instructions to completely fill space to be grouted.

B. Place grouting mortar to completely fill spaces adjacent to equipment and metalwork as shown on drawings.

C. Use forms, where required, to confine nonshrink grout.

3.3 CURING

A. Cure exposed surface of packaged nonshrink grout by method recommended by manufacturer.

B. Cure exposed surface of grouting mortar for 72 hours with burlap, damp sand, or other means approved by the COR

C. Do not apply loads sooner than 72 hours after placement and only after mortar has attained compressive strength of at least 3,000 lb/in^2.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Metal Fabrications:

1. Payment: Lump sum, incidental to the related structure.

B. List of metal fabrications covered by this section:

1. Includes:
    a. Guardrails for the intake tower.
    b. Cover for pullbox.
    c. Covers and ladders for inspection wells and toe drain cleanouts.
    d. Anchors and fasteners required for complete installation of the metalwork.
    e. Metal doors and frames.
    f. Window louvers.
    g. Other miscellaneous items incidental to the related structures.
2. Does not include:
    a. Guardrails for vehicular traffic control along the BIA Road 8077.

1.02 REFERENCE STANDARDS

A. Aluminum Association (AA)

1.	AA ADM-105	Aluminum Design Manual - 2005

B. American Institute of Steel Construction (AISC)

1.	AISC 325-05	Steel Construction Manual, 13th Edition

C. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2003(2008)	Unified Inch Screw Threads (UN and UNR Thread Form)
2.	ASME B18.2.1-2010	Square and Hex Bolts and Screws (Inch Series)

D. ASTM International (ASTM)

1.	ASTM A 36/A 36M-08	Carbon Structural Steel

2.	ASTM A 53/A 53M-10	Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless
3.	ASTM A 108-07	Steel Bars, Carbon, Cold-Finished, Standard Quality
4.	ASTM A 123/A 123M-09	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A 153/A 153M-09	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A 193/ A 193M-10a	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
7.	ASTM A 307-10	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
8.	ASTM A 385/A 385M-09	Providing High-Quality Zinc Coatings (Hot-Dip)
9.	ASTM A 563-07a	Carbon and Alloy Steel Nuts
10.	ASTM A 780/A 780M-09	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
11.	ASTM F 844-07a	Washers, Steel, Plain (Flat), Unhardened for General Use

E. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-10	Structural Welding Code – Steel
2.	AWS D1.2/D1.2M-08	Structural Welding Code - Aluminum

F. Commercial Item Description (CID)

1.	CID A-A-1923A	Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

G. Federal Specifications (FS)

1.	FS RR-C-271E	Chains and Attachments, Welded and Weldless

H. International Code Council (ICC)

1.	ICC ES AC 308	Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete, November 2009
2.	ICC IBC-2009	International Building Code

I. National Association of Architectural Metal Manufacturers (NAAMM)

1.	NAAMM MBG 531-00	Metal Bar Grating Manual

J. Code of Federal Regulations (CFR)

1.	29 CFR Part 1926	Occupational Safety and Health Administration (OSHA) - Safety and Health Regulations for Construction –Subpart M – Fall Protection

K. Society of Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-SP6/NACE 3-07	Commercial Blast Cleaning

L. U. S. Bureau of Reclamation (USBR)

1.	RSHS – Revised May 2002	Reclamation Safety and Health Standards

1.3 DEFINITIONS

A. Miscellaneous metalwork: Where either shown on the drawings or specified elsewhere in this section or these specifications, "miscellaneous metalwork" means metal fabrications as used in this section.

1.4 QUALIFICATION OF WELDERS

A. Qualify welders in accordance with AWS D1.1 and D1.2 using procedures, materials, and equipment of the type required for the work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect metal fabrications items from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

1.6 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

1. A copy of this specification, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of reasons for requesting the deviation. The COR representative shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. RSN 05 50 00-1, Shop Drawings: Containing the following information.

1. Erection views, plan and elevation as appropriate, of completed assemblies including connection hardware.

2. Detailed drawings of fabricated pieces, including sections, size and thickness, material proposed for use, dimensions, camber, welds and fasteners.

3. Complete structural properties for similar sections proposed to substitute for those indicated on the drawings.

C. RSN 05 50 00-2, Quality Control Plan: QA/QC plan for welding inspection and acceptance procedures, shop and field.

D. RSN 05 50 00-3, Mill Certificates: Mill certificates for all materials and hardware.

E. RSN 05 50 00-4, Manufacturer's Certificate: Evidence of fabrication shop certification to provide Special inspection through their standard QA/ QC program, and approved by the Building Official.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B 209, alloy 6061-T6 (plates) and ASTM B 221, alloy 6061-T6 (shapes, tubes).

B. Aluminum Floor Plate: ASTM B 632, alloy 6061-T6.

C. Structural steel:

1. Plates, and bars: ASTM A 36.

D. Steel Pipe and Pipe Sleeves: ASTM A 53, type E or S, grade B.

1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.

2. COR inspection at the mill and hydrostatic tests will not be required.

E. Chain: FS RR-C-271, type 1, class 1, 2, or 4.

F. Grating: NAAMM MBG 531 galvanized steel or aluminum, as shown on drawings.

1. Welded grating.

2. Banding bars: Same size as bearing bars, where required.

G. Arc-Welding Electrodes:

1. Use filler metal and shielding gases suitable for base materials, positions, and other conditions.

2. Filler metal and required shielding gases or fluxes: AWS D1 and D1.2.

3. Filler metal for steel, minimum tensile strength: 70,000 pounds-per-square inch (psi).

4. Aluminum alloy filler metal: AWS classification 4043.

H. Bolts, Studbolts, Nuts, and Washers:

1. Bolts:

a. ASTM A 307, galvanized.

b. Length of bolt threads: ASME B18.2.1.

c. Thread class: 2 free-fit, American National coarse-thread series.

2. Studbolts:

a. Suitable for end welding to steel with automatically timed stud-welding equipment

3. Nuts: ASTM A 563, galvanized.

4. Washers: ASTM F 844, galvanized.

I. Grout: Nonshrink grout in accordance with Section 03 62 20 – Grouting Mortar for Equipment and Metalwork.

2.2 ANCHORS

A. Adhesive Anchors: Drilled type, installed with a chemical adhesive system.

1. Seismic qualified per ICC IBC and ICC AC 308 for seismic design category A through F and cracked concrete conditions.

2. Adhesive: HIT-RE 500-SD epoxy adhesive manufactured by HILTI, PO Box 21148, Tulsa OK 74121; or equal, having the following essential characteristics:

a. Injectable two-component epoxy adhesive.

b. Dual packaging system designed for automatic mixing during injection.

c. Weathering resistant.

d. Resistant against high temperatures.

e. Suitable for use in diamond cored or pneumatic drilled holes.

f. Extended temperature range from 41 degrees F to 120 degrees F.

3. Threaded carbon steel anchor rod: HAS Super rod manufactured by HILTI, PO Box 21148, Tulsa OK 74121; or equal, having the following essential characteristics:

a. Rod material: ASTM A 193, Grade B7.

b. Thread: ASME B1.1, continuously threaded (all-thread).

c. Fabricate with 45-degree chisel point on one end to facilitate insertion into adhesive-filled hole.

d. Hot-dip galvanized.

4. Standard steel nuts: ASTM A 563, Grade DH.

a. Hot-dip galvanized.

5. Standard steel washers: ASTM F 436, Type 1.

a. Hot-dip galvanized.

B. Expansion Anchors:

1. CID A-A-1923, Type 4, galvanized steel, except stainless steel anchors when submerged in water.

2. Bolt length: As shown on drawings. If not shown, provide bolt length with 3-1/2 inch minimum embedment.

C. Headed Concrete Anchors: ASTM A 108.

1. Flux-filled ends suitable for end welding to steel with automatically timed stud-welding equipment.

2.3 LADDERS

A. Metal Safety Steps for Ladders

1. "Tread-Grip" No. 11-gauge sheet steel ladder rungs, as manufactured by Morton Manufacturing Co., PO Box 640, Libertyville IL 60048; "One Diamond Ladder Rung", as manufactured by GS Metals Corp., PO Box 7, Pinckneyville IL 62274; 1-inch-square "Mebac" solid ladder rungs, as manufactured by IKG Industries, 270 Terminal Avenue, Clark NJ 07066; or equal, having the following essential characteristics:

a. Concentrated design load at center of rung: 200 pounds.

b. Raised button, serrated-edge, or metal bonded encapsulated grit surface.

B. Safety Posts:

1. "Ladder-Up" ladder extensions as manufactured by The Bilco Co., PO Box 1203TR, New Haven CT 06505; or equal, having the following essential characteristics:

a. High-strength galvanized steel.

b. Tubular section that provides upward and downward movement and locks automatically when fully extended in up position.

c. Upward and downward movement controlled by stainless steel springs.

d. Operates in corrosive environment.

2. Attach securely to ladder rungs.

3. Extend a minimum of 42 inches above walking surface.

2.4 FABRICATION

A. Fabricate metalwork in accordance with AISC 325, AA ADM 105, and these specifications.

1. Perform welding and related work in accordance with AWS D1.1 and D1.2.
2. Grind all welds on pipe guardrails and ladders smooth.

B. If straightening is necessary, use methods that will not injure the metal.

C. After shop work completion and before galvanizing, if required, clean material of rust, loose scale, dirt, oil, grease, slag from welded areas, and other foreign substances.

D. Fabricate ladders and pipe guardrails from standard weight pipe of diameter shown on drawings and use standard pipe fittings suitable for welded joints.

E. Fabricate metal guardrails from structural tubing and bars of sizes shown on drawings and miter corners and weld watertight.

F. Galvanizing:

1. Galvanize items of metalwork as specified or shown on drawings. Use hot-dip galvanizing, where required after fabrication, in accordance with ASTM A 123 and A 385.
2. Galvanize bolts, nuts, washers, and locknuts in accordance with ASTM A 153. Remove excess spelter by centrifugal spinning.
3. Fabricator's Galvanizing Repair:
    a. Redip material with damaged galvanizing unless damage is local and can be repaired by zinc primer.
    b. If the galvanized coating becomes damaged after being dipped twice, material will be rejected.
    c. Where local repair is authorized: Repair damaged galvanized surfaces in accordance with ASTM A 780, except repair materials containing cadmium and lead are not permitted.

PART 3 EXECUTION

3.1 PREPARATION

A. Where locations and dimensions of miscellaneous metalwork shown on drawings are tentative or subject to change dependent upon equipment furnished, confirm locations and dimensions prior to fabrication of miscellaneous metalwork.

3.2 INSTALLATION

A. Expansion Anchors:

1. Drill holes for anchors straight and true and of diameter recommended by anchor manufacturer.
2. Install anchors in accordance with manufacturer's recommendations.
3. Follow manufacturer’s recommendations when embedded steel or reinforcement is encountered during drilling for anchors.
4. When drilling water is used, clean surfaces of concrete to remain exposed immediately to prevent discoloration.
5. Following drilling, clean holes with water to remove cuttings, followed by air to ensure holes are dry.

B. Grout:

1. Where shown on drawings, fill spaces under metalwork completely as required with nonshrink grout in accordance with Section 03 62 20 – Grouting Mortar for Equipment and Metalwork.
2. Clean surfaces of metalwork to be in contact with or embedded in concrete or nonshrink grout in accordance with SSPC-SP6/NACE 3.

C. Holes in Metalwork:

1. Drill, or drill and tap as required, holes in metalwork required for installation.

D. Galvanizing Repair:

1. Repair damaged galvanized surfaces in accordance with ASTM A 780, except repair materials containing cadmium and lead are not permitted.

E. Coatings:

1. Paint surfaces of aluminum covers to be in contact with concrete with one or more coats of any commercial grade of bituminous paint as required to produce a 5-mil minimum thickness.

END OF SECTION

SECTION 07 53 10

SINGLE PLY MEMBRANE ROOFING - FULLY ADHERED

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cover board; and polyvinyl-chloride membrane roofing, base flashings, cant strips and sheet metal flashings.

B. Related Sections:
   1. Section 07 72 33 - Roof Hatches.

1.2 MEASUREMENT AND PAYMENT

A. Payment is incidental to the construction of the intake tower.

1.3 REFERENCES

A. ASTM International:
   1. ASTM C79/C79M - Standard Specification for Gypsum Sheathing Board.
   2. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   3. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
   4. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
   5. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
   6. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   7. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
   8. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
   9. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
   10. ASTM D4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.

11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
13. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
14. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
15. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
16. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
17. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
18. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

B. FM Global:
1. FM DS 1-28 - Wind Loads to Roof Systems and Roof Deck Securement.
2. FM 4450 - Approval Standard for Class 1 Insulated Steel Deck Roofs.

C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

D. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

E. Single Ply Roofing Institute:
1. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

F. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.
4. UL 1897 - Uplift Tests for Roof Covering Systems.

G. U.S. Environmental Protection Agency:
1. ENERGY STAR - ENERGY STAR Voluntary Labeling Program.

1.4 DESIGN REQUIREMENTS

A. Low Slope Membrane Roof Edge Securement: Conform to SPRI ES-1 for wind speeds determined from applicable code.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 07 53 10-1, Product Data
   1. Submit characteristics on membrane materials, adhesives, seaming materials, flashing materials, vapor retarders, and cover board.

C. RSN 07 53 10-2, Manufacturer's Installation Instructions: Submit special precautions required for seaming membrane.

D. RSN 07 53 10-3, Shop Drawings: Show layouts of sheet metal flashing and trim. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer’s original containers, dry, undamaged, with seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Protect foam insulation from direct exposure to sunlight.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply roofing membrane during inclement weather or when ambient temperatures are outside of the manufacturers recommended application temperature range.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of associated roof penetrations and metal flashings, as Work of this section proceeds.

1.11 WARRANTY

A. Furnish 20 year manufacturer's warranty including coverage of materials resulting from failure to resist penetration of moisture.

PART 2 PRODUCTS

2.1 SINGLE PLY ROOFING - FULLY ADHERED

A. Manufacturer:

1. IB Roofing Systems, 1-800-426-1626, Model: IB 80 Mil Single Ply.
2. Substitutions: Not Permitted

2.2 COMPONENTS

A. Cover Board: 4’x8’ Dens-Deck Prime Glass Mat Faced Gypsum Roof Board: Thickness ¼”, Permeance (per ASTM E 96) not more than 50 perms, Water absorption (per ASTM C 1177) less than 10% of weight, weight per sq ft: 1.15 lbs.

B. Detail Flashing Membrane: 0.060 mil. Smooth, unreinforced thermoplastic PVC membrane for flashing/reinforcing.

C. Roof Covering: Field and base flashing membrane (1-layer): 80 mil. IB Single-Ply Polyvinyl Chloride (PVC) non-wicking polyester fiber reinforced thermoplastic membrane, conforming to ASTM D4434, Type III with the following physical properties:

D. Seaming Materials: As recommended by membrane manufacturer.

E. Washer Disc: Membrane material with adhesive backing.

F. Adhesive Materials:

1. Membrane Adhesives: As recommended by membrane manufacturer.
2. Cover Board Adhesive: As recommended by membrane manufacturer.
3. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

G. Flexible Flashings: Same material as membrane manufactured by membrane manufacturer.

2.3 ACCESSORIES

A. Wood Cant Strip: pressure preservative treated.

B. Roofing Nails: Galvanized, hot dipped or non-ferrous type, size as required to suit application.

C. Sealants: As recommended by membrane manufacturer.

D. Walkway Pads: 3’ wide, 100 mil WalkTread by IB Roof Systems.

E. Stack Boots: Flexible boot and collar for pipe stacks through membrane.

2.4 SHEET METAL FLASHINGS

A. Material:

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

B. Underlayment Materials:

1. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.
2. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
3. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

C. Miscellaneous Materials:

1. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
2. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
    a. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
    b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

c. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

3. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

4. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

5. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

PART 3 EXECUTION

3.1 QUALITY CONTROL

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Surface Burning Characteristics:

1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

3.2 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum twenty years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum five years documented experience and approved by manufacturer.

3.3 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces and site conditions are ready to receive Work.

C. Verify deck is supported and secure.

D. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains or eaves, and suitable for installation of roof system.

E. Verify deck surfaces are dry and free of snow or ice.

F. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood cant strips are in place.

G. Beginning of installation means installer accepts substrate.

3.4 PREPARATION

A. Concrete Deck:

1. Fill surface honeycomb and variations with latex filler.
2. The roof deck shall be smooth, even, free of dust, dirt, excess moisture or oil and be structurally sound. Sharp ridges, and other projections above the surface shall be removed to ensure a smooth surface before roofing.

B. Accurately lay out work surfaces for materials application. Verify acceptability of substrate for roofing. Lay PVC field membrane perpendicular to the incline starting at the low point of the roof.

3.5 INSTALLATION

A. General Installation Requirements

1. All drains, projections and edges shall be installed in strict accordance with practices set forth in the NRCA Roofing Manual or manufacturer of membrane. All mechanical equipment requiring fastening shall be fastened with hex head screws with neoprene washers.
2. Provide cut-offs at end of each day's work, to cover exposed partially installed membrane and insulation. Remove cut-offs before resuming work.
3. In finished areas, storing, walking, wheeling, or trucking will not be permitted. Provide smooth, clean boards or plank walkways, runways, and platforms near supports, as needed to distribute weight to conform to indicate live load limits and transient loads imposed during roofing installation and construction.
4. Membrane overlaps shall be shingled with the flow of water whenever possible.

B. Cover Board Adhesive Application

1. Install adhesive per Manufacturer's Recommendations
2. Place Cover-board onto adhesive beads within 5 minutes of application and walk-in immediately to spread beads for maximum contact.

C. Install gypsum sheathing on concrete substrate using continuous mopping of adhesive.

1. Lay sheathing perpendicular to roof slope; stagger end joints.

2. All courses shall be installed with side and end-laps of no more than ¼" gaps.
3. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface. Tape joints.
4. Installer must not kick or damage Cover-board during installation. All damaged, severely cupped, or unusable pieces must be discarded.
5. Completely cover applied Cover-board with finished roofing system. Coverboard may not be left uncovered overnight.

D. Membrane Application:

1. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
2. All Zones (1 field, 2 perimeter, & 3 corner): Start by installing a 72" (full rolls) wide sheets at the low side of the roof (either at the base of a perimeter parapet wall or at the nailer of the perimeter edge) so that the water flows over, but never against the side laps. Turn over the edge, below the nailer (roof edge applications) or at the base of the perimeter parapet or roof curbs. Apply adhesive to the top surface of the substrate, and the bottom surface of the sheet at the nominal rate of 1 gallon per 120 sq.ft per surface per square. Allow the adhesive to dry to the touch. Carefully roll the sheets in and avoid wrinkles or buckles. Use a weighted roller and run over the entire surface of the adhered membrane to ensure a bond between the bottom surface of the membrane, and the adhesive applied to the surface of the substrate.
3. Welding Start-Up (start of every welding cycle: morning, after break, after lunch, etc.): Before starting any finish welding, operators are to conduct several test welds using the same membrane at the same ambient temperature as the just installed courses and cut 1" wide strips of the test membrane and pull apart (tear bond) to determine quality of the welds. A satisfactory weld is when the weathering layer (membrane surface) is fully welded to the underside of the overlapping membrane, and when pulled, is torn away, exposing the reinforcement scrim of the underlying membrane. Minimum acceptable Automatic welds are 1-1/2"wide and 2" wide for hand welds. Automatic Welder temperature and speed is to be monitored and adjusted throughout the day to prevent over-heating (creating blisters, burns and/or distortions of the lap area), under-heating (laps are not thermally sealed). Hand Welders are to be monitored and adjusted throughout the day to prevent over-heating (creating blisters, burns and/or distortions of the lap area), under-heating (laps are not thermally sealed).
4. All courses shall be installed with (3) side-laps, and 4" end-laps.
5. Membrane must be installed tightly around the base of pipe penetrations, or trimmed and gapped as required by the fire code around heat sources (like heat flumes, chimneys, etc.).
6. Seal membrane around roof penetrations.

E. Flashings And Accessories:

1. Apply flexible flashings to seal membrane to vertical elements.
2. Coordinate installation of roof hatches and related flashings.
3. Seal flashings and flanges of items penetrating membrane.
4. Install walkway pads in locations shown on drawings. Install per Manufacturer's recommendations.

3.6 SHEET METAL FABRICATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

F. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

G. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

I. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

J. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

K. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

L. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

M. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

N. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

O. Drip Edges: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch thick.

3.7 SHEET METAL INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

2. Aluminum: Use aluminum or stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder metallic-coated steel and aluminum sheet.

2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.

3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.8 CLEANING

A. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

B. Repair or replace defaced or disfigured finishes caused by Work of this section.

C. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

D. Clean and neutralize flux materials. Clean off excess solder and sealants.

E. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

F. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect building surfaces against damage from roofing Work.

B. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SECTION 07 72 33

ROOF AND MANHOLE COVER HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefabricated roof hatches, with integral support curbs, operable hardware, curb insulation and counter flashings

B. Related Sections:

1. Section 07 53 10 – Single Ply Membrane Roofing: Flashing to roof system and roof system.

1.2 MEASUREMENT AND PAYMENT

A. Payment is incidental to the construction of the intake tower.

1.3 REFERENCES

A. Underwriters Laboratories Inc.:

1. UL - Building Materials Directory.

1.4 PERFORMANCE REQUIREMENTS

A. Hatches to withstand live loads as calculated in accordance with applicable code.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 07 07 33-1, Product Data: Submit data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.

C. RSN 07 07 33-2, Manufacturer's Installation Instructions: Indicate special installation criteria and interface with adjacent components.

PART 2 PRODUCTS

2.1 ROOF HATCHES

A. Manufacturers:

1. Bilco; Model: Type SS-50C.
2. Substitutions: Not Permitted.

B. Product Description: Manufacturer's standard aluminum or zinc-coated steel, with nominal 12 inch high integral curb.

1. Roof Hatches:
   a. Single Leaf Personnel Access: 3'-0" x 3'-6" ladder access.
   b. Accessories: Security lock (from inside).

2.2 COMPONENTS

A. Integral Curb: Minimum 11 gage aluminum with nominal 1 inch rigid glass fiber or foam insulation, fully covered and protected by a metal liner of 18 gauge aluminum; integral cap flashing to receive roof flashing; extended flange for mounting.

B. Flush Cover: Minimum 11 gauge aluminum; nominal 1 inch glass fiber or foam insulation; minimum 28 gage aluminum interior liner; continuous neoprene gasket to provide weatherproof seal.

C. Finish: Factory finish shall be mill finish aluminum.

D. Hardware: Manufacturer's standard finish:

1. Compression spring operator;
2. Steel manual pull handle for interior and exterior operation;
3. Steel hold open arm with vinyl covered grip handle for easy release,
4. Padlock hasp.
5. Hinges: Manufacturer's recommended type for specific type of roof hatch.

2.3 ACCESSORIES

A. Anchorage Devices: Type recommended by manufacturer.

B. Counterflashings: Same metal type and finish as roof hatch frame.

C. Sealant: Manufacturer's recommended sealants integral with roof hatch installation, nonhardening, nonskinning, nondrying, nonmigrating butyl based sealants.

2.4 FABRICATION

A. Fabricate components free of visual distortion and free of defects. Weld corners and joints.

B. Provide for condensation occurring within components and within assembly to drain to exterior above roofing.

C. Fit components for weather tight assembly.

D. Sloped Roofs: Fabricate roof hatch curbs tapered to maintain hatch top level.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings and substrate conditions are ready to receive Work of this section.

3.2 INSTALLATION

A. Install curb assembly, fastening securely to roof decking. Flash curb assembly into roof system per Manufacturer's Recommendations.

B. Place roof hatch and secure to curb assembly. Install integral setting sealant and counterflashing as required.

C. Final installation to be watertight assembly.

D. Coordinate with installation of roofing system and related flashings for weather tight installation.

E. Apply bituminous paint on surfaces of units in contact with cementitious materials or dissimilar metals.

F. Adjust hinges for smooth operation.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Wash down exposed surfaces; wipe surfaces clean.

C. Remove excess sealant.

END OF SECTION

This page intentionally left blank.

SECTION 26 05 02
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

a. Includes cost of :

1) Performing required design.

2) Furnish drawing and data.

3) Furnishing certified calibrated testing equipment.

4) Transporting and storing equipment and materials.

5) Performing testing.

6) Modifying equipment.

7) Assembling, adjusting, and installing equipment.

8) Painting equipment and materials.

9) Brackets, fasteners, bolts, nuts, lock washers, and other accessories required for mounting or installing electrical equipment and materials.

10) Electrical equipment support.

11) Earthwork for buried conduit and cable.

12) Making electrical connections.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)

B. National Fire Protection Association (NFPA)

1. NFPA 70-2011 National Electrical Code (NEC)

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Conform to NFPA 70 and IEEE C2.

B. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.

C. Change designs as required where Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. COR will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

D. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by COR.

B. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70 and IEEE C2.

C. Make electrical installations complete and ready for service.

D. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books.

E. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.

F. Installation of electrical equipment includes:

1. Drilling holes, furnishing hardware, and assembling components to each other.
2. Furnishing materials for and making all connections correctly in accordance with final wiring diagrams.
3. Tagging wires and cables at each end.

3.2 REPAIR

A. Repair damaged painted surfaces of equipment to match original finish.

3.3 FIELD QUALITY ASSURANCE

A. COR or Construction Manager will inspect all equipment during construction. Acceptance of equipment will be made after equipment is operational.

END OF SECTION

SECTION 26 05 10
CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B 8-04	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. National Fire Protection Association (NFPA)

1.	NFPA 70-2011	National Electrical Code (NEC)

1.3 DEFINITIONS

A. Cable: Cable, cables, wire, or wires of one or more insulated conductors.

B. Power Cable: For power loads including motors; direct-current distribution circuits; lighting circuits; and lighting equipment.

C. Control Cable: For control, metering, indication, annunciation, and relaying circuits; and circuits not identified as power circuits.

D. Instrumentation Cable: For transducer output circuits.

E. Solar Panel Module Interconnect And Output Cable: For connecting solar power modules to each other and the photovoltaic controller. Also used to connect photovoltaic controller to battery array.

F. Battery Cables: For interconnecting individual batteries into array and providing power to hydraulic power unit.

1.4 DESIGN REQUIREMENTS

A. All conductors and cables for the lighting system, hydraulic control unit, and solar electrical system will be determined by the Contractor and shall be sized according to the requirements in the NEC.

PART 2 PRODUCTS

2.1 CABLE

A. Manufactured no more than 24 months prior to Notice to Proceed.

B. Round, except for 2-conductor cable with parallel conductors.

C. Copper conductor: ASTM B 8, class B or C.

D. AWG or kcmil designation.

E. Coverings or insulation: Suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70, Article 300-19.

F. Stranded conductors.

G. Cable color coding:

1. Control and instrumentation cable:
    a. In accordance with NEMA WC 57.
    b. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.
2. Power cables:
    a. Color coded by polarity, using red for positive and black for negative.
    b. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.

2.2 POWER CABLE

A. Single-conductor or multiconductor, nonshielded type.

B. Suitable for installation in conduits, and for general use.

C. Individual conductor insulation type: THWN

D. Provide integral ground wire with multi-conductor power cable.

E. Multi-conductor cable jacket: PVC (Polyvinyl chloride) type flame-retardant.

2.3 CONTROL CABLE

A. Type: Multiconductor nonshielded.

B. Individual conductor insulation: THWN.

C. Overall jacket insulation: Polyvinyl chloride (PVC).

2.4 INSTRUMENTATION CABLE

A. Twisted pair for transducer output circuits.

B. Suitable for installation in cable trays and conduit, for direct burial, and for general use.

C. Conductor size: No. 18 AWG.

D. Conductor insulation: 600 volts and suitable for operation at an ambient temperature of 105 degrees C.

E. Shielding: Copper or aluminum tape which completely covers pair or triad assembly. Provide shielding with a tinned, stranded copper drain wire.

F. Jacket:

1. Flame-retardant.
2. 600 volts

2.5 SOLAR PANEL MODULE INTERCONNECT AND OUTPUT CABLES

A. 6 AWG THHN.

B. UL listed.

C. Rating: 600V, 90 degrees C.

D. Outdoor rating.

E. Sunlight resistant.

F. Specifically manufactured for use on photovoltaic modules.

G. Color

1. Positive polarity cables: Red.
2. Negative polarity cables: Black.

2.6 BATTERY CABLES

A. 4/0 AWG MTW/THW.

B. UL listed.

C. Rating: 600V, 105 degrees C.

D. Lugs:

E. Factory crimped.

F. Size: Fitted to battery terminal size.

G. Color

1. Positive polarity cables: Red.
2. Negative polarity cables: Black

2.7 ACCESSORIES

A. Conductor markers:

1. White.
2. Self-laminating-vinyl type or heat-shrink type.
3. Marked with conductor designation.
4. Computer generated lettering.

B. Cable tags.

1. Suitable for outdoor use.
2. Shape: Rectangular.
3. Color: white.

C. Terminal connectors:

1. Heavy-duty, preinsulated, pressure-crimp-type.
2. Tin-plated copper.
3. Insulation support sleeve for vibration resistance.
4. UL listed.
5. Compatible with conductor size and type of cable for which it is used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NFPA 70.

B. Install cable without exceeding allowable pulling tensions and sidewall pressures recommended by cable manufacturer.

C. Conduit installation:

1. Do not pull cable into conduits until conduit runs have been cleaned and are free from obstructions and sharp corners.

2. Draw a clean, dry, tight-fitting rag through conduit immediately before installing cable.

3. Install cable to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.

4. Block cable opening in sleeves under equipment or passing through blockouts, with silicone-foam, fire-retardant type material in accordance with NFPA 70.

5. Lubricant:

   a. Use only as aid to pulling.

   b. Soapstone or other suitable material not injurious to cable sheath.

D. Marking:

1. Mark conductors, whether single-conductor cables or individual conductors of multiconductor control, instrumentation, and power cables at each end with conductor designation on first line followed by cable designation on second line as indicated on approved wiring diagrams.

2. Mark spare conductors of multiconductor cables with cable designation and word "SPARE".

3. Numerically sequence markings (e.g., Panel-Circuit).

E. Tagging.

1. Tag multi-conductor cables at each end.

2. Attach tags to cable by self-locking cable ties.

3. Mark tags with cable designation.

   a. Cable designations: As indicated on approved wiring diagrams.

   b. Computer-generated lettering.

3.2 CONTRACTOR FIELD QUALITY TESTING

A. Perform testing after installation, but before connection to equipment.

B. Test cables in large groups to minimize number of testing sessions.

C. Notify COR, in writing, of date, time, and cables to be tested at least 5 working days before testing.

END OF SECTION

This page intentionally left blank.

SECTION 26 05 20
GROUNDING AND BONDING

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM B 3-01(2007) Soft or Annealed Copper Wire
2. ASTM B 8-04 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. National Fire Protection Association (NFPA)

1. NFPA 70-2011 National Electrical Code (NEC)

C. Underwriters Laboratories (UL)

1. UL 467-2007 Grounding and Bonding Equipment

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – List of Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 20-1 Approval Drawing

1. Provide a layout drawing showing the outlet works control building footprint and all ground connections between equipment, miscellaneous metalwork, photovoltaic system, and ground bar of outlet works control building.
2. Provide all sizes of each individual ground wire and methods for bonding on drawings.

C. RSN 26 05 20-2 Test Report

1. Provide a full description of the method of testing as well as all results.

PART 2 PRODUCTS

2.1 MATERIALS

A. Ground Cable:

1. Annealed bare-copper cable:

a. ASTM B 8, class B.

b. Solid wires used in forming the copper cable: ASTM B 3.

2.2 ACCESSORIES

A. Cable Connectors:

1. Welded, bolted solderless or compression type.

2. Current-carrying capacity: Equal to cable with which they are used.

3. Connectors for ground cables, including fittings, lugs, bolts, nuts, and washers: Copper alloy containing not more than 4 percent zinc.

B. Ground Rods:

1. Length: 10-feet.

2. Diameter: ¾-inch, nominal.

3. Bond 0.018 inch thick layer of copper inseparably to steel core.

4. In accordance with UL 467.

C. Ground Bar:

1. Material: High-strength, high-conductivity, cast-copper alloy.

2. Connector: Welded type.

3. Provide with sufficient connection points for grounding all devices as required by code.

2.3 WELDING PROCESS

A. Use Cadweld, Thermoweld, or equivalent exothermic process where necessary to bond ground wires.

B. Molds and weld metal:

1. Use fresh stock from same manufacturer.

2. Weld metal and starting material: No significant quantities of hazardous ingredients.

3. Conform to UL 467.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 70.

B. Grounding bar installation for the control room may use either compression or exothermic connection.

C. Connect 6 AWG bare copper grounding conductor from ground rods to grounding system of the control room.

D. Connections:

1. Make all ground connections between all equipment, miscellaneous metalwork of the outlet works control building as well as the photovoltaic system, and ground bar of grounding system.
2. Remove paint, enamel, scale, oil, grease, or other foreign nonconductive material from point of contact on metal surfaces before making ground connections.
3. Repair damaged or removed paint or galvanizing material on metal finishes.
4. Make ground connections that will be direct buried or embedded in concrete:
    a. Exothermic process.
    b. In accordance with manufacturer's instructions.

3.2 CONTRACTOR FIELD QUALITY TESTING

A. On-Site Test:

1. Demonstrate grounding resistance meets code requirements of 25 ohms or less.
2. COR will witness test. Notify COR in writing at least twenty-eight (28) days prior to beginning of test.

END OF SECTION

This page intentionally left blank.

SECTION 26 05 33
ELECTRICAL CONDUIT

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1.	ANSI C 80.1-2005	Electric Rigid Steel Conduit (ERSC)

B. National Electrical Manufacturers Association (NEMA)

1.	NEMA FB 1 – 2007	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
2.	NEMA RN 1 – 2005	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

C. National Fire Protection Association, Inc (NFPA)

1.	NFPA 70-2011	National Electrical Code (NEC)

D. Underwriters Laboratories (UL)

1.	UL 360-2009	Liquid-tight Flexible Steel Conduit

1.3 DESIGN REQUIREMENTS

A. All conduit runs will be determined by the Contractor. The installation of all exposed conduits will be done so that they will not create a tripping hazard to personnel.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and 01 33 26 - Electrical Drawings and Data.

B. RSN 26 05 33-1, Approval Data:

1. Provide manufacturer’s technical data for all conduits planned to be used in construction.

PART 2 PRODUCTS

2.1 CONDUIT

A. UL listed.

B. Rigid Steel Conduit: Conform to ANSI C 80.1, galvanized.

C. Plastic-Coated Rigid-Steel Conduit:

1. Rigid steel conduit: Conform to ANSI C 80.1.
2. External coating: Conform to NEMA RN 1 with 0.040-inch thickness, minimum.
3. Internal coating: 0.002-inch of urethane, minimum.

D. Flexible Liquid-tight Metal Conduit:

1. Liquid-tight type.
2. Ultra-violet resistant.
3. Conform to UL 360.

E. Fittings and Conduit Bodies:

1. Conform to NEMA FB 1.
2. Material to match conduit.

2.2 CAST DEVICE BOXES

A. Type FD, rectangular, single-gang with threaded hubs for rigid steel conduit.

B. Material: Iron alloy or copper-free aluminum.

C. Large Cast Metal Boxes:

1. Cast iron or aluminum.
2. Furnish with covers, stainless steel screws, and neoprene gaskets where required.
3. Surface- or flush-mounting types.
4. Size as applicable.
5. Drill and tap as required.
6. Provide bases for five full threads where necessary.
7. Exterior boxes: Watertight type.
8. Interior surface-mounted boxes: Dust tight type.

2.3 CONDUIT ACCESSORIES

A. Fittings required completing electrical conduit systems. Includes caps, connectors, couplings, nipples, reducers, elbows, pipe plugs, locknuts, bondnuts, bushings, seals, and any other fittings.

B. Devices required completing electrical conduit systems and to fasten, clamp, attach, and support each conduit in place.

1. Includes threaded joint compound; protective sealant; materials for sealing conduit through wall of structures; supports and clamps.

2. Complete with bolts, washers, and nuts.

C. Protective Sealant:

1. Water repellant.

2. Resistant to peeling and cracking.

D. Sealing Materials:

1. General use:

a. Non-toxic.

b. Non-shrinking.

c. Fire retardant type.

d. Seal ends of conduit against liquid, gas, and vapor seepage.

E. Adhesive: In accordance with conduit manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70 with necessary fittings and supports.

B. Determine routing of exposed conduits.

C. Ensure that conduit runs and bends are free from kinks, indentations, or flattened surfaces.

D. Remove burrs and sharp corners at ends of metal conduit.

E. Coat male threads of rigid metal conduit joints with suitable graphite or zinc sealing material before making joints.

F. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.

G. Install bushings or Chase-type nipples on ends of conduit to protect insulation of insulated conductors from abrasion.

H. Install locknuts and bondnuts to provide tight ground connections between conduit and boxes, panelboards, and cabinets.

I. Seal ends of conduits that terminate at control board, or cabinets with sealing compound. Install sealing compound in accordance with manufacturer's instructions and recommendations.

J. Exposed conduit runs:

1. Straight and parallel with each other and with centerlines of room or structure.
2. Support conduit in accordance with NFPA 70.
3. Installation includes, where required, drilling holes in bottom, side, or top of enclosures or plates of other electrical equipment.
4. Tighten conduit securely.
5. Make connections to outdoor boxes watertight.

END OF SECTION

SECTION 26 05 90
WIRING CHECKOUT AND OPERATIONAL TESTS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.2 PERFORMANCE REQUIREMENTS

A. Furnish materials, including test instruments, required for checkout and testing.

B. Make wiring changes and drawing revisions to ensure there are no discrepancies between check prints, and internal equipment wiring and external cabling.

C. Replace defective equipment and make device setting adjustments as required for operation of electrical systems in accordance with specifications and manufacturer's instructions.

D. If required during testing, remove and replace wire connections.

E. Make wiring changes, wire tag revisions, and other repairs or revisions during initial testing session until the discrepancy is discovered.

F. Perform wiring checkout and operational and functional tests in presence of Government representatives.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 26 - Electrical Drawings and Data.

B. RSN 26 05 90-1, Test Reports:

1. Certification of performance of wiring checkout and results of operational tests.

1.4 QUALIFICATIONS

A. Testing Personnel:

1. Competent and qualified employees to perform wiring checkout, and operational and functional testing.
2. Have thorough knowledge of the electrical equipment, installation, and drawings.
3. Qualified to operate equipment being tested.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Notification: In writing to COR fourteen (14) days in advance of each testing session.

B. Provide the following at time wiring checkouts and test are performed:

1. Two complete sets of full-size (D-size) electrical schematic and wiring diagram check prints for equipment being tested.
    a. One set will be used and maintained by the Government.
    b. One set will be maintained by Contractor and used to produce final drawings.
2. Instruction books, test reports, and manufacturer's catalog data for equipment being tested.

3.2 CONTRACTOR FIELD QUALITY TESTING

A. Perform wiring checkout and tests in accordance with approved testing plan and the following:

B. Wiring Checkout:

1. Use electrical schematic and wiring diagram check prints to perform wiring check of internal and external cabling provided.
2. Verify: contact configuration and contact numbering, continuity of wiring, and proper wiring tagging at ends of conductors.
3. Check conductors for insulation damage. Perform additional insulation resistance test of damaged conductors.

C. Operational and Functional Testing:

1. Perform after completion of wiring checkout of electrical system being tested.
2. If required, adjust and calibrate protective devices in accordance with specifications and manufacturer's instructions.
3. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagrams.

END OF SECTION

SECTION 26 27 31

INTERIOR LIGHTING

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in the schedule for other items of work.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 26 - Electrical Drawings and Data.

1. RSN 26 27 31-1, Approval Data: Manufacturer's technical data.

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish all necessary mounting hardware.

2.2 LIGHT FIXTURES

A. Type: LED.

B. Wall-mount.

C. Weatherproof.

D. 800 lumens

E. 4.8 watts

F. 12 VDC operable

G. LED life: 100,000 hours

H. Equivalent to Thin-Lite Model LED1607CP

I. Quantity:

1. Control Room – Four (One installed at the top center of each wall).

2. Gate Chamber – Two (One installed at the top center of the north wall and the top center of the south wall)

2.3 LIGHT SWITCHES

A. Single pole/single throw

B. Surface Mount

C. Minimum voltage: 24VDC

D. Minimum current capacity: 4A

E. Weatherproof

F. Quantity: 2

2.4 FABRICATION

A. Light fixtures requiring special modifications shall be modified and wired by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install light fixtures, light switches, and accessories in accordance with manufacturer's instructions.

1. Install the light switch for control room lights to the south of the control room door on the inside wall, centered 4 inches from the door opening and 54 inches above the floor.
2. Install the light switch for the gate chamber in the northeast corner of the control room, centered 54 inches above the floor.

B. Install fittings and accessories required for complete installation.

C. Install surface mounted light fixtures plumb and adjust to align with building lines and with each other. Secure to prevent movement.

D. Make connections to branch circuits. Use insulated conductors with insulation suitable for temperature conditions within light fixture.

E. Bond light fixtures to branch circuit equipment grounding conductor.

F. Operate each light fixture and light switch after installation and connection. Inspect for proper connection and operation.

G. Remove dirt and debris from enclosures.

H. Clean finishes and touch up damage.

I. Clean light fixtures and replace any broken or inoperable parts or fixtures.

END OF SECTION

This page intentionally left blank.

SECTION – 26 28 00

SOLAR AND ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered for in the schedule for other items of work.

1.2 REFERENCES

A. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2008	Enclosures for Electrical Equipment (1000 Volts Maximum)

B. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL)

1.	UL 50-2003	Enclosures for Electrical Equipment
2.	UL 67-2006	Panelboards
3.	UL 467-2007	Grounding and Bonding Equipment
4.	UL 489-2002	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

1. RSN 26 28 00-1 Approval Drawings and Data:
    a. Drawings in Government Format:
    1) Layout of each equipment enclosure and roof mounted equipment.
    2) Schematic diagrams.
    3) Wiring diagrams.
    b. Data: Manufacturer's product data.
2. RSN 26 28 00-2, Final Drawings and Data:
    a. Drawings in Government Format:

1) Layout of each equipment enclosure and including the equipment on the structure of roof.

2) Schematic diagrams.

3) Wiring diagrams.

b. Data: Manufacturer's product data.

3. RSN 26 28 00-3, Notification Prior to On-site Test.

4. RSN 26 28 00-4, Operations and Maintenance Manuals: For each piece of equipment installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle and store equipment in accordance with manufacturer's instructions. Include copy of these instructions with equipment at time of shipment.

1.5 PROJECT CONDITIONS

A. Altitude: 7050 feet above sea level.

B. Ambient Temperature Range: -40 degrees C to 40 degrees C.

PART 2 PRODUCTS

2.1 BATTERY ENCLOSURE

A. Construction material: Steel or aluminum.

B. NEMA 250 Type: 3R

C. Finish: Manufacturer's standard powder coat.

D. Spill containment tray.

E. Ventilation: Passive, with filtered louvers.

F. Size: Able to accommodate all batteries required, plus 20 percent spare.

G. Connections between batteries must be made with UL-listed Class B insulated stranded 4/0 AWG copper cables or equivalent. Cables connecting positive (+) terminals are to be red and cables connecting negative (-) terminals are to be black.

2.2 BATTERY

A. Type: Maintenance Free, Valve Regulated Lead Acid, Absorption Gas Mat, specifically made for deep cycle solar applications. Equivalent to Concorde SunXtender PVX or better.

B. Terminal Voltage: 12 VDC nominal.

C. Temperature Range: -40 degrees C to +72 degrees C.

D. Total Nominal 72 Hour Capacity at 25 degrees C: Greater than 780 AH @ 12 VDC.

1. Battery must meet a system run-time of 72 hours or greater without use of solar modules from a fully charged battery under nominal system load.

E. Self discharge: Less than 1 percent per month at 25 degrees C.

F. Total number of batteries to fit in battery enclosure.

G. Use of flooded cell batteries is not permitted.

2.3 PHOTO-VOLTAIC MODULE MOUNTS

A. Roof Mount Support Structures having the following essential characteristics:

1. Solar module mounting angle: 45 degrees from horizontal, facing true south.
2. Clearance between solar modules and roof: 2 foot minimum.
3. Size: Total structure must support all photovoltaic solar modules and fit on roof of control house without hindering access.
4. Wind load rating: 120mph
5. Material: Aluminum, or galvanized steel.
6. Mounting Equipment:
    a. As necessary to mount on concrete structure.
    b. As necessary to mount each photo-voltaic module.

2.4 PHOTOVOLTATIC SOLAR MODULES

A. Type: mono crystalline, non-glass construction with bypass diodes. Equivalent to SBM Solar 258W panels.

B. Damage resistant.

C. Nominal power rating: 750 watts (entire system) minimum.

D. Maximum Power Current (entire system): 27A.

E. Maximum Power Voltage (per module): 31 V.

F. Size: Total number of modules must fit on roof of control house without hindering access.

2.5 12 VDC CHARGE CONTROLLER

A. TriStar MPPT 45 Controller manufactured by Morningstar Corporation 1098 Washington Crossing Road, Washington Crossing, PA 18977; or equal, having the following essential characteristics:

1. System voltage rating: 12 VDC
2. System current rating: 45 Amps continuous current, minimum.
3. Current Consumption:
    a. Controller: 20 mA, maximum.
    b. Meter: 7.5 mA, maximum.
4. Selectable charging program for battery type. Available charging program matches battery provided, i.e. AGM type batteries.
5. Operating temperature: -40 degrees C to +40 degrees C
6. Remote Temperature Sensor:
    a. Same manufacturer as the charge controller.
    b. Temperature range: -30 degrees C to 80 degrees C.
    c. Accuracy: +/- 1.5 degrees C.

2.6 DC DISCONNECT POWER CENTER

A. Enclosure Type: Aluminum or stainless steel with hinged door, specifically made for solar applications.

B. Mounting: Wall mounted.

C. Ground Bus:

1. Material: Copper.
2. Size: Sufficient to attach equipment ground conductors.

D. Finish: Manufacturer’s standard coating.

E. Knockouts for solar module and battery cables, and charge controller mounting.

F. DC Circuit Breakers:

1. Mounting for battery and solar module disconnect breakers.
2. Din rail mounting for DC circuit breakers.

3. Voltage Rating on Breakers: 60 Volts DC, minimum.
4. Ground fault protection for incoming voltage from photovoltaic modules.
5. All disconnect breakers specifically designed for disconnect under load.
6. Two 30A disconnect breakers for the lines between the solar module array and the charge controller.
7. Two 50A disconnect breakers for the lines between the battery enclosure and the charge controller.
8. Disconnect breakers must accommodate a minimum wire size of 6 AWG.

G. Ventilation: Provides sufficient ventilation for charge controller.

2.7 FABRICATION

A. Wiring and Wiring Connections:

1. Make connections at device terminals or terminal blocks. Maximum of two wires per termination.
2. Form wiring into compact groups bound together and firmly supported. Run wiring groups straight, horizontally, or vertically with short-radius, right-angle bends.
3. Support and secure wire bundles with cable tie mounting bases. Secure cable tie mounting base with two No. 8 screws. Mounting cable tie bases with only adhesive will not be allowed.
4. Group wires at terminal blocks to minimize number of external cables.
5. Install ring tongue pressure-crimp-type connectors for terminations at electrical devices.
6. Install pin pressure-crimp-type connectors for terminations where the use of ring tongue is not practical such as terminations at selector switches, pushbuttons, indicating lamps, or auxiliary relays.

B. Wire Markers:

1. Install wire markers on conductor end.
2. Print conductor designation on first line.
3. Print conductor destination and terminal number on second line.

C. Nameplates: Attach nameplate with machine screws. Use of adhesives for attaching nameplates is not acceptable.

D. Mounted Components:

1. Install in accordance with manufacturer’s instructions and recommendations.

2. Install per layout drawing with secure and suitable fasteners and connectors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install battery enclosure in location shown on drawings and secure with suitable fasteners in accordance with manufacturer's instructions.

B. Install photovoltaic modules, mounting hardware and interconnection equipment so as to not impede any roof access hatches.

C. Make conduit and electrical connections.

D. Furnish and install all photovoltaic module output cables, module interconnect cables, battery cables, grounding, and associated equipment required for a complete independent solar electrical supply system.

E. Install Remote Temperature Sensor in Battery Enclosure in a location that will monitor battery temperature and connect to 12 VDC Charge Controller in accordance with 12 VDC Charge Controller manufacturer instructions.

F. Install grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding and NEC.

G. Perform field wiring checkout and test in accordance with Section 26 05 90 – Wiring Checkout and Tests.

3.2 CONTRACTOR FIELD QUALITY TESTING

A. On-Site Test:

1. Demonstrate functionality of system.
2. Government will witness test. Notify COR in writing at least twenty-one (21) days prior to beginning of test.
3. To demonstrate the system is fully functional perform the tests below:
    a. Proper function of each piece of equipment.
    b. System run-time of 72 hours or greater without use of solar modules from a fully charged battery.

3.3 ACCEPTANCE OF THE SYSTEM

A. Government will furnish a discrepancy list to Contractor twenty (20) days after satisfactory completion of on-site test.

B. Contractor will resolve discrepancies.

C. Government will provide final acceptance.

END OF SECTION

This page intentionally left blank.

SECTION 31 02 10
WATER FOR DUST ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other work items, in accordance with Section 01 51 00 – Temporary Utilities.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 APPLYING WATER FOR DUST ABATEMENT

A. Provide water in accordance with Section 01 51 00 - Temporary Utilities.

B. Provide means of conveying water to point of use and applying water.

C. Use pressure spray or distributor bar to apply water evenly.

D. Apply water for dust abatement as directed by the COR.

END OF SECTION

This page intentionally left blank.

SECTION 31 03 10

DIVERSION AND CARE OF STREAM DURING CONSTRUCTION

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Diversion and Care of Stream During Construction:

1. Payment: Lump-sum price offered in the schedule.

a. Includes:

1) Constructing and maintaining cofferdams, channels, flumes, drains, sumps, and other temporary diversion and protective works.

2) Removing or leveling such works, where required.

3) Disposing of materials.

4) Diverting the stream.

5) Making required closures.

6) Cleaning the outlet works and stilling basins.

7) Excavation of Sediments (not related to existing dam removal).

8) Other work required by this Section.

b. Monthly progress payments will be based on approved cost allocations to the major work divisions and the percentage of each major division of work performed.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 31 03 10-1, Water control plan:

1. Describe proposed method for diversion and care of stream during construction and measures to be taken to meet permit requirements and water quality standards required in Section 01 57 30 - Water Pollution Control.

2. The water control plan shall contain not more than 6 major divisions of work for diversion and care of stream during construction.

a. Outline and identify each major division by title.

b. Allocate a proportionate part of the lump-sum price to each major division of work of the water control plan. The price allocation is subject to COR approval.

c. A diversion concept is presented in Section 51 00 00 – Information Available to Offerors. It is the responsibility of the Contractor to verify the suitability of the proposed concept for this project and make any modifications or changes as needed for the water control plan submittal.

C. In addition to the requirements of Section 01 33 00 - Submittals, submit one copy of the plan and transmittal letter to the Navajo Nation EPA representative.

1.3 SITE CONDITIONS

A. Unwatering:

1. The Contractor shall devise a means of draining the reservoir, possibly through the existing outlet works pipe, without allowing flow to exceed the half full flow condition. A drawing of the existing intake structure configuration and bathymetry data are provided in Section 51 00 00 – Information Available to Offerors.

B. Hydrographs and Discharge Curves:

1. Tsaile Creek reservoir inflows with time and reservoir water levels with time are given in Section 51 00 00 - Information Available to Offerors.

2. Computed reservoir inflow flood peaks and volumes in acre-feet for the 2-, 5-, 10-, 25-, 50-, and 100-year flood events are given in Section 51 00 00 – Information Available to Offerors.

3. Flow and water level information are provided solely for information of the Contractor in timing construction operations to prepare for such flood storage or flow bypassing as it deems necessary to mitigate flood risk damage during construction.

4. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government for the Contractor, in accordance with the clause at FAR 52.236-3 "Site Investigations and Conditions Affecting the Work."

C. Environmental and Regulatory Requirements:

1. Do not interrupt or interfere with natural flow of Tsaile Creek through the damsite for any purpose or reason without the prior written approval of the COR, except as provided below.

a. The Contractor will be permitted to reduce such flow by the amount of water used for construction purposes as provided in Section 01 51 00 - Temporary Utilities.

b. There may be periods where the Contractor will be required to temporarily store inflow behind the cofferdam.

c. Flow reduction to Tsaile Creek shall require the prior written approval of the COR.

d. During reservoir drawdown, discharges to Tsaile Creek downstream of the dam site shall be limited to 20 cfs to avoid flooding of the canyon downstream and the residents of the canyon.

e. Discharges in excess of 20 cfs may be required. The COR and BIA shall be notified for review and approval if flow rates in excess of 20 cfs are anticipated. Residents in Canyon del Muerto shall be notified by the COR or their representative prior to releases of flows greater than 20 cfs.

2. Reservoir sediments are not to be released into Tsaile Creek downstream of the project area.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to construction of the new outlet works, the upstream cofferdam shall be constructed to a height of no less than elevation 7019.5 (NAVD88) to temporarily store inflows and protect the work area. Cofferdam construction shall be in accordance with Section 31 24 00 – Embankments.

B. The existing 12-inch and 16-inch-diameter siphons on the dam may be removed and salvaged for use in its water control plan. Provide a means for regulating flows from the reservoir into the existing outlet works pipe (e.g., a slide gate).

C. Remove rock fragments, lumber, metal, and other solid debris materials prior to diversion, and prevent such materials from being washed through the outlet works.

D. Approved protective works may be required at the entrance to keep the outlet works free of debris. The contractor's water control plan shall contain provisions that no accumulated sediments in Tsaile Reservoir are released into Tsaile Creek.

3.2 DIVERSION

A. Construct and maintain temporary diversion and protective works necessary for diversion and care of the stream during construction, including, but not limited to, cofferdams, channels, flumes, drains, and sumps.

B. Releases through the existing outlet works in its 'as is' condition are recommended to not exceed half full flow to avoid pressurization and subsequent damage and erosion in and adjacent to the outlet works pipe. The existing outlet works may be used as a temporary diversion during flooding for flows higher than half full flow if approved by the COR.

The new outlet works shall not be used as a diversion until the outlet works intake tower walls are above elevation 7015, the outlet conduit is in place and encased in concrete, and the terminal structure is complete and has been approved by the COR.

C. Construct a sump area upstream of the cofferdam that is at least four feet deep and has storage capacity of one acre-foot of water to store water for use during construction.

3.3 CLEANUP AND RESERVOIR REGULATION

A. Remove temporary diversion and protective works and level cofferdam materials in reservoir to maximum two foot height in a manner approved by the COR.

1. Removed materials remain property of the Contractor, with the exception of the salvaged siphon pipes, which shall be stored within the temporary construction easement for pickup by the NNSOD after completion of the work.

2. Dispose of removed material in accordance with Section 01 74 00 – Cleaning and Waste Management.

B. Temporary diversion and protective works in the stream channel downstream from the dam:

1. Remove structures from stream channel and level protective earthwork to give a natural appearance and so as not to interfere with operation or usefulness of the reservoir or degrade fish habitat.

2. Remove pumps and piping required for obtaining construction water from the reservoir. Regrade and seed pipe corridors as approved by the COR.

C. Temporary diversion and protective works constructed upstream from the dam are not a part of the permanent dam embankment:

1. Remove or level and grade to extent required to prevent obstruction of flow to spillway or outlet works.

2. If existing or new outlet works are used as a temporary diversion during flooding:

   a. Remove existing outlet works pipe after diversions have been moved to the new outlet works pipe. Upstream portion of pipe remaining in cofferdam remnant may be filled with concrete and abandoned in place if not removed.

   b. Unwater new outlet works and stilling basins.

   c. Remove sediment, rocks, and debris from new outlet works hydraulic flow surfaces.

   d. Inspect new outlet works and clean as necessary.

3. After installation and testing of gates and other metalwork and equipment in the outlet works structure, the COR will operate the gates and regulate the flow in the river and reserves the right to commence storage in the reservoir.

4. Repair damage to foundations, structures, or other part of the work caused by floods, water, or failure of diversion or protective works.

END OF SECTION

This page intentionally left blank.

SECTION 31 03 33
REMOVAL OF WATER FROM EXCAVATION

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Removal of Water from Excavations:

1. Payment: Lump-sum price offered in the schedule for Dewatering.

   a. Except as otherwise provided in Section 31 23 23– Excavation from Borrow or Section 31 23 21 - Excavation for Dam Embankment and Structure Foundations, the lump-sum price includes costs of furnishing labor, equipment, and materials for maintaining the work free from water.

   b. Includes costs of furnishing labor, equipment, and materials for maintaining work related to the removal of water as required by this section.

2. Payment Allocation:

   a. Allocation of the lump-sum price is subject to approval of the COR.

1.2 DEFINITION

A. Dewatering: Removal and control of groundwater from pores or other open spaces in soil or rock formations to allow construction activities to proceed as intended, and includes relief of groundwater pressure.

B. Unwatering: Control and removal of ponded, seeping, or flowing surface water or emerging subsurface water from excavated surfaces and from precipitation within and adjacent to excavations and construction zones using channels, ditches, gravel drains, gravel blankets, pipe, sumps, and discharge lines. Includes control and discharge of effluent waters.

1.3 SYSTEM DESCRIPTION

A. Design, install, operate, maintain, and monitor water removal facilities.

B. Design and layout facilities to collect discharge water from water removal systems and convey water to designated approved discharge points.

C. Locate water removal facilities to maximize water removal and minimize construction interference.

D. Select pump types and design discharge systems and settling ponds, if required.

E. Provide required equipment and monitor as required by permit.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittals.

B. RSN 31 03 33-1, Removal of water plan:

1. Showing proposed method for removal of all water from foundations and other excavations.

1.5 REGULATORY REQUIREMENTS

A. Obtain required Federal, State, and local permits for water discharge and other activities associated with removal and control of water.

B. Refer to Section 01 57 30 - Water Pollution Control.

1.6 PROJECT CONDITIONS

A. Conditions which may influence the dewatering or unwatering include:

1. Frequency and rate of precipitation at the site.
2. Subsurface conditions including natural layering, thickness, permeability, and storativity of materials, and groundwater levels.
3. Efficiency of pumps, collectors, and discharge systems.
4. Inflow of water into excavation from existing toe drain, seepage through the existing embankment, foundation, or outlet works.
5. Reservoir level behind the dam or temporary cofferdam.

B. Water content and water levels and pressures in subsurface materials vary with location, depth, and material.

C. Refer to Section 53 10 00 - Geologic Investigations and Section 53 20 00 - Records of Geologic and Subsurface Investigations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES

A. Design, furnish, install, construct, operate, monitor, maintain, and remove temporary facilities required to remove and control water during construction. Provide or construct pumps, pipelines, cofferdams, wells, well-points, sumps, ditches, channels, and other facilities required for dewatering or unwatering.

B. Supplement or modify facilities when monitoring or other conditions reveal inadequate performance of facilities. Obtain approval of additions or modifications from COR.

C. Remove temporary facilities when no longer required.

3.2 WATER REMOVAL AND CONTROL

A. Remove water and maintain foundations, work areas, and borrow area free from water so that construction operations are performed in dry conditions.

B. Plans may be placed in to operation upon approval, but nothing in this Section shall relieve the Contractor from full responsibility for the adequacy of the water removal and control.

C. Control water so that stable excavations are maintained and damage to work is prevented. Draw down water levels to a minimum of 3 feet below excavation grades in soil and a minimum of 1 foot below excavation grades in rock.

D. Remove water to a minimum of 3 feet below cut slopes or below grades to receive overlying fill.

E. Unwatering:

1. Remove surface water from work areas.
2. Control and collect flowing surface water, precipitation runoff, and seepage to prevent accumulation of water which could interfere with construction operations or damage work.
3. Locate ditches, channels, sumps, and settling ponds at locations approved by COR.
4. Refill ditches or channels excavated below final lines and grades indicated on drawings to established lines and grades as specified for refill of over-excavation.

3.3 REPAIR

A. Repair damage to work caused by inadequate performance of facilities, mechanical or electrical failure of equipment, or inadequate monitoring or maintenance of facilities. Obtain approval of repair or replacement work from COR.

3.4 DISPOSAL

A. Dispose of removed water in accordance with Section 01 57 30 - Water Pollution Control.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Clearing and Grubbing:

1. Measurement: Acres of site cleared and grubbed.
2. Payment: Per acre price offered in the schedule for Clear and Grub.

1.2 DEFINITIONS

A. Vegetation: Trees, shrubs, brush, stumps, exposed roots, downed timber, branches, grass, and weeds.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CLEARING

A. Clear rights-of-way to be occupied by permanent construction, and surfaces of borrow areas, stockpile sites, waste pile sites, and staging areas.

B. Clear adjacent to cut or fill sections outside of slope lines.

1. Minimum distance: 15 feet.
2. Maximum distance: 20 feet.

C. Remove vegetation, rubbish, and objectionable material as determined by COR.

D. Preserve and protect vegetation designated for preservation within clearing limits and vegetation outside clearing limits in accordance with Section 01 57 60 - Protected Species.

3.2 GRUBBING

A. Grub ground surfaces to be under embankment and surfaces of excavation to be used for embankment.

B. Remove stumps, roots, and vegetative matter.

1. Remove roots to a depth of 12 inches below finished grade as directed by COR.

C. Perform grubbing in advance of grading operations.

3.3 DISPOSAL OF CLEARED MATERIAL

A. Dispose of material in accordance with Section 01 74 00 – Cleaning and Waste Management.

B. Nonvegetative material: Dispose of as noncombustible material in accordance with Section 01 74 00 – Cleaning and Waste Management.

C. Vegetative materials: Chip and spread, or remove from jobsite.

1. Removing from jobsite: Dispose of as combustible material in accordance with Section 01 74 00 – Cleaning and Waste Management.

2. Chipping and spreading:

a. Reduce woody vegetation material to chips of 2 - inch maximum dimension.

b. Spread chips uniformly to a 2 - inch maximum thickness on areas designated by the COR, and mix the chips with underlying earth so as to not float or support combustion.

c. Spread chips over the landscape area no deeper than two inches, and apply nitrogen fertilizer at the rate of 200 pounds of actual nitrogen per acre of chips.

END OF SECTION

SECTION 31 20 00

STRUCTURE BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: structure backfilling and compacting.

B. Related Sections:

1. Section 31 23 02 – Compacting Earth Material.
2. Section 33 42 13 – Pipe Culvert.
3. Section 33 05 16 - Precast Components.

1.2 RELATED DOCUMENTS

A. The work under this section shall perform in accordance with requirements of the Earthwork, Section 203 of the 2008 or the most recent edition of the Standard Specifications of Arizona Department of Transportation.

1.3 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.
    a. Box Culvert and Wingwalls.
    b. CPVC Pipe Culvert.

1.4 SUBMITTALS

A. Section 31 20 00 - Submittal Procedures: Requirements for submittals.

B. RSN 31 20 00-1, Test Result: Submit compaction test result to verify compliance with the requirements of ASTM D2922 or ASTM D698.

C. RSN 31 20 00-2, Materials Data:

1. Name and location of soil source.
2. Gradation of backfill soil.
3. Certified laboratory test results demonstrating soil meets specified material requirements.

D. RSN 31 20 00-3, Product Data: Submit data for the Geocomposite Drain’s manufacturer, product type and quantity.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Backfill material shall not contain salvaged asphaltic concrete materials.

B. Backfill material shall have resistivity of 2,000 ohm-centimeters or greater (AASHTO T288) and PH≥6.0 (AASHTO T289).

C. Plasticity Index shall not exceed 5 when tested in accordance with the requirements of AASHTO T90.

D. Gradation:

1. Structure backfill material shall conform to the following gradation:

Sieve Size	Percent Passing
3 inch	100
¾ inch	60 – 100
No. 8	35 – 80
No. 200	0 – 12

E. Topsoil material:

1. The top 6 inches of soil (topsoil) scraped off the surface of the ground, shall be stocked piled out of the way of construction and be used for reclamation.
2. The topsoil shall be used as fill material in the construction process.
3. It will be safeguarded and only be used for reclamation at the completion of the construction.

2.2 ACCESSORIES

A. Geocomposite Wall Drains:

1. The geocomposite shall be resistant to commonly encountered chemicals and hydrocarbons, and resistant to ultraviolet exposure.
2. The geocomposite wall drain materials shall conform to the requirements of Subsections 1014-1 and 1014-6 of the Standard Specifications of ADOT.
3. The identification, packaging, handling, and storage of the geocomposite wall drain material shall be in accordance with ASTM D 4873.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Notify COR of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

C. Verify foundation or basement walls are braced to support surcharge forces imposed by backfilling operations.

D. Backfill material shall not be placed against the back of concrete structures until the concrete has developed its full design strength.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

F. Geocomposite Wall Drains:

1. Geocomposite wall drains shall be installed permanently on the soil side of wingwalls and culvert sidewalls.
2. The geocomposite drain shall be installed in accordance with the requirements of Subsection 203-5.03(C) of the Standard Specifications of ADOT.

3.2 TRENCHING

A. Cut trenches sufficiently wide to enable installation of utilities and allow inspection as indicated on the Drawings.

B. Support pipe during placement and compaction of bedding fill.

C. Backfill trenches to required contours and elevations.

D. Place and compact fill materials as for Backfilling.

3.3 BACKFILLING

A. Backfill areas to contours and elevations. Use unfrozen and unsaturated materials.

B. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Place geotextile fabric over unstable subsoil or sediment for Temporary Road.

D. Place material in continuous layers as follows:

1. Fill Materials: Maximum 8 inches compacted depth.

E. Employ placement method so not to disturb or damage foundations or utilities in trenches.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill against supported foundation walls. Backfill simultaneously on each side of unsupported foundation walls.

3.4 COMPACTION

A. Backfill compacted by pneumatic or mechanical tamping devices shall be placed in layers not more than eight inches in depth.

B. Backfill material shall be compacted as necessary to provide a density of not less than 95 percent of the maximum density in accordance with the requirements of ASTM D698, Standard Proctor Density.

3.5 QUALITY CONTROL

C. Perform backfill soil test in accordance with the following requirements:

1. Salvage asphalt concrete is not allowed.
2. Resistivity: 2,000 ohm-centimeters or more (AASHTO T288).
3. PH value: between 6.0 and 12.0 (AASHTO T289).
4. Gradation as specified.
5. Plasticity Index: not more than 5.0 (AASHTO T90).

D. Perform in place compaction tests in accordance with:

1. Density Tests: ASTM D698, Standard Proctor Density Tests for Density of Soil and Soil-Aggregate in Place for a 95% compaction requirement.

E. Frequency of Tests: Determined by COR.

END OF SECTION

SECTION 31 23 02
COMPACTING EARTH MATERIALS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Payment:

1. Include in prices offered in the schedule for items of work where earth materials are required to be compacted.

   a. Includes furnishing water, processing earth materials to achieve particle size requirements and moisture requirements, and drying or moistening earth materials.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D 422-63(2007)	Particle-Size Analysis of Soils
2.	ASTM D 653-09	Terminology Relating to Soil, Rock, and Contained Fluids
3.	ASTM D 698-07	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4.	ASTM D 1140-00(2006)	Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5.	ASTM D 1556-07	Density and Unit Weight of Soil in Place by the Sand-Cone Method
6.	ASTM D 2216-10	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7.	ASTM D 2487-10	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8.	ASTM D 2488-09a	Description and Identification of Soils (Visual-Manual Procedure)
9.	ASTM D 4253-00(2006)	Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
10.	ASTM D 4254-00(2006)	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
11.	ASTM D 4318-10	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

12.	ASTM D 4718-87(2007)	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
13.	ASTM D 4959-07	Determination of Water (Moisture) Content of Soil by Direct Heating
14.	ASTM D 5080-08	Rapid Determination of Percent Compaction
15.	ASTM D 6938-10	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depths)

B. Bureau of Reclamation (USBR)

1. USBR EM - Earth Manual, Part 2, Third Edition (1990)

2. Procedure No. and Title:

a.	USBR 3900-89	Standard Definitions of Terms and Symbols Relating to Soil Mechanics
b.	USBR 5000-86	Determining Unified Soil Classification (Laboratory Method)
c.	USBR 5005-86	Determining Unified Soil Classification (Visual Method)
d.	USBR 5300-89	Determining Moisture Content of Soil and Rock by the Oven Method
e.	USBR 5315-89	Determining Moisture Content by the Microwave Method
f.	USBR 5325-89	Performing Gradation Analysis of Gravel Size Fraction of Soils
g.	USBR 5330-89	Performing Gradation Analysis of Fines and Sand Size Fraction of Soils, Including Hydrometer Analysis
h.	USBR 5335-89	Performing Gradation Analysis of Soils Without Hydrometer
i.	USBR 5350-89	Determining the Liquid Limit of Soils by the One-Point Method
j.	USBR 5355-89	Determining the Liquid Limit of Soils by the Three-Point Method
k.	USBR 5360-89	Determining the Plastic Limit and Plasticity Index of Soils
l.	USBR 5500-89	Performing Laboratory Compaction of Soils--5.5-lbm Rammer and 18-in Drop

m.	USBR 5525-89	Determining the Minimum Index Unit Weight of Cohesionless Soils
n.	USBR 5530-89	Determining the Maximum Index Unit Weight of Cohesionless Soils
o.	USBR 7205-89	Determining Unit Weight of Soils In-Place by the Sand-Cone Method
p.	USBR 7230-89	Determining Unit Weight and Moisture Content of Soil In-Place - Nuclear Moisture-Density Gauge
q.	USBR 7240-89	Performing Rapid Method of Construction Control
r.	USBR 7250-89	Determination of Percent Relative Density
s.	USBR 7255-89	Determining the Percent Compaction of Earthwork for Construction Control

3. Guidelines for Earthwork Construction Control Testing of Gravelly Soils, Earth Sciences and Research Laboratory, Technical Service Center, Bureau of Reclamation, Denver, Colorado, September 2008.

1.3 DEFINITIONS

A. Use definitions from USBR 3900 when using USBR reference standards or from ASTM D 653 when using ASTM reference standards.

B. Control Fraction: The portion of a soil sample consisting of particles smaller than a designated sieve size. The fraction is used to compare in-place unit weight with standard laboratory unit weight. The control sieve size depends on the laboratory test used for determination of laboratory maximum or minimum density.

C. Oversize Particles: Particles larger than the maximum allowed in the laboratory test for determining the laboratory maximum and minimum density.

D. C-value: The ratio expressed as a percentage of (1) in-place unit weight at fill moisture content to (2) the wet unit weight of a laboratory-compacted specimen prepared at fill moisture content as determined by the rapid method of construction control in accordance with ASTM D 5080 (USBR 7240). The C-Value is a comparison of compactive effort of field compaction equipment to standard laboratory compactive effort.

E. D-value: The ratio expressed as a percentage of (1) in-place wet unit weight at fill moisture content to (2) laboratory maximum wet unit weight as determined from a compaction curve constructed at fill moisture content as determined by the rapid method of construction control ASTM 5080 (USBR 7240). The D-value is the equivalent of percent compaction in accordance with ASTM D 698 (USBR 5500).

F. Percent Compaction: The ratio, expressed as a percentage, of (1) dry unit weight of a soil, to (2) maximum dry unit weight obtained in a laboratory compaction test (ASTM D698).

G. Percent Relative Density : The ratio of (1) the difference between void ratio of a cohesionless soil in the loosest state and any given void ratio, to (2) the difference between its void ratios in the loosest state and densest state in accordance with USBR 7250.

H. Special compaction: Compaction close to structures or in spaces not accessible by self-propelled compaction equipment or rollers.

1.4 AMBIENT CONDITIONS

A. Do not place and compact soil under following conditions:

1. Ambient air temperature below freezing.
2. Rain that creates puddles in clayey or silty materials.
3. Heat or wind or both that dries material below special moisture conditions.
4. Ice or snow pockets are visible in soil being placed or in underlying materials.

PART 2 PRODUCTS

2.1 CLASSIFICATION

A. When required, classify earth materials using the Unified Soil Classification System (USCS) according to ASTM D 2487 (USBR 5000) or ASTM D 2488 (USBR 5005).

1. Gradation tests for classification: ASTM D 422 or D 1140 (USBR 5325, 5330, or 5335).
2. Atterberg limits testing for classification: ASTM D 4318 (USBR 5350, 5355, or 5360).

2.2 SOIL TYPES

A. Clean Fill:

1. Any soil except soils with classifications Peat (PT), Organic Silts and Organic Clays (OL and OH), or Elastic Silt (MH).
2. Free of roots, stumps, limbs, vegetation, organic matter, and ice.
3. Does not contain construction debris, scrap materials, refuse, man-made wastes, or chemical or hydro-carbon contamination.

B. Do not use frozen soils.

2.3 DESIGNATION OF SOILS FOR COMPACTION

A. Requirements for lift thickness, method of compaction, and method of determining degree of compaction depends on whether soil is considered to be silty or clayey, cohesionless, or cohesionless containing some silt and clay.

B. Low Permeability Fill (Zone 1):

1. Conform to requirements of Low Permeability Fill (Zone 1) in Section 31 24 10 – Embankment Fill

C. Embankment Shell Fill (Zone 2):

1. Conform to requirements of Embankment Shell Fill (Zone 2) in Section 31 24 10 – Embankment Fill

D. Sand Filter (Zone 3) :

1. Conform to requirements of Section 31 24 12 – Sand Filter

E. Gravel Drain (Zone 4):

1. Conform to requirements of Section 31 24 16 – Gravel Drain

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Clear, grub, and strip.

B. Allow concrete in structures to attain full strength before performing adjacent compaction.

C. Allow concrete in structures to attain its full design strength, as determined by COR, before placing any fill material against structures.

D. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing layer of material to be compacted.

E. Do not place soil on frozen surface.

3.2 SOIL MOISTURE CONTENT

A. Pre-conditioning and curing is expected to be required to obtain uniform and homogenous distribution of moisture within stockpiled embankment materials and within borrow materials for the embankment. Use of disks, harrows, or rakes may be required to blend moisture in the borrow area.

B. Moisten or aerate material, as necessary, to provide moisture content that will readily facilitate obtaining specified compaction. Add water to soil only in increments that will permit moisture content to be uniform and homogenous throughout each layer after mixing.

C. Perform adequate moisture conditioning in a designated stockpile or borrow area prior to hauling material for placement in the embankment. Supplement by minor sprinkling of the embankment fill just prior to compaction, subject to approval of the COR.

D. Low Permeability Fill (Zone 1) and Embankment Shell Fill (Zone 2)

1. Moisture content during compaction:

a. Not greater than 2 percentage points wet or not less than 1 percentage points dry of optimum moisture content.

2. Moisture content will be determined as follows:

a. Moisture content is determined on the control fraction material.

b. Moisture Content Comparison:

1) Optimum moisture content determined by ASTM D 698 (USBR 5500).

2) Difference between optimum moisture and compaction moisture can be measured in accordance with ASTM D 5080 (USBR 7240).

3) Compared to field compaction moisture content with moisture contents determined in accordance with:

a) ASTM D 2216 (USBR 5300), or

b) ASTM D 6938 (USBR 7230). The moisture from the nuclear gage will require corrections for gage error for the specific soils tested and the moisture content of the total material may require adjustment for the control fraction (USBR 7230, Method C; ASTM D 4718), or

c) ASTM D 4959, provided the results have been correlated to ASTM D 2216 (USBR 5300) for specific soil tested.

E. Sand Filter (Zone 3) and Gravel Drain (Zone 4):

1. Add water liberally during compaction, as necessary to achieve required density, since these soils are free-draining.

3.3 PLACEMENT

A. Perform adequate moisture conditioning in a designated stockpile or borrow area prior to hauling material for placement in the embankment.

B. Construct embankment to the lines and grades shown.

C. Overbuild embankment slopes by a sufficient amount to allow full compaction of the horizontal lifts to the design lines, then remove outer material and trim completed embankment to design lines with allowance for topsoil, gravel surfacing, and slope protection, where applicable.

D. Place soils to be compacted in horizontal layers. In any separate work area and fill zone of embankment being constructed, construct each placement lift layer continuously and approximately horizontally for the width and length of such work area. Slope between separate fill areas no steeper than 2 horizontal to 1 vertical (2H:1V), unless otherwise shown or approved by the COR.

E. Place and spread embankment materials in a direction parallel to the dam crest centerline.

F. If necessary, blend materials by disking after placement and prior to compaction so that the compacted fill is homogenous and free from lenses, pockets, streaks, voids, or laminations.

G. Remove and rework by disking and scarifying any smooth hard surfaces and deep ruts in the surface of the fills resulting from passage of construction equipment prior to placing overlying embankment.

H. Maintain placement of Low Permeability Fill (Zone 1) fill 1 to 2 feet above the level of adjacent Embankment Shell Fill (Zone 2), but below the level of adjacent Sand Filter (Zone 3) in the chimney drain.

I. Place in loose lift thickness as described for the specified material in Article 3.04 Compaction.

J. Maintain the embankment, including sloping the surfaces to drain, preventing or repairing gullies, and maintaining surfaces free of weeds or other vegetation until final completion and acceptance of all work.

3.4 COMPACTION

A. Compact material with following methods and techniques appropriate to type of soil.

B. Special Compaction:

1. Compaction close to structures or in confined spaces.
2. Required within 5 feet of outlet conduit and concrete structures, and within 3 feet of inspection wells, piezometer installations, and other pipes.

C. Zone 1 – Low Permeability Soils:

1. Compact with heavy-duty, self-propelled, sheepsfoot or tamping foot rollers capable of kneading material into a uniform embankment. The weight of each roller shall be at least 3,300 pounds per foot of drum length and the feet shall be at

least 7 inches long measured from the drum surface. Rollers shall be free to pivot about an axis parallel to the direction of travel.

a. Uniformly distribute equipment passes.

b. Place in maximum loose lift thickness of 8 inches prior to compaction.

c. Scarify lifts as required for lift bonding.

2. Special compaction: Compact with hand held impact tampers, or small tamping equipment

a. Uniformly distribute effort.

b. Place in maximum loose lift thickness of 6 inches prior to compaction.

3. Density:

a. Percent Compaction

1) Minimum 98 percent, or

2) C- Value and D- Value minimum: 98 percent

3) As determined on portion of soil passing the No. 4 sieve.

D. Zone 2 – Embankment Shell Fill Soils:

1. Compact with heavy-duty, self-propelled, sheepsfoot or tamping foot rollers capable of kneading material into a uniform embankment. The weight of each roller shall be at least 3,300 pounds per foot of drum length and the feet shall be at least 7 inches long measured from the drum surface. Rollers shall be free to pivot about an axis parallel to the direction of travel.

a. Uniformly distribute equipment passes.

b. Place in maximum loose lift thickness of 8 inches prior to compaction.

c. Scarify lifts as required for lift bonding.

2. Special compaction: Compact with hand held impact tampers, or small tamping equipment

a. Uniformly distribute effort.

b. Place in maximum loose lift thickness of 6 inches prior to compaction..

3. Density:

a. Percent Compaction

1) Minimum 94 percent, or

2) C- Value an D- Value minimum: 94 percent

3) As determined on portion of soil passing the No. 4 sieve.

E. Zone 3 and Zone 4 – Sand and Gravel Filter/Drain Soils:

1. Compact with heavy-duty, self-propelled, steel drum vibratory roller. The static weight of the roller shall be at least 8,000 pounds. The vertical applied dynamic force shall be at least 3,000 pounds per foot of drum width when operated between 1,300 and 1,800 vibrations per minute.
    a. Uniformly distribute equipment passes.
    b. Place in maximum loose lift thickness of 12 inches prior to compaction.
2. Special compaction: Compact with hand held vibrating plate tampers having a minimum static weight of 270 pounds and a minimum dynamic force of 1,000 pounds.
    a. Uniformly distribute effort.
    b. Place in maximum loose lift thickness of 6 inches prior to compaction..
3. Density:
    a. As achieved by three coverages of the specified steel drum vibratory roller. Target degree of compaction is between 65 percent and 80 percent relative density. Modify number of coverages of the specified roller as directed by the COR to achieve the target degree of compaction.
    b. Relative density as determined on portion passing the 3-inch control fraction when using ASTM D 4253 and D 4254.

F. Granular Soils Containing Some Silt and Clay (Structural Backfill):

1. Compact in accordance with either procedure above in a lift thickness which can achieve density requirement.
2. Density:
    a. Percent Compaction, minimum: 98 percent.
    b. D-value minimum: 98 percent

G. Adjustment:

1. Silty and clayey soils containing more than 20 percent oversize particles: Required D-value or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 3 in USBR Guidelines for Earthwork Construction Control Testing of Gravelly Soils.

3.5 MEASURE OF COMPACTION

A. Methods for determining the unit weight of soils in-place:

1. ASTM D 1556 (USBR 7205), or
2. ASTM D 4914 (USBR 7220), or
3. ASTM D 5030 (USBR 7221), or
4. ASTM D 5080 (USBR 7240)

5. ASTM D 6938 (USBR 7230).

6. In-place dry density unit weight of the control fraction determined by oversized particles, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (USBR 7205).

3.6 FIELD QUALITY ASSURANCE

A. Testing:

1. The COR will perform tests as required to verify that type of soil used, placement of soil, and compaction of soil conform to contract requirements.

2. Notify the Government 24 hours before compaction work begins and 24 hours before significant change in compaction operations (major change in equipment or procedure used).

3. Notify the Government immediately of equipment change due to breakdown, or re-deployment.

4. Quality assurance testing does not relieve Contractor of his responsibility to perform quality control testing for management and control of the work.

B. Testing Frequency:

1. Frequency of testing is at discretion of the COR.

2. After a successful work operation pattern is established, testing frequency is normally performed at these minimum guidelines.

   a. At least one test for each shift for each compaction operation.

   b. Compacted embankment: One test for every 2,500 yd^3.

   c. Compacted structural backfill: One test for every 250 yd^3.

   d. Additional tests may be performed at sites considered questionable by a COR Inspector; such as suspected incomplete compaction, surfaces that may have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.

C. Tests:

1. Standards listed in Table 31 23 02A - Standard Used for Testing, will be used by the COR for testing compacted soil for conformance with specification requirements. Substitution or modification of standards shall be done only with concurrence of all parties.

Table 31 23 02A - Standard Used For Testing

PROCEDURE	STANDARD NO.

Table 31 23 02A - Standard Used For Testing

PROCEDURE	STANDARD NO.
Soil Classification	ASTM D 2487 (USBR 5000) ASTM D 2488 (USBR 5005)
Gradation Analysis	ASTM D 422 (USBR 5325, 5330, 5335)
Atterberg Limits	ASTM D 4318 (USBR 5350, 5355, 5360)
Moisture Content	ASTM D 2216 (USBR 5300) ASTM D 6938 (USBR 7230)
Relative Density of Cohesionless Soils	ASTM D 4253 and ASTM D 4254 (USBR 5525, 5530, and 7250)
In-Place Density: Sand Cone Test Pits Sleeve Nuclear	 ASTM D 1556 (USBR 7205) ASTM D 4914 (USBR 7220) ASTM D 5030 (USBR 7221) ASTM D 6938
Rapid Construction Control	ASTM D 5080 (USBR 7240)
Laboratory Maximum Density of Granular soils containing Silty or Clayey Fines	ASTM D 7382
Laboratory Maximum Density	ASTM D 698, Procedure A (USBR 5500)

D. Contractor Support:

1. Provide timely access to areas for density testing and excavate and level an area in compacted material to provide a surface for testing.
    a. Fills compacted by sheepsfoot rollers are normally tested one or two lifts below surface.
2. When density is being measured by a sand-cone device (ASTM D 1556, USBR 7205), cease construction activity in immediate vicinity of testing.
3. Dig test pits as requested by COR to examine compacted soil. Backfill test pits to original requirements.

4. Provide warning lights, flags, or other safety devices as needed by testing personnel.
5. Provide adequate lighting for performing tests if required because of darkness.

END OF SECTION

SECTION 31 23 21

EXCAVATION FOR DAM EMBANKMENT AND STRUCTURE FOUNDATIONS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Excavation for Dam Embankment:

1. Measurement: Volume measured in excavation will be made to lines shown on the drawings or as directed by COR.
    a. Does not include volume of materials removed in stripping.
    b. Includes excavating existing embankment fill, riprap and alluvium.
    c. Includes excavating reservoir sediment for detour road, existing intake structure excavation, and colluvium/alluvium.
    d. Includes excavation and disposal of existing gabions.
    e. Excavation of the existing dam embankment as shown in the drawings will be measured on a cubic yard basis.
2. Payment:
    a. Excavation and hauling of existing dam embankment to stockpiles is by the cubic yard price offered in the Schedule for Remove Existing Dam to Stockpile.
        1) Includes cost of excavating, hauling, stockpiling separately for each material type, and disposing unsuitable materials.
        2) Includes excavation and removal of existing toe drains, piezometers, and gabions.
    b. Payment for additional excavation directed by COR and replacement or refill of additional excavation will be made in accordance with applicable sections of these specifications.
    c. No payment will be made for overexcavation and replacement or refill of overexcavation beyond approved excavation lines.

B. Excavation for Structure Foundations:

1. Measurement: Volume measured in excavation will be made to lines shown on the drawings or as directed by COR.
    a. Includes excavating rock for dam embankment.
    b. Includes excavating rock for intake tower structure, stilling basin, ductile iron pipe, spillway culvert foundations, and spillway channel deepening.
    c. Structural excavation as shown in the drawings will be measured on a cubic yard basis.

2. Payment:

   a. Excavation and hauling of rock material is by the cubic yard price offered in the Schedule for Excavate for Structures.

   b. Excavation for other items is incidental to those items of Work and includes cost of excavating, hauling, stockpiling separately for each material type, and disposing unsuitable materials.

   c. Payment for additional excavation directed by COR and replacement or refill of additional excavation will be made in accordance with applicable sections of these specifications.

   d. No payment will be made for overexcavation and replacement or refill of overexcavation beyond approved excavation lines.

1.2 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines. Includes removal of foundation damaged by the Contractor.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 23 21-1, Excavation Plan:

1. Describe equipment, schedule, sequence, and methods for each excavation area. Describe rock excavation method(s) that will achieve the required grades or excavation limits. Describe methods for maintaining stable excavation slopes. Describe all excavation, temporary shoring, dewatering and unwatering methods.
2. Include materials distribution chart with anticipated production rates.
3. Include haul traffic plans.

1.4 PROJECT CONDITIONS

A. Refer to Section 53 10 00 – Geologic Investigations.

B. Accomplish excavation of existing embankment, riprap, colluvial and alluvial foundation materials and rock by common methods with heavy duty construction equipment.

C. Excavation lines shown on drawings are subject to changes as determined necessary by the COR to adapt foundation excavation to conditions exposed by the excavation.

D. Groundwater will likely be encountered in the dam and intake structure foundation excavations. Soils exposed in excavations may contain excessive moisture which could

result in difficulties when placing embankment or structure backfill. It is anticipated that dewatering and unwatering will be required to allow work to progress. Remove and control water in accordance with Section 31 03 33 – Removal of Water From Excavations.

E. Demolish existing shallow monitoring wells in the dam embankment and remove for disposal.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Clear, grub and strip excavation surfaces in accordance with Sections 03 11 00 – Clearing and Grubbing.

3.2 EXCAVATION

A. Excavate the existing dam embankment completely within the limits shown.

B. Excavate to expose top of rock within the foundation limits of the dam and excavate into rock for the key trench, intake tower foundation, and outlet conduit trench. Outside the foundation limits of the dam excavate into rock for the energy dissipation structure, outlet discharge channel, and spillway channel excavation including excavation for box culverts in the spillway.

1. Excavations in the bedrock materials should be possible using conventional earth-moving equipment, including hydraulic hoe-ram hammers. Ripping is not recommended. Blasting is not allowed. Excavation slopes should be 0.5H:1V or flatter.

C. Excavate foundations for the intake structure and, stilling basin.

D. Do not excavate beyond depths shown on drawings unless directed by COR.

E. Remove existing shallow monitoring wells in excavated areas. Dispose of monitoring well materials in accordance with Section 01 74 00 - Cleaning and Waste Management.

F. Excavate existing gabions as directed by COR.

1. Stockpile rock at locations directed by COR.
2. Dispose of gabion baskets in accordance with Section 01 74 00 - Cleaning and Waste Management.

G. Remove existing toe drain pipes

1. Dispose of toe drain pipes in accordance with Section 01 74 00 - Cleaning and Waste Management.

H. Excavation slopes shall conform to the specified lines shown on the drawings.

I. Sloped excavations shall conform to applicable OSHA regulations, and be safe for workers.

1. Do not excavate beyond horizontal limits or depths shown on drawings unless directed by COR.

J. Dewater, and remove and control water in accordance with Section 31 03 33 –Removal of Water From Excavations.

K. Stockpile suitable excavated materials separately for each embankment zone for potential reuse in the work, subject to approval of COR.

3.3 PROTECTION

A. Provide temporary work, such as water removal and control systems and shoring, to maintain excavations during construction operations.

1. Temporary shoring and dewatering and unwatering methods may be required for the intake structure, outlet dissipation structure, outlet channel excavation, and the reservoir sediment slope cut.

B. Protect final surfaces from freezing.

1. Remove frozen materials and replace with suitable materials at Contractor's expense.

3.4 STOCKPILING MATERIALS

A. As excavation progresses, COR will sample and test materials for suitability for potential reuse as dam embankment materials.

1. Place materials determined by COR to be suitable for dam embankment or other backfill materials in separate stockpiles in the borrow area as directed by COR. In general, place material from the upstream and downstream shell of the existing dam in a stockpile for potential re-use as Zone 2 material and place material from the core of the existing dam in a stockpile for potential re-use as Zone 1 material.

2. Suitable material that has excess moisture content shall be stockpiled separately and processed to meet the standards specified for moisture content in Section 31 23 02 – Compacting Earth Materials.

3. Stockpiled materials excavated from structure foundations should be placed no closer than 10 feet from the top of the excavation slope.

4. Locate stockpiles to not interfere with borrow excavation or other construction operations.

3.5 FOUNDATION PREPARATION FOR INSPECTION

A. Rock surfaces: Clean foundation surfaces for inspection by COR after excavation has been completed to specified lines, grades, and dimensions shown on the drawings. All excavated rock surfaces shall be cleaned by air jet, water jet, a combination of both, brooming, and hand removal as directed by the COR to achieve the desired results. Only the minimum amount of air or water pressure required to achieve the desired results as directed by the COR is allowed. Desired results equal clean, sound foundation. Clean foundation surfaces to remove all slaked materials, loose or sloughed material, sediments, other loose materials, and other areas as directed by the COR. Remove unconsolidated or highly weathered or fractured portions of formation, as directed by the COR.

B. Excavated embankment and alluvium surfaces: Once lines and grades have been reached, remove loose debris or oversized material for inspection by COR prior to placement of new fill materials.

3.6 FOUNDATION INSPECTIONS

A. Inspection will be performed by the COR to obtain geologic record of the foundation surfaces and cut slopes.

B. Provide safe access for COR personnel during inspection.

C. Notify COR at least 3 working days prior to reaching final excavation elevation for each exposed portion of the embankment foundation. Allow 3 days for the COR to complete its inspection.

D. Do not operate equipment in area being inspected until inspection and survey are complete.

3.7 FOUNDATION TREATMENT

A. Rock surfaces: Excavated rock surfaces at the base and abutments of the dam embankment excavation shall receive foundation treatment including slush grouting and/or dental concrete as needed. The slush grout and dental concrete foundation treatment shall extend over the area shown or as directed by the COR.

1. Prior to application of any foundation treatment, the foundation surface shall be cleaned in accordance with section 3.05 above, inspected and approved by the COR for the Contractor to perform the specified foundation treatment.

2. Foundation treatment includes cleaning out fractures and placing slush grout in accordance with Section 03 37 52 – Slush Grouting, in selected open fractures and any fractures that are cleaned out. Areas of intensely to very intensely fractured rock, or large open fractures, or concentrated zones of highly fractured rock may

require foundation treatment by excavation and replacement with dental concrete in accordance with Section 03 37 55 – Dental Concrete.

3. Additionally, the COR will evaluate the need for additional excavation zones of decomposed or broken rock. Overhangs shall be shaped, either by removal or filling with dental concrete as approved by the COR.

4. Exposed rock surfaces outside the limits of the slush grout and dental concrete foundation treatment shall be cleaned only with the foundation preparation procedures described in section 3.05 above or as directed by the COR.

3.8 FOUNDATION SURFACE PREPARATION

A. Maintain all foundation surfaces in a clean condition and free of standing water. Final foundation clean up shall include the removal of all unsuitable material as directed by the COR.

B. Rock surfaces: Clean exposed rock surfaces immediately prior to placing the first lift of embankment:

1. The dam foundation surface shall be approved by the COR prior to placing embankment materials.

2. Final cleanup procedures shall be subject to COR approval.

3. Place fill onto the surface within a day of final cleanup.

4. Equipment traffic on the final approved surface shall be minimal. If equipment traffic damages an approved surface the COR will direct the Contractor to perform additional cleanup.

C. Exposed slopes of excavations in the existing dam embankment and alluvium surfaces shall be scarified to a minimum depth of 8 inches, moistened and compacted before placing adjacent or overlying materials. Any cracks or voids should be excavated and/or backfilled as directed by the COR.

D. Equipment traffic on the final approved excavation surface shall be minimal. If equipment traffic damages or ruts an approved surface the COR will direct overexcavation to firm in-place soils or to a depth of 2 feet, whichever is less. Disturbed soils will be identified by the COR and/or Construction Manager once the excavation is complete. Overexcavations should be backfilled with the material required for the overlying fill.

E. Place Sand Filter or embankment fill onto the prepared surface within one day of foundation preparation.

3.9 DISPOSAL

A. Dispose of excavated materials which are determined by the COR to not meet specifications for use in the embankment or fills, or which are determined by the COR to

be excess material, in accordance with Section 31 23 39 – Disposal of Excavated Materials.

END OF SECTION

This page intentionally left blank.

SECTION 31 23 23
EXCAVATION FROM BORROW

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Schedule for Furnish and Place Zone 1 Core, Furnish and Place Zone 2 Shell, and Furnish and Place Type 1 Riprap.

1.2 PROJECT CONDITIONS

A. Coordinate excavation and use of materials from borrow area as described in Section 31 24 10 - Embankment Fill. Obtain materials required to construct dam embankment from borrow areas shown on drawings.

B. COR will designate locations within borrow areas from which materials shall be removed.

C. Refer to Section 53 10 00 – Geologic Investigations for descriptions of borrow area material.

D. Establish and maintain haul road to access borrow area.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXCAVATION

A. Coordinate opening and processing of portions of borrow areas to deliver material timely for scheduled placement in the embankment. Do not open portions of borrow areas if the material will not be used in the scheduled construction season.

B. Excavate additional materials required to complete dam embankment, road fills or grading from borrow area shown on the drawings. During excavation of borrow area, selectively excavate materials unsuitable for use as dam embankment fill.

1. Refer to Section 53 10 00 – Geologic Investigations for descriptions of materials.
2. Place unsuitable materials in separate stockpile within borrow area at location directed by COR.

C. Do not operate outside of borrow area boundaries shown on the drawings.

D. Clear, grub and strip borrow area to be excavated and area where stockpile is to be located.

E. Excavate sufficient material from borrow area to complete required work.

F. Excavate side slopes of borrow areas at 2H:1V, or flatter.

3.2 MAINTENANCE

A. When necessary, as determined by COR, drain borrow area by means of open ditches or pumping to prevent accumulation of standing water.

3.3 RESTORATION OF BORROW AREA

A. Replace earth materials not used for dam embankment fill, road fills, or grading in borrow areas A-1, A-2 and A-3.

B. Grade borrow area to even and uniform surfaces in accordance with Section 01 14 10 - Use of Site, and at grades not to exceed pre-excavation elevations.

C. Restore borrow areas A-1, A-2 and A-3 by seeding in accordance with Section 32 92 20 – Seeding and Soil Supplements.

END OF SECTION

SECTION 31 23 39
DISPOSAL OF EXCAVATED MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the applicable schedule for excavation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DISPOSAL OF EXCAVATED MATERIALS

A. Waste material from required excavation which is not suitable or required for backfill, embankment, grading, and topsoil.

B. Waste excavated materials in borrow areas A-1, A-2 and A-3 or as directed by the COR such that deposited materials do not interfere with construction and borrow operations.

C. Do not waste material by dumping from top of slope.

D. Grade waste banks to reasonably even and uniform surfaces that blend with natural terrain.

1. Minimum slope: 2 percent.
2. Maximum slope: 3H:1V.

E. Leave surface in a condition that will facilitate natural revegetation. Seed surface in accordance with Section 32 92 20 - Seeding and Soil Supplements.

END OF SECTION

This page intentionally left blank.

SECTION 31 24 00

EMBANKMENTS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Measurement Procedure:

1. Measurement for the various zones of embankment compacted in-place will be made to lines shown on the drawings or as directed by COR.
2. Survey embankment foundations, placed drainage layer surfaces and completed embankment surfaces; compute quantities of in place embankment placed using surveys and neatline templates.
3. No allowance for shrinkage, settlement, or consolidation.
4. Volume of structures and pipe will be deducted.

B. Payment Procedure:

1. For various items of embankment shall include the following costs:
   a. Preparing foundations for inspection including cleaning, but not including slush grout, dental concrete, and foundation grouting.
   b. Preparing foundations prior to placing embankment materials.
   c. Scarifying, moistening, and compacting foundations.
   d. Preparing bonding surfaces.
   e. Furnishing material from commercial sources or construction processing plants.
   f. Moistening or drying as required, mixing, placing, and compacting embankment materials.
   g. Loading and transportation of materials from borrow to stockpiles.
   h. Loading and transportation of materials from stockpiles and borrow to the embankment.
   i. Placement and compaction of the embankment materials.

1.2 DEFINITIONS

A. Embankment:

1. Embankment Fill, see Section 31 24 10 – Embankment Fill.
2. Sand Filter Material, see Section 31 24 12 – Sand Filter.
3. Gravel Drain Material, see Section 31 24 16 –Gravel Drain.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 31 24 00-1, Embankment Construction Plan:

1. Describe equipment, schedule, sequence, and methods.
2. Include materials distribution chart with anticipated production rates.
3. Include haul route plans.
4. Include proposed distribution of materials in stockpile areas.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle, load, haul, stockpile and place materials in a manner that minimizes segregation and breakdown.

B. Prevent contamination with soil or vegetative matter.

C. If materials are stockpiled on site, clear stockpile areas prior to stockpiling.

D. Protect stockpiled materials from erosion.

1.5 PROJECT CONDITIONS

A. Prevent contamination of embankment zones to ensure that these zones perform as designed.

B. Take all practical measures to ensure that the sand filter material, and the gravel drain material do not become contaminated with fines.

1. Controlling surface runoff, careful attention to haul patterns and crossing areas, protection during shutdown periods, and keeping zones higher than the surrounding earthfill are examples of sound measures to help minimize contamination.

C. Protect sand filter material and gravel drain material from contamination in a manner approved by COR at equipment crossings,. Remove sand filter and gravel drain material that becomes contaminated and dispose as a waste material.

D. Remove all materials used to protect the embankment materials before resuming placement of sand filter material and gravel drain material at equipment crossings or after shutdown. If the materials are contaminated or otherwise harmed, restore them to satisfactory state at Contractor's expense.

E. Earthfill material used for temporary protection may be reused for performing other embankment work at the Contractor's option if the material is suitable for such use.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Clear, grub, and strip as required.

B. Control water in all excavations before placing materials.

3.2 PLACING AND COMPACTING

A. Do not place material until foundation has been inspected and approved by the COR.

B. Place soils to be compacted in horizontal layers.

C. Maintain elevation of embankment on each side of structures within 1 foot of each other.

D. No longitudinal bearing surfaces steeper than 2H:1V.

E. Transverse bonding surfaces in any embankment zone above original ground surface shall be allowed as long as they are no steeper than 4H:1V.

F. Each layer of each material shall be constructed continuously and approximately horizontal for the width and length of the layer.

G. All placement and compaction operations adjacent to geosynthetics shall be carefully conducted so that no damage to geosynthetics occurs.

H. Where exposed, protect all compacted sand filter and gravel drain materials from erosion, excessive saturation, and contamination with other soil materials.

I. Provide temporary construction as necessary to protect exposed sand filter and gravel drain materials from surface drainage.

J. Place soil materials by methods that prevent contamination and segregation.

K. Blend Embankment Fill so that the compacted fill is homogeneous and free from lenses, pockets, streaks, voids, laminations, or other imperfections.

L. Rework materials not meeting specified gradation, moisture content, and density requirements until approved results are obtained.

M. Reworking may include removal, re-handling, re-conditioning, reprocessing, re-placing, re-compacting, or combinations of these procedures.

N. No additional compensation is due to the Contractor for reworking materials.

O. Any zones of segregation will be replaced or otherwise mitigated to COR approval.

3.3 SPECIAL COMPACTION

A. Perform special compaction in areas within 5 feet of concrete structures, unless otherwise specified.

B. Perform special compaction within 2 feet of toe drain pipe and in areas not applicable to large equipment operation, as approved by the COR.

C. Use mechanical tampers, vibratory plate compactors, hand-held equipment, or other approved compaction methods appropriate for the soil requiring compaction.

D. Meet density requirements for respective earthfill material.

END OF SECTION

SECTION 31 24 10
EMBANKMENT FILL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Embankment Fill:

1. Measurement: Volume as specified for measurement procedures in Section - 31 24 00 Embankments.

2. Payment: Cubic yard price offered in Schedule for Furnish and Place Zone 1 Core, Furnish and Place Zone 2 Shell, Furnish and Place Zone 3 Sand Filter, Furnish and Place Zone 4 Gravel Drain, and Furnish and Place Type 1 Riprap in accordance with payment procedures in Section - 31 24 00 Embankments.

PART 2 PRODUCTS

2.01 EMBANKMENT FILL

A. SOURCES:

1. Use suitable materials excavated from existing dam embankment. Obtain additional materials required to complete Embankment Fill from borrow area in accordance with Section 31 23 23 - Excavation from Borrow.

B. LOW PERMEABILITY FILL (ZONE 1)

1. Low Permeability Fill (Zone 1) shall be material from the stockpiled low permeability core material excavated from the existing dam or fat clay (CH) from Borrow Area A-1. Use stockpiled low permeability core material excavated from the existing dam first and, if there is insufficient quantity of material in the stockpile, supplement with material from Borrow Area A-1 that meets the requirements. In the event Borrow Area A-1 is depleted of suitable material before construction of the embankment Zone 1 is complete, expansion into Borrow Area A-3 will be allowed.

2. Select or processed borrow consisting of fat clay with occasional lean clay.

3. Maximum particle size of 1 inch.

4. Minimum fines content of 55 percent.

5. Minimum plasticity index of 15.

6. Allowable Unified Soil Classification System (USCS) classifications: CH and CL.

7. Free of deleterious materials.

8. Process materials from stockpiles and borrow areas as necessary to meet specified fill material requirements.

9. Blend adequately during placement such that the compacted Zone 1 material forms a uniform, homogeneous, and relatively impervious compacted embankment fill.

C. EMBANKMENT SHELL FILL (ZONE 2)

1. Embankment Shell Fill (Zone 2) shall be stockpiled shell material from the existing dam or lean clay (CL) from Borrow Area A-2. Use stockpiled shell material excavated from the existing dam first and, if there is insufficient quantity of material in the stockpile, supplement with material from Borrow Area A-2 that meets the requirements. In the event Borrow Area A-2 is depleted of suitable material before construction of the embankment Zone 2 is complete, expansion into Borrow Area A-3 will be allowed.

2. Embankment Shell Fill (Zone 2) shall be material from the stockpiles or borrow areas that meets the requirements for Zone 2, does not meet the requirements for Zones 1, or is excess material that does meet the requirements for Zone 1.

3. Maximum particle size of 3 inches.

4. Minimum fines content of 55 percent.

5. Minimum plasticity index of 12.

6. Allowable Unified Soil Classification System (USCS) classifications: CL.

7. Free of deleterious materials.

8. Wet alluvium excavated from the dam foundation that is processed by drying and disking to meet the required moisture content may be used as Zone 2 fill within the downstream embankment shell at a minimum offset distance of 30 feet from dam centerline.

9. Process materials from stockpiles and borrow areas as necessary to meet specified fill material requirements.

10. Blend adequately during placement such that the compacted Zone 2 material forms a uniform, homogeneous, compacted embankment fill.

D. SAND FILTER (ZONE 3)

1. As specified in Section 31 24 12 - Sand Filter.

E. GRAVEL DRAIN (ZONE 4)

1. As specified in Section 31 24 16 - Gravel Drain.

F. Process excavated and borrow materials to meet specified requirements.

PART 3 EXECUTION

3.1 COMPACTION EQUIPMENT

A. Self propelled tamping roller or sheepsfoot roller compactor, single or dual drum.

B. Smooth rollers will not be allowed.

C. Small rollers are required for special compaction within five feet of structures and in tight, restricted, or steep areas not accessible by larger rollers.

D. Equipment for special compaction shall be approved by the COR.

3.2 PREPARATION OF FOUNDATION

A. Conform to applicable requirements of Section 31 23 21 – Excavation for Dam Embankments and Structural Foundations and Section 31 24 00 - Embankments.

3.3 MOISTURE CONTROL

A. Conform to applicable requirements of Section 31 23 02 - Compacting Earth Materials.

3.4 PLACING

A. Place material to the lines, grades, and dimensions shown on the drawings.

B. Place in continuous, approximately horizontal layers not to exceed 8 inch loose lifts with self-propelled equipment, and 6 inch loose lifts where special compaction is used.

C. Place any layer or zone in a monolithic fashion such that the top surface elevation of that layer/zone is not higher than adjacent layer/zone and no lower than 12 inches below elevation of adjacent embankment.

D. Rework and/or remove previously placed materials that have become soft or loose, which contain erosion channels or cracks, are excessively dry or wet, or have frozen prior to placing additional material.

3.5 REQUIRED COMPACTION

A. Conform to applicable parts of Section – 31 23 02 Compacting Earth Materials.

B. Perform special compaction of materials within 5 feet of structures and within 3 feet of pipes.

3.6 PROTECTION

A. Protect material from erosion and contamination.

END OF SECTION

SECTION 31 24 12
SAND FILTER

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Sand Filter:

1. Measurement: Volume as specified for measurement procedures in Section - 31 24 00 Embankments.

2. Payment: Cubic yard price offered in Schedule in accordance with payment procedures in Section - 31 24 00 Embankments.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM C 33 /C 33M-11 Concrete Aggregates

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 31 24 12-1, Certification and Laboratory Test Results:

1. Certification and laboratory test results demonstrating filter material meets concrete hardness and durability requirements of ASTM C 33 and specified gradation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle, load, haul, stockpile, and place materials to minimize segregation, contamination, and breakdown.

B. Prevent contamination with soil or vegetative material.

C. When stockpiling material on site, whether temporary or permanent stockpile, clear and strip stockpile areas prior to stockpiling.

PART 2 PRODUCTS

2.01 SAND FILTER MATERIAL

A. Provide from an off-site commercial quarry source.

B. Well-graded mixture conforming to ASTM C 33, fine aggregate, except meet gradation requirements specified in Table 31 24 12A - Sand Filter Material Gradation. Material shall meet specified gradation requirements after placement and compaction.

Table 31 24 12A - Sand Filter Material Gradation

U.S. Standard Sieve Size	Percent Passing by Weight
3/4-inch	100 – 100
3/8-inch	95 – 100
No. 4	85 – 100
No. 8	65 – 90
No. 16	40 – 70
No. 30	20 – 40
No. 50	0 – 15
No. 100	0 – 4
No. 200	0 – 2*

*Non-plastic fines.

PART 3 EXECUTION

3.1 COMPACTION EQUIPMENT

A. Compaction equipment: In accordance with Section 31 23 02 - Compacting Earth Materials.

B. Small walk-behind rollers or tampers will be required for special compaction of sand filter material around toe drains.

3.2 PREPARATION OF FOUNDATION

A. Control water in all excavations before placing materials in accordance with Section – 31 03 33 Removal of Water from Excavations.

B. Prevent materials from contaminating the Sand Filter or the dam embankment materials.

C. Do not allow sloughing of any materials from excavated surfaces onto the sand filter material to minimize contamination.

D. Compact surface of soil foundation prior to placement of initial lift of sand filter material.

3.3 PLACING

A. Place in continuous, approximately horizontal layers not to exceed 12 inch loose lifts, and 6 inch loose lifts where special compaction is used.

B. Thoroughly wet the sand filter material immediately before compaction as needed to meet required densities.

C. Place material to the lines, grades, and dimensions shown on the drawings.

D. Prevent segregation, contamination, over compaction, or breakdown of materials.

3.4 REQUIRED COMPACTION

A. Conform to applicable parts of Section 31 23 02 - Compacting Earth Materials.

B. Uniformly distribute effort. Do not overcompact.

C. At start of work, determine compactive effort, with the equipment to be used, to achieve the minimum relative density.

D. Minimum: 65 percent relative density.

E. Maximum: 80 percent relative density.

F. Use special compaction methods for compacting sand filter material adjacent to structures, inspection wells, and toe drain gravel envelope.

3.5 PROTECTION

A. Protect material from erosion, contamination, excessive saturation, and surface drainage.

END OF SECTION

This page intentionally left blank.

SECTION 31 24 16
GRAVEL DRAIN

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Gravel Drain:

1. Measurement: Volume as specified for measurement procedures in Section 31 24 00 - Embankments.

2. Payment: Cubic yard price offered in Schedule in accordance with payment procedures in Section 31 24 00 - Embankments.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM C 33 /C 33M-11 Concrete Aggregates

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 31 24 16-1, Certification and Laboratory Test Results:

1. Certification and laboratory test results demonstrating gravel drain material meets concrete aggregate hardness, durability, and gradation requirements of ASTM C 33.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle, load, haul, stockpile, and place materials to minimize segregation, contamination, and breakdown.

B. Prevent contamination with soil or organic material.

C. When stockpiling material on site, whether temporary or permanent stockpile, clear and strip stockpile areas prior to stockpiling.

PART 2 PRODUCTS

2.1 GRAVEL DRAIN MATERIAL

A. Provide from off-site commercial source.

B. Hardness and Durability: ASTM C 33.

C. Well-graded mixture of sand and gravel conforming to ASTM C 33, Coarse Aggregate gradation No. 8.

2.2 GRADATIONS

A. Gradations are shown in Table 31 24 16A - Gradation Requirements for Gravel Drain Material.

B. Material shall meet the gradation requirements of Table 31 24 16A - Gravel Drain Material Gradation Requirements after placement and compaction.

Table 31 24 16A - Gravel Drain Material

U.S. Standard Sieve Size	Percent Passing by Weight
	No. 8
1/2-inch	100
3/8-inch	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

PART 3 EXECUTION

3.1 COMPACTION EQUIPMENT

A. Compaction Equipment: In accordance with Section 31 23 02 - Compacting Earth Materials.

B. Small walk-behind rollers and tampers will be required for special compaction of gravel drain material around toe drain pipes.

3.2 PREPARATION OF FOUNDATION

A. Control water in all excavations before placing materials in accordance with Section – 31 03 33 Removal of Water from Excavations.

B. Do not allow sloughing of any materials from excavated surfaces onto the gravel drain material to minimize contamination.

C. Compact surface of sand blanket prior to placement of initial lift of gravel drain material.

3.3 PLACING

A. Place in continuous, approximately horizontal layers not to exceed 12 inch loose lifts, and 6 inch loose lifts where special compaction is used.

B. Thoroughly wet gravel drain material immediately before compaction.

C. Place material to the lines, grades, and dimensions shown on the drawings.

D. Minimize persons working and equipment travel on gravel drain material to prevent segregation, contamination, or breakdown of materials.

3.4 REQUIRED COMPACTION

A. Conform to applicable parts of Section 31 23 02 - Compacting Earth Materials.

B. Uniformly distribute effort.

C. Minimum: 65 percent relative density.

D. Maximum: 80 percent relative density.

3.5 PROTECTION

A. Protect material from erosion, contamination, excessive saturation, and surface drainage.

END OF SECTION

This page intentionally left blank.

SECTION 31 25 00
GEOTECHNICAL INSTRUMENTATION

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. The work described in this Specification includes the following general items of work:

1. Embankment and reservoir instrumentation.

2. Miscellaneous measurement, temporary construction, and control instrumentation.

B. Payment: The lump sum price for Geotechnical Instrumentation included in the bid schedule and in accordance with the drawings and specifications.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:
1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

1.03 DEFINITIONS

A. Performance Testing – initial connection, programming, testing, troubleshooting, reading, and calibration of an instrument or system as necessary to ensure that the instrument/system is functioning within expected parameters and to the desired accuracy.

B. Initial Reading – first recorded reading of an instrument/system following performance testing.

C. Geotechnical Instruments – inclinometers, open standpipe piezometers (permanent and temporary), and survey monuments.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00.

B. RSN 31 25 00-1, Shop Drawings

1. Drawings for V-notch weir plates.
   a. Submit prior to manufacturing

2. Instrumentation Plan

   a. Include:

      1) Procedures for installation, performances testing, and initial instrument reading or each type of instrument;

      2) Sequence of installation and coordination with other Work;

      3) Proposed methods to protect installed instruments from damage;

      4) Layout drawings showing locations of instruments, routing of cable conduits, and instrument installation details;

      5) Copies of proposed quality control forms for documenting instrument installation;

      6) Schedule for instrument installation performance testing and initial instrument reading;

      7) Instrument manufacturers' literature including catalog cut sheets, installation directions, operations and maintenance manuals and pamphlets, and warranty information for all instruments.

      8) Drilling procedures for piezometers and inclinometers.

   b. Submit at least 5 calendar days prior to installation.

C. RSN 31 25 00-2, Administrative

1. Geotechnical Instrumentation Log

   a. Log documenting installation of all geotechnical instrumentation, to include:

      1) Geotechnical boring logs of all drilled instrument borings;

         A list of geotechnical instruments installed with installation notes, performance testing notes, and initial readings for each instrument; and Drawings showing surveyed locations and elevations of geotechnical instruments and cable runs.

   b. Submit within 14 days following completion of each instrument installation.

2. Survey

   a. Submit staff gage survey results no later than 10 days following staff gage installation.

   b. Submit quality control survey results for the new permanent survey monuments, structural monitoring points, and embankment station markers no later than 5 days following installation of said items.

D. RSN 31 25 00-3, Quality Control
   1. Statements of Qualifications:
      a. Submit for:
         1) Driller
         2) Geotechnical Instrumentation Consultant
         3) Surveyor (if different from surveyor represented in Section 01 72 20- Surveying)
      b. Submit prior to person or entity arrival on Site.

1.5 QUALIFICATIONS

A. Driller
   1. Successful completion of at least three drilling and instrument installation projects of similar size and scope within the last 5 years.
   2. Current licensure in the State of Arizona.

B. Geotechnical Instrumentation Consultant
   1. Registered professional engineer in the State of Arizona
   2. At least 5 years of experience in installing and monitoring similar geotechnical instruments on projects of similar size and scope.

C. Surveyor
   1. As specified in Section 01 72 20- Surveying.

1.06 EQUIPMENT MANUFACTURERS

A. NEMA - NEMA Enclosures Manufacturing Corp., 1118 Pleasantville Dr, Houston, TX 77029. Manufacturer of electronics enclosures.

B. Slope Indicator- Slope Indicator, Inc., 12123 Harbour Reach Dr., Mukilteo, WA 98275, (425) 493-6200. Manufacturer of geotechnical instruments.

C. Spears- Spears Manufacturing Company, 4880 Florence Street, Denver, CO (303) 371-9430. Manufacturer of PVC products.

D. Stevens- Stevens Water Monitoring Systems, Inc., 12067 NE Glenn Widing Drive, Suite 106, Portland, OR 97220, (503) 445-8000. Manufacturer of water resources instruments.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate instrumentation installation with embankment, temporary roadway/cofferdam, and concrete placement.

B. Notify COR in writing:

1. At least 14 days prior to start of instrument installation.

C. Make readout boxes and software available to COR to perform readings, as necessary.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide new instruments and equipment.

B. Provide models and manufacturers specified. No "or-equals" or substitutions will be allowed.

2.2 INCLINOMETER

A. Inclinometer casing:

1. Slope Indicator Model 51100 I 00.

B. Casing caps:

1. Slope Indicator Model 51100500.

C. Casing couplings:

1. Slope Indicator Model 51100200.

D. Telescoping sections:

1. Slope Indicator Model 51106400.

E. Grout valve:

1. Slope Indicator Model 51100830.

F. Pop rivets:

1. Slope Indicator Model51103301.

G. Provide one inclinometer probe:

1. Slope Indicator Model 50302500.

H. Sondex rings:

1. Slope Indicator Model 02842004.

I. Protective casing:

1. Galvanized steel conforming with ASTM A53.
2. ANSI Schedule 40.
3. Lockable cover.
4. Provide each casing with a lock. AU casing locks shall be keyed the same.

J. Dummy Probe:

1. Slope Indicator Models 50304800 and 50304900.

2.3 READOUT BOXES AND SOFTWARE

A. Provide one inclinometer readout box:

1. Slope Indicator Model 50310900.

B. Provide one inclinometer software:

1. Slope Indicator Model 50310001.

C. Probes, readout boxes and software shall become the property of OWNER after the initial readings of all instruments are complete.

2.4 STRUCTURAL MONITORING POINTS, PERMANENT SURVEY MONUMENTS, AND EMBANKMENT STATION MARKERS

A. Standard survey brass caps.

B. Inscribe each brass cap with “Tsaile Dam” the survey monument number, and station at the point of survey.

2.5 V-NOTCH WEIRS

A. V -notch weir plate:

1. Fabricated stainless steel conforming to ASTM A240.

B. V-notch Weir Staff Gages

1. Stevens Style C stream gage.
2. 1.06 feet long.
3. Graduated in 0.01-foot intervals and numerically labeled every 0.1 foot.
4. Secure directly to concrete weir box using fasteners recommended by Stevens.

2.6 RESERVOIR STAFF GAGE

A. Stevens Style E stream gage.

B. 29 feet long.

C. Graduated in 0.1-foot intervals.

D. Label every 2 feet with Stevens Style E number plates.

E. Display water surface elevation in feet (1988 NAVD).

F. Label even-numbered (7020, 7022, 7024, etc.) elevations with 2-inch by 3-inch numbers

G. Label every 10-foot elevation (7020, 7030, etc.) with 4-inch by 6-inch numbers.

H. Secure to south edge of the west side of the outlet works tower.

2.7 INSTRUMENT CABLE

A. Furnish each geotechnical instrument with the required length of electrical cable to extend from the instrument to the appropriate datalogger station without splicing.

B. Provide connectors on each end suitable for use with the instruments, and suitable for direct burial.

C. Required cable lengths:

1. General alignment and lengths of the cable/tubing runs for instruments are shown on Drawings.
2. Verify all field alignments and individual cable lengths prior to ordering materials.

D. Prior to shipment, permanently mark each cable with the instrument's identification.

E. Ship each instrument and cable to the field as a unit, with each cable mounted on a reel and mechanically protected against shipping damage. Clearly label each reel with the instrument identification.

F. Electrical Cables

1. Provide one inclinometer cable:
    a. Slope Indicator Model 50601004.
        b. Graduated with marks every 1 foot.
2. Provide one inclinometer cable reel, Slope Indicator Model 50503100.
3. Provide one inclinometer cable pulley assembly, Slope indicator Model 51104606.

G. Furnish splice kits as recommended by instrument manufacturer for each instrument to repair damaged electrical cables as necessary.

2.8 RISER PIPE AND CABLE RACEWAY CONDUIT

A. As specified in Section 26 05 33: Electrical Conduit.

2.9 CEMENT-BENTONITE GROUT MIX (TYPE 1)

A. Type 1 grout shall be a mixture of cement, pulverized bentonite, and water. The cement-bentonite mixture shall contain 10 gallons of water and between 4 and 6 pounds of bentonite for each 94-pound sack of cement. The cement and water shall be mixed first. Then add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being pumpable. The amount of bentonite added will vary depending on the application and desired mixture consistency.

2.10 CEMENT BENTONITE NON-SHRINK GROUT MIX (TYPE 2)

A. Type 2 grout shall be a mixture of cement, pulverized bentonite, and water. The cement-bentonite mixture shall contain 45 gallons of water and between 30 to 40 pounds of bentonite for each 94-pound sack of cement. The cement and water shall be mixed first. Then add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being pumpable. The amount of bentonite added will vary depending on the application and desired mixture consistency.

2.11 BENTONITE PELLETS

A. A naturally occurring clay (Wyoming sodium bentonite) containing no additives.

1. Maximum pellet size of1/4-inch and contain at least 90 percent montmorillonite.

2.12 CONCRETE

A. As specified in Section 03 30 10 - Cast-In-Place Concrete.

2.13 POLYETHYLENE PIPES

B. Non-Slotted PVC Pipe:

1. Pipe Material: Type I, Grade I Polyvinyl Chloride (PVC) compound with Cell Classification of 12454-B per ASTM D1784.
2. Wall Thickness: Dimension ratio of 18.
3. Schedule 80.
4. Color: White.

PART 3 EXECUTION

3.1 GENERAL

A. Install instrumentation, monitoring equipment, and cables in accordance with the manufacturer's written instructions and the approved installation plan.

B. Provide slack in cable to allow for embankment settlement.

C. Coordinate instrument installation with other work.

D. Geotechnical Instrumentation Consultant shall provide full-time supervision of all drilling and logging of borings and installation, performance testing, and initial readings of all geotechnical instruments.

E. Protect instruments and cable runs before, during, and after installation.

1. Repair or replace damaged instruments or cabling to the satisfaction of COR.

3.2 DELIVERY AND STORAGE OF MATERIALS

A. Inspect all instrumentation and cable/tubing upon delivery and verify:

1. Appropriate documentation and packaging
2. Correct make and model
3. All connectors, splice kits, and other required items are included
4. No damage that will impair function

B. Store all electronic equipment, wiring, tubing, and inclinometer casing indoors and away from direct sunlight and moisture until time of installation.

3.3 INSTALLATION PROCEDURES

A. Inclinometers

1. Drilling Procedures

a. Drill settlement inclinometer borings using reverse circulation mud rotary methods.

b. Drilling fluid shall consist of bentonite or synthetic polymers mixed with water to maintain sidewall stability as necessary.

c. Soil sampling in inclinometer borings is not required.

d. Install boring within ± 1.0° from vertical.

e. Verify plumb, boring depth, and minimum diameter by sounding prior to installation of inclinometer casing.

f. After completion of drilling, boring shall be flushed with fluid until relatively free of debris or sediment.

2. Inclinometer Casing Installation

a. Inspect each inclinometer casing section for groove burrs, excessive spiral, or other signs of damage prior to installation.

1) Remove groove burrs.

2) Replace casing sections with spiral in excess of the manufacturer's specified tolerances.

b. Counteract casing buoyancy during installation in accordance with approved installation plan.

1) Weighting or pushing on the top of the casing is not allowed.

c Install inclinometer casing in temperatures between 40°F and 95°F.

d. Shield casing from direct sunlight until immediately prior to installation.

e. Use pipe clamps to hold the casing at the borehole collar during installation.

f. Secure the casing with a safety line at all times.

g. Secure telescoping joints into extended position using pop rivets.

h. Verify correct inclinometer probe tracking:

1) Verify while the casing is fully extended to the specified depth, but prior to grouting.

2) Run a dummy probe down and up both groove pairs.

3) If the dummy probe will not pass along the casing to the specified depth, or if it returns with one or more wheels disengaged from the grooves, adjust or repair the casing until the dummy probe can be completely lowered and raised without hanging up or disengaging.

i. Align casing groves:

1) Align one set of grooves parallel to the centerline of the embankment and the other set perpendicular to the centerline.

2) Verify correct groove alignment by surveying.

3. Grouting
    a. Install grout into the annulus between the casing and the boring.
    b. For inclinometers greater than 150 feet deep, grout in at least two stages to prevent fluid pressure crushing of the casing. Allow a minimum of 24 hours between completion of the first stage and beginning the second stage.
    c. Maximum stage height is 150 feet.
    d. Install grout to the bottom of the boring (or to the top of the previous stage for staged grouting) using grout valves and an external grout or tremie pipe.
    e. Install the steel protective casing.

B. Piezometers

1. Drilling Procedures
    a. Drill piezometer borings using reverse circulation mud rotary methods.
    b. Drilling fluid shall consist of bentonite or synthetic polymers mixed with water to maintain sidewall stability as necessary.
    c. Soil sampling in piezometer borings is not required.
    d. Install boring within ± 1.0° from vertical.
    e. Verify plumb, boring depth, and minimum diameter by sounding prior to installation of piezometer casing.
    f. After completion of drilling, boring shall be flushed with fluid until relatively free of debris or sediment.
2. Piezometer Casing Installation
    a. Inspect each piezometer casing section for signs of damage prior to installation.
    b. Install inclinometer casing in temperatures between 40°F and 95°F.
    c. Shield casing from direct sunlight until immediately prior to installation.
    d. Use pipe clamps to hold the casing at the borehole collar during installation.
    e. Secure the casing with a safety line at all times.
3. Piezometer Construction
    a. Place bentonite chips into the annulus between the casing and the boring at the base of the hole.
    b. Place sand within specified zones 2 feet below the screened interval and 2 feet above the screened interval.
    c. Place bentonite chips into the annulus between the casing and the boring up to the top of the hole.
    d. Install the steel protective casing.

C. Structural Monitoring Points, Permanent Survey Monuments, and Embankment Station Markers

1. Auger holes for monitoring points, survey monuments, and station markers.
2. Set and center rebar and brass cap.
3. Backfill hole with concrete.
4. Vibrate concrete from top to bottom of hole to ensure consolidation.
5. Survey and record the following information:
    a. Point, monument, and station number
    b. Elevation, northing, and easting of each point, monument, and station

D. V-Notch Weirs

1. Install the weir plate into the notch in the weir box.
2. Bolt weir plate to concrete.
3. Secure the staff gage to the weir box.

E. Reservoir Staff Gage

1. Secure the staff gage and elevation plates to the gate tower.
2. Survey the gage to verify actual elevations.
3. Adjust staff gage and elevation plates as necessary to provide elevation accuracy within 0.05-feet.

F. Instrument Electrical Cable

1. Backfill electrical cable trenches in Zone I with Zone 1 fill placed in accordance with Section 31 24 10 - Embankment Fill.
2. Backfill electrical cable trenches outside of Zone 1 with instrument cable backfill placed in accordance with Section 31 24 10 - Embankment Fill.

3.4 PERFORMANCE TESTING, INITIAL READINGS, AND TEMPORARY MONITORING STATIONS

A. It is the intention of COR to begin reading geotechnical instruments as soon as possible following installation.

B. Perform performance testing of each installed geotechnical instrument as soon as practicable following installation.

C. Perform initial reading of each geotechnical instrument after completion of performance testing.

D. Coordinate with COR to schedule each initial reading.

E. Obtain a daily reading of the open standpipe piezometer on the temporary access road/cofferdam upon completion and notify the COR if a water level reading of 7005 or higher is obtained.

F. Coordinate installation and location of temporary monitoring stations with CONTRACTORS schedule, location, and sequence of work.

TABLE 13400-1
ELECTRICAL EQUIPTMENT LIST

Part 4 Instruments					
Instrument	**Manufacturer**	**Quantity**	**Model**	**Operating**	**Drawings Designation**
Inclinometer	Slope Indicator	1	50302500	--	--
Readout Boxes and Software					
Instrument	**Manufacturer**		**Model**	**Hardware Options**	
Inclinometer Readout Box	Slope Indicator	1	50310900		
Inclinometer Software	Slope Indicator	1	50310002		
Casing Electrical Cable					
Hardware	**Manufacturer**	**Estimated Quantity**	**Model**	**Hardware Options**	
Inclinometer Casing	Slope Indicator	70 feet	51150310		

END OF SECTION

This page intentionally left blank.

SECTION 31 32 32
GEOTEXTILE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Geotextile:

1. Cost: Include in prices offered for Furnish and Place Type 1 Riprap, Construct Outlet Works Structures and Relocate and Reconstruct BIA Road 8077.

    a. Includes geotextile placed in anchor trench.

1.2 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 3786/3786M-09	Bursting Strength of Textile Fabrics–Diaphragm Bursting Strength Tester Method
2.	ASTM D 4355-07	Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
3.	ASTM D 4491-99a(2009)	Water Permeability of Geotextiles by Permittivity
4.	ASTM D 4533-04(2009)	Trapezoid Tearing Strength of Geotextiles
5.	ASTM D 4632-08	Grab Breaking Load and Elongation of Geotextiles
6.	ASTM D 4751-04	Determining Apparent Opening Size of a Geotextile
7.	ASTM D 4833-07	Index Puncture Resistance of Geomembranes and Related Products
8.	ASTM D 5261-10	Measuring Mass per Unit Area of Geotextiles

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals

B. RSN 31 32 32-1, Certifications and Data:

1. Geotextile certification:

    a. Manufacturer’s certification that geotextile meets specified chemical, physical, and manufacturing requirements.

2. Protection methods:

    a. Methods to protect exposed geotextile, when covering is not possible within 14 days.

3. For sewn seams, if used:

a. Certification stating that polymeric threads to be used for sewing have chemical resistance properties equal to or exceeding those of geotextile.

b. Include data showing that sewn seams have tensile strength of not less than specified percent of parent geotextile material.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Wrap geotextile rolls in relatively impermeable and opaque protective covers.

B. Mark or tag geotextile rolls with manufacturer's name, product identification, lot number, roll number, and roll dimensions.

C. Mark with special handling requirements such as "This Side Up" or "This Side Against Soil to be Retained."

D. Protect geotextile from ultraviolet light exposure, temperatures greater than 140 degrees F (60 degrees C), precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions.

E. Elevate and cover material stored outside with waterproof membrane.

PART 2 PRODUCTS

2.1 GEOTEXTILES

A. Needle-punched, nonwoven geotextile comprised of long-chain polymeric filaments composed of at least 85 percent, by weight, polyolefins or polyesters.

B. Orient filaments into stable network which retains its structure during handling, placement, and long-term service.

C. Stabilizers or inhibitors added to filament base material: Resist deterioration due to ultraviolet or heat exposure.

D. Geotextile edges: Selvaged or otherwise finished to prevent outer material from pulling away.

E. Conform to roll values listed in Table 02342A - Geotextile Physical Properties.

1. Values listed are minimum average roll values (MARV’s), unless otherwise noted.

2. Test results for weaker principal direction shall meet or exceed minimum values listed in the table.

3. Mass per unit area is a nominal value and is provided for information purposes only.

F. Direct exposure to sunlight: Withstand 14 days with no measurable deterioration.

Table 02342A - Geotextile Physical Properties

Property	Test Method	Required Values
Mass per unit area, nominal	ASTM D 5261	16 oz/yd^2
Grab tensile	ASTM D 4632	380 lbs
Elongation at break	ASTM D 4632	50 percent
Trapezoidal tear	ASTM D 4533	140 lbs
Puncture strength	ASTM D 4833	230 lbs
Burst strength	ASTM D 3786	700 lb/in^2
Permittivity	ASTM D 4491	0.5 sec^{-1}
Apparent opening size (minimum US Sieve No. / maximum opening size)	ASTM D 4751	100 US Sieve
UV resistance – tensile strength retained at 500 hours, minimum	ASTM D 4355	70 percent

2.2 PINS

A. Pins: 3/16-inch diameter, 18-inches long steel pins, pointed at one end, and fitted with 1-1/2 inch diameter washer at other end.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Prepare surface upon which geotextile is to be placed to a firm surface, reasonably even and smooth, and free of offsets, abrupt indentations, and protruding materials greater than 1-1/2 inches.

B. Obtain COR approval of subgrade before installing geotextile.

3.2 INSTALLATION

A. Place geotextile in the manner and at locations shown on drawings.

B. Lay geotextile smoothly, free of tension, stress, folds, wrinkles, or creases so far as is practical and except where required in these specifications.

C. Shingle overlaps on slopes with upstream roll placed over downstream roll.

D. Pin, staple, or weight to hold geotextile in position.

E. Anchor terminal ends of geotextile with key trenches or aprons at crest and toe of slopes.

F. In the presence of wind, weight geotextiles with sandbags or equivalent until cover material is placed.

G. Do not entrap stones, soil, excessive dust, or moisture in geotextile that could damage geotextile or hamper subsequent seaming.

H. Do not drive or operate equipment directly on geotextile.

I. Cover geotextile within 14 days after geotextile placement.

1. If covering geotextile with specified material is not possible within 14 days, protect exposed geotextile with suitable cover approved by the Government.
2. Replace geotextile not protected.

3.3 SEAMING

A. Join adjacent sheets of geotextile by overlapping, sewing, or thermal welding.

B. Overlapped seams:

1. Overlap minimum: 12 inches.
2. Upstream/upslope roll placed over the downstream/downslope roll.
3. Weight or pin on 3-foot centers to secure the overlap during placement of cover material.

C. Sewn seams:

1. Interlocking or sewn twice.
2. Thread:
   a. Contrasting color.
   b. Chemical resistance: Equal to geotextile.
3. Sew geotextiles continuously. Spot sewing is not allowed.
4. Sewn seam strength: Not less than 70 percent of parent material strength.

D. Thermal welding: In accordance with manufacturer's recommendations.

3.4 RIPRAP INSTALLATION

A. Place riprap so as not to damage geotextile.

1. Place directly on geotextile with drop height not exceeding 1 foot.

B. Before placing riprap, demonstrate to COR that placing technique will not damage geotextile or underlying geomembrane. If the demonstration does not show that riprap can be installed without damaging geotextile, modify riprap placing technique (such as reducing drop height, installing additional layer of sacrificial geotextile, or installing additional gravel cushion).

3.5 REPAIRS

A. At placement, geotextile will be rejected if it has defects, rips, holes, flaws, deterioration, contamination, or damage.

B. Replace or repair geotextile damaged during installation or placement of cover in the following manner:

1. Remove cover from damaged area of geotextile.
2. Remove any soil or other material which may have penetrated torn geotextile.
3. Repair damaged geotextile by placing additional layer of geotextile to cover damaged area and either sew the patch to undamaged geotextile according to sewing requirements stated above or overlap undamaged geotextile by at least 3 feet on all sides.

3.6 FIELD QUALITY CONTROL

A. After installation, the COR or Construction Manager will examine the entire geotextile surface to ensure that potentially harmful foreign objects (such as needles) are not present.

B. Remove foreign objects or replace geotextile if damaged, as directed by the COR or Construction Manager.

C. Acceptance of geotextile installation will be made after inspection and approval by the COR.

END OF SECTION

This page intentionally left blank.

SECTION 31 37 00

RIPRAP

PART 1 GENERAL

All new erosion control features designated on the Drawings are permanent and shall remain at their location for the permanent use after the completion of construction unless otherwise indicated on the Drawings.

1.1 MEASUREMENT AND PAYMENT

A. Type 1 Riprap:

1. Measurement: Volume to outlines placed and to thickness shown on drawings.
2. Payment: Cubic yard price offered in the schedule, which includes rock spalls, gravel to fill voids in riprap and geotextile.

B. Other Riprap:

1. Type 2 Riprap on Outlet Channel:
   a. Payment: Lump sum incidental to Outlet Structure Bid Item.
2. Type 3 Riprap and Check Dams at Pipe Culvert:
   a. Payment: Lump sum incidental to “Relocate and Reconstruct BIA ROAD 8077” bid item.
3. Type 3 Riprap at Wingwalls:
   a. Payment: Lump sum incidental to “Relocate and Reconstruct BIA ROAD 8077” bid item.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C 88-05	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
2.	ASTM C 127-07	Density, Relative Density, (Specific Gravity), and Absorption of Coarse Aggregate
3.	ASTM C 131-06	Resistance to Degradation of Small-Size Coarse Aggregate and Impact in the Los Angeles Machine

B. ADOT: Section 810 of 2008 Standard Specification of Arizona Department of Transportation for Erosion Control and Pollution Prevention.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals, separately for each pay item.

B. RSN 31 37 00-1, Riprap Materials Data and Test Results:

1. Name and location of commercial rock source, if reused.
2. Gradation of riprap.
3. Certified laboratory test results demonstrating rock meets specified material requirements.

PART 2 PRODUCTS

2.01 ROCK

A. Obtain from approved commercial source, salvage from onsite, or obtain from the riprap borrow area in the spillway channel as approved by the COR.

B. Hard, dense, and durable.

1. Specific gravity, ASTM C 127, minimum: 2.2.
2. Absorption, ASTM C 127, maximum: 2 percent.
3. Loss, Sulfate Soundness, ASTM C 88, maximum: 10 percent.
4. Loss at 100 cycles, Los Angeles Abrasion, ASTM C 131, maximum: 10 percent.
5. Loss at 500 cycles, Los Angeles Abrasion, ASTM C 131, maximum: 40 percent.

C. Quarried rock shall be used for riprap.

D. Shape:

1. Predominantly angular.
2. Maximum dimension not greater than 3 times minimum dimension.

E. Type 1 - Upstream Embankment Slope Riprap Gradation: Reasonably well graded within limits shown in the Type 1 - Riprap Gradation table below.

Type 1 – Riprap Gradation

Diameter, in.	Percent Smaller than Given Size by Weight	Typical Stone Weight (lbs)
D_{50} Size = 24 in.		
42	100	3500
33	50 - 70	1700
24	35 - 50	650
9	2 - 10	35

F. Type 2 - Outlet Works Channel Riprap Gradation: Reasonably well graded within limits shown in the Type 2 - Riprap Gradation table below.

Type 2 – Outlet Works Channel Riprap Gradation

Diameter, in.	Percent Smaller than Given Size by Weight	Typical Stone Weight (lbs)
D_{50} Size = 12 in.		
21	70 - 100	440
18	50 - 70	275
12	35 - 50	85
4	2 - 10	3

G. Type 3 :

1. Includes: Wingwall treatment, Ditch, Pipe Inlet and Outlet protection and Check Dam Riprap.
2. Gradation: Reasonably well graded within limits shown in the Type 3 - Riprap Gradation table below.

Type 3 –Riprap Gradation

Diameter, in.	Percent Smaller than Given Size by Weight	Typical Stone Weight (lbs)
D_{50} Size = 9 in.		
15	70-100	160
12	50 – 70	85
9	35 - 50	35
3	2 - 10	1.3

3. Accessories:

   a. Non-Woven Geotextile:

      1) Use non-woven geotextile under all riprap types.

      2) Anchor the geotextile to the subgrade by the anchor stakes.

      3) Comply with the Section 208 of 2008 Standard Specification of ADOT.

   b. Gabion for check dams:

      1) Hot deep galvanized.

      2) Conform to ASTM A 974-97.

      3) Zinc Coating conform to ASTM A-90.

      4) Mesh opening: 3 inch by 3 inch.

      5) Mesh Wire Diameter: 0.106” – US Gauge 12 as minimum.

      6) Container size: 6’ length, 3’ width, 3’ height.

PART 3 EXECUTION

3.1 AREAS TO RECEIVE RIPRAP

A. Place riprap to the outlines and thicknesses shown on the drawings.

3.2 PLACING

A. Erosion controls shall be installed in accordance with phasing provisions in the approved SWPPP as indicated in Section 810 of 2008 Standard Specification of Arizona Department of Transportation and coordinated with the related constructions.

B. Place riprap geotextile material as shown on drawings.

C. Place rocks so that larger rocks are evenly distributed and small rock fragments fill the spaces, and in a manner so as not to damage the geotextile.

1. Include rock spalls or gravel in an amount to fill voids in riprap, but not in excess of an amount to be determined by the COR.

D. Dump and smooth by moving rocks into position so that material when in place is stable.

E. Begin riprap placement at toe and proceed up slope.

F. Leave no unreasonably large unfilled spaces within riprap.

G. An approved geotextile fabric shall be placed between the earth material and riprap at locations indicated on the Drawings in accordance with Section 208 of 2008 Standard Specification of Arizona Department of Transportation.

H. Check Dams:

1. Place check dams across the riprap ditch at locations indicated on the Drawings.
2. Install base and dams according to the dimensions indicated on the Drawings.
3. Install the center section of the rock check lower than the edges.
4. The edges of checks shall be at the same elevation as the adjacent finish ground level.
5. Gabion:
    a. Used for raping the rock check dams.
    b. Embedded into the face of the dam and roadway shoulder and buried into the ditch 24” at locations indicated in the Drawings.
    c. Leave 1' of gabion above ground with the ends of the gabion buried well into the banks of the channel to prevent erosion from cutting around the end of the gabion.

3.3 FIELD QUALITY CONTROL

A. Contractor shall perform the installed erosion control devices works properly. Necessary repairs shall be placed by contractor to ensure erosion and sediment controls are in good working order.

END OF SECTION

SECTION 32 15 10
GRAVEL SURFACING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplying material, transporting, placing aggregates for road surfacing placing, treating with moisture and soil stabilization additives, sub-base preparation, shaping and compacting the gravel road surface coarse material.

B. Related Sections:

1. Section 31 23 02 – Compacting Earth Material.
2. Section 33 42 13 – Pipe Culvert.
3. Section 31 37 00 – Riprap.
4. Section 34 71 13 – Guardrail.
5. Section 01 55 20 – Traffic Control.

1.2 MEASUREMENT AND PAYMENT

A. Measurement: By lump sum.

B. Payment:

1. BIA Road 8077: Incidental to the "Relocate and Reconstruct BIA Road 8077" bid item.
2. Temporary Road: Incidental to the "Construct, Maintain and Remove Temporary Road" bid item.
    a. Grading the temporary road to match existing road surface at their intersection is included.
3. 10-Foot Access Road: Incidental to the "Relocate and Reconstruct BIA Road 8077" bid item.

1.3 REFERENCES

A. ADOT: Section 303 of 2008 Standard Specification of Arizona Department of Transportation for Aggregate Bases and Aggregate Subbases.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal.

B. RSN 32 15 10-1, Compaction Test Result: Submit compaction test result to verify compliance with the requirements of ASTM D2922 or ASTM D698.

C. RSN 32 15 10-2, Materials Source Data: Submit name of aggregate materials suppliers and distance from Project site to COR at least 14 days prior to delivery to the site.

D. RSN 32 15 10-3, Manufacturer's Certificate includes:

1. Certify products meet or exceed specified design requirements.

E. RSN 32 15 10-4, Product Cost Data: Submit cost of products to verify compliance with Project design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

a. Reused products.

b. Local and regional products.

F. RSN 32 15 10-5, Product Data: Submit the data for the soil stabilizer material including the manufacturer name, material name, percentage used and method of installation.

PART 2 PRODUCTS

2.01 GRAVEL

A. Aggregate Base Class 2 per Section 303 of 2008 Standard Specification of Arizona Department of Transportation for Aggregate Bases.

B. Graded within the following limits as listed in Table 303-1 ADOT Standard Specification:

Sieve Size	Percent Passing by Weight
1½ ”	100
1”	90 - 100
No. 8	35 - 55
No. 200	0 – 8.0

C. Free from vegetable matter and other deleterious substances.

PART 3 EXECUTION

3.1 PREPARATION

A. Base preparation:

1. Grade and prepare subgrade free from depressions and soft spots.

2. The area to be surface shall be compacted as specified to the lines and grades shown on the Drawings.

3. The subgrade surface shall be inspected and approved by the COR before any aggregate surfacing material is placed.

4. The top six inches of the subgrade shall be compacted to a density of not less than 95 percent of the maximum density in accordance with the requirements of the ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods for shallow depths; or ASTM D698, Standard Proctor Density.

5. Subgrade Soil Stabilization:

   a. The top six inches of the entire BIA Road 8077 subgrade shall be treated with the following material:

      1) "Road Bond EN1" soil stabilizer in accordance with supplier's specifications. http://www.roadbondsoil.com/

      2) The other alternative material and methods for the soil stabilization shall be approved by COR before the placement:

         a) Lime treated subgrade complying with the requirements of Section 301 of 2008 Standard Specification of ADOT.

         b) Cement treated subgrade complying with the requirements of Section 302 of 2008 Standard Specification of ADOT.

   b. Do not install the soil stabilizer in wind in excess of 20 mph.

B. Obtain approval of the materials from COR 20 days before placing.

3.2 PLACING

A. Place gravel surfacing on areas indicated on drawings.

B. The top 6 inches of the native soil shall not be used as fill material in the construction process.

C. Compaction:

1. Place and compact gravel surfacing to depth indicated on the Drawings.

2. The road gravel surface coarse material shall be compacted as necessary to provide a density of not less than 95 percent of the maximum density in accordance with the requirements of the ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods for shallow depths; or ASTM D698, Standard Proctor Density.

3. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

D. Notify the Government 24 hours before compaction work begins and 24 hours before significant change in compaction operations (major change in equipment or procedure used).

E. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

F. In the event segregation occurs, the material shall be bladed until the various sizes of aggregate are uniformly and satisfactorily blended.

G. After being spread, the material shall be watered, mixed, shaped to the required section, and compacted as specified on Drawings. The completed course shall be smooth, true to grade and cross-section, and free from ruts, humps, depressions, and irregularities.

H. Maintain optimum moisture content of fill materials to attain specified compaction density.

I. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.3 QUALITY CONTROL

A. Compaction testing will be performed in accordance with ASTM D2922, Standard Test Methods, or ASTM D698, Standard Proctor Density, for density of soil and soil-aggregate in place of not less than 95 percent of the maximum density.

B. Frequency of testing is at discretion of the COR:

1. BIA Road 8077: Minimum frequency of testing shall be every 2000 square yards compacted aggregate.
2. 10-foot Access Road: One test for the entire quantity.
3. Temporary Road: Minimum frequency of testing shall be every 3000 square yards compacted aggregate.
4. Additional tests may be performed at sites considered questionable by a COR Inspector; such as suspected incomplete compaction, surfaces that may have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.

END OF SECTION

SECTION 32 31 10
CHAIN LINK FENCE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Chain Link Fence:

1. Cost: Include in prices offered for Prefabricated Bridge.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A 121-07	Metallic-Coated Carbon Steel Barbed Wire
2.	ASTM A 392-07	Zinc-Coated Steel Chain-Link Fence Fabric
3.	ASTM A 780/A 780M-09	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
4.	ASTM A 824-01(2007)	Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
5.	ASTM C 150/C 150M-09	Portland Cement
6.	ASTM C 1107/C 1107M-11	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
7.	ASTM F 567-07	Installation of Chain-Link Fence
8.	ASTM F 626-08	Fence Fittings
9.	ASTM F 900-05	Industrial and Commercial Swing Gates

B. Chain Link Fence Manufacturers Institute (CLFMI)

1.	CLFMI 2445-10	Product Manual

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 32 31 10-1, Certifications:

1. Manufacturer’s certification that fence materials, fittings, and accessories meet specified requirements.
2. Include manufacturer’s names and product designations and specified product standards in the certification.

PART 2 PRODUCTS

2.1 CHAIN LINK FABRIC

A. Zinc-Coated Steel Fabric: ASTM A 392.

1. Size of mesh: 2-inch.
2. Coat before weaving.
3. Diameter of coated wire: 0.148 inch (no. 9-gauge).
4. Coating weight: Class 1.

2.2 INTERMEDIATE POSTS

A. CLFMI 2445, Type I round pipe.

2.3 TERMINAL POSTS, BRACES, AND RAILS

A. CLFMI 2445, Type I round pipe.

2.4 TENSION WIRE

A. Zinc-coated steel marcelled tension wire: ASTM A 824.

1. Coating: Type II, Class 4.

2.5 BARBED WIRE

A. Steel barbed wire: ASTM A 121.

1. Coating: Type Z, Class 3.
2. Design Number: 12-2-4-14R.

2.6 FITTINGS

A. Post and Line Caps, Rail and Brace Ends, Braces, and Bands: ASTM F 626, zinc-coated steel or zinc-coated cast iron.

B. Toprail Sleeves, Tension Bars, and Truss Rods: ASTM F 626, zinc-coated steel.

C. Tie Wires, Clips, and Bands: ASTM F 626.

1. Standard round wire ties.
    a. 9 gauge steel.
    b. Zinc coating, 1.2 oz/ft^2.

D. Barbed wire arms: ASTM F 626, Type I (angled).

2.7 GATES

A. Gates: ASTM F 900.

1. Single-swing type as shown on drawings.
2. Directions of swing: 180 degrees in or out opening, as shown on drawings.

B. Frame: CLFMI 2445, Type I round pipe.

1. Corners:
   a. Welded or heavy fittings.
   b. Rigid and watertight.

C. Fabric: Same type used in fence.

D. Barbed Wire: Same type used in fence.

E. Accessories:

1. ASTM F 900.
2. Gate hinges, latches, stops, and keepers: Zinc-coated or zinc-coated cast iron.

2.8 Razor Wire Fencing

A. Razor wire fences installed on top of chain link fence for security enhancement as shown on drawings.

1. Barbed concertina wire.
2. Barbed tape style: Long Barb.
3. Fabricated from 0.020" thick ASTM A653 (GA).
4. Hot dipped galvanized.
5. Type: Single coil.
6. Coil Spacing: 16 inches.
7. Coil Diameter: 18 inches.

B. Accessories:

1. Handles.
   a. Two opposing handles at each end attached to the end coils.
   b. Galvanized.
2. Barbed wire crossing through the coils.
   a. Two twisted line wires with 4 spikes.
   b. Hot dipped galvanized.

2.9 CONCRETE

A. Manufacture and delivery: In accordance with Section 03 30 00 – Cast-In-Place Concrete, except:

1. Coarse aggregate size, maximum: 3/4-inch.
2. Compressive strength at 28 days, minimum: 2,500 pounds per square inch.

2.10 GROUT

A. Packaged grout:

1. Pre-mixed commercial grout mixture:
   a. ASTM C 1107.
   b. Cement in mixture: ASTM C 150, Type II.
2. Mix in accordance with manufacturers instructions.
3. Consistency: No wetter than necessary for satisfactory placement.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect chain link fence and gate at location shown on drawings.

B. Install fence, razor wire fence and gate as shown on drawings.

1. Provide 7-foot-high fabric with 1-foot-high barbed wire.

C. Install chain link fence in accordance with ASTM F 567 and CLFMI 2445, except as shown on drawings or specified.

3.2 REPAIR OF FENCE MATERIALS

A. Repair damage to zinc coatings as follows:

1. Redip material with damaged galvanizing unless damage is local and can be repaired by zinc primer.
2. If the galvanized coating becomes damaged after being dipped twice, material will be rejected.
3. Where local paint repair is authorized:
   a. Repair damaged galvanized surfaces in accordance with ASTM A 780, except repair materials containing cadmium and lead are not permitted.

3.3 TESTING AND ADJUSTING

A. After installation, test and adjust gate for proper operation.

END OF SECTION

This page intentionally left blank.

SECTION 32 34 00
PREFABRICATED BRIDGE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Prefabricated Bridge

1. Payment: Lump-sum price offered in the schedule.
2. Includes cost of designing, fabricating, delivering and installing steel truss bridge; complete with chain link fence, guardrail for intake tower; bearing assemblies, elastomeric bearing pads, anchor bolts and cover plates, and safety bollards.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials (AASTHO)

1.	AASHTO LRFD 2009	Design of Pedestrian Bridges, 2nd Edition
2.	AASHTO LRFD 2010	Bridge Design Specifications, 5th Edition (2010 Interim Revisions)

B. American Institute of Steel Construction (AISC)

1.	AISC 325-05	Steel Construction Manual, 13th Edition

C. American Society for Testing and Materials (ASTM)

1.	ASTM A 36/A36M-08	Carbon Structural Steel
2.	ASTM A 325-10	Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength
3.	ASTM A 606-09a/A606M-90a	Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
4.	ASTM A 653-10/A653M-10	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
5.	ASTM A 847-11/A847M-11	Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
6.	ASTM D 3542-08	Preformed Polychloroprene Elastomeric Joint Seals for Bridges

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-10	Structural Welding Code – Steel

2. AWS D1.5M/D1.5 2002 Bridge Welding Code

1.3 SYSTEM DESCRIPTION

A. Pre-engineered, prefabricated steel truss bridge, complete with bridge trusses, floor beams, stringers, steel decking designed for concrete overlay, bearing assemblies, anchor bolts and miscellaneous metalwork for cover plates.

1.4 DESIGN REQUIREMENTS

A. Refer to drawings.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals

B. RSN 32 34 00-1, Shop Drawings and Calculations

1. Prepared, signed and sealed by structural engineer registered in the State of Arizona
2. Show size, type, locations, and finishes for all members, bolts, and welds.
3. Identify welds by AWS standard welding symbols. Indicate net weld lengths.
4. Include assembly manuals.
5. Certify that structure is designed to carry minimum specified loading utilizing AASHTO design stresses in accordance with AASHTO.
6. Shop drawings for joints:
    a. Indicate movement rating.
    b. Show fabrication details.
    c. Provide material specifications.

C. RSN 32 34 00-2, Mill Certificates: Mill and manufacturer certificates verifying that structural steel, fasteners, welding electrodes, and finishes conform to specified requirements.

D. RSN 32 34 00-3, Welder's Certifications: Certificates for welders and AWS Certification (CWI) for welding inspector.

E. RSN 32 34 00-4, Welding test records: Welding test records and nondestructive testing records.

F. RSN 32 34 00-5, Qualifications

1. Manufacturer's experience.
2. Copy of American Institute of Steel Construction (AISC) certification.

3. List of 5 pre-engineered steel truss bridge projects successfully completed with contact information.

G. RSN 32 34 00-6, Certification, Product Data, and Installation Instructions

1. Bridge bearings.

H. RSN 32 34 00-7, Erection Drawings and Installation Instructions

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabricator's instructions.

PART 2 PRODUCTS

2.1 PREFABRICATED STEEL TRUSS BRIDGE

A. Truss bridge as indicated on drawing.

B. Accessories

1. Furnish complete with bridge trusses, floor beams, stringers, bearing assemblies with anchor bolts, preformed compression joint seals, steel-in-place steel shoring, pedestrian guardrail, and bolts and hardware necessary for installation.

2.2 MATERIALS

A. Refer to the Drawings.

B. Tubing: ASTM A 847, cold-formed, high-strength, self-weathering.

C. Plate and structural steel shapes: ASTM A 606, high-strength, self-weathering.

D. Hardware: ASTM A 325, Type 3, structural bolts.

E. Stay-in-place steel shoring:

1. ASTM A 653, galvanized steel suitable for placing reinforced concrete overlay.

2. Designed to carry dead load of wet concrete, construction loads, and other loads indicated on drawings.

2.3 BEARINGS

A. Designed by bridge fabricator.

2.4 WELDING

A. AWS D1.5.

2.5 SHOP FABRICATION

A. Assemble bridges in shop.

B. Match mark sections prior to shipment.

PART 3 EXECUTION

3.1 QUALITY CONTROL

A. Fabricator

1. At least 5 years experience in design and construction of pre-engineered steel truss pedestrian or vehicular bridges.
2. Fabricator shall have successfully manufactured and installed at least 5 pre-engineered steel truss pedestrian or vehicular bridges.
3. Certified Category III shop for Major Steel Bridges by AISC.
4. Welding shall be performed by welders qualified in accordance with AWS D1.5.

B. Designer

1. Licensed Structural Engineer registered in the State of Arizona.

C. Onsite Technical Advisor

1. At least 2 years experience and successful completion of at least 3 steel pre-engineered, pre-fabricated steel truss bridge installations.

3.2 SITE ASSEMBLY

A. Comply with fabricator’s instructions.

B. Comply with onsite technical advisor instructions.

3.3 BRIDGE ERECTION

A. Comply with fabricator’s instructions.

B. Install anchor bolts, bearing plates and bearing pads as required at locations indicated on the drawings and as required by bridge manufacturer's design requirements.

C. Comply with onsite technical advisor instructions.

D. Field welding: Comply with AWS D1.5.

3.4 DECK

A. Furnish and place steel deck grating (ADA compliant).

END OF SECTION

This page intentionally left blank.

SECTION 32 92 20
SEEDING AND SOIL SUPPLEMENTS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in schedule for Site Restoration.

1.2 DEFINITIONS

A. Pure live seed content: Weight of seed times percent purity times percent germination.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 32 92 20-1, Seeding plan:

1. Qualifying experience for person responsible for supervision of seeding, for approval.
2. Names, addresses, and telephone numbers of references.
3. Equipment.
4. Name and address of seed suppliers.

C. RSN 32 92 20-2, Certifications:

1. Origin of seed.
2. Percent purity and germination.
3. Prohibited and restricted weed seed content.

1.4 DELIVERY STORAGE AND HANDLING

A. Seed containers:

1. Sealed.
2. Labeled:

a. Identify seed origin on label.

1) Intrastate shipping: In accordance with Arizona State Seed Laws and Regulations.

2) Interstate shipping: In accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

1.5 AMBIENT CONDITIONS

A. Do not seed or fertilize when ambient temperature is below 38 degrees F without approval of the COR.

B. Do not seed or fertilize when ground is snow covered.

C. Do not seed, fertilize, or mulch, or hydroseed when wind velocities prevent uniform application of materials or would drift materials.

PART 2 PRODUCTS

2.1 SEED

A. Weed seeds classified by State Seed Department:

1. Prohibited noxious weeds: None
2. Restricted noxious weeds: 0.5 percent maximum, by weight.

B. Seed mixture:

1. Purity, minimum: 85 percent.
2. Germination, minimum: 85 percent.
   a. Germination test: Less than 1 year old at time of seeding.
3. Seed Mixture to be approved by the COR.

Table 32 92 20 - Seed Mixture
Dam Embankment, Borrow, Stockpile, Staging, and Downstream Areas

Common Name	Cultivar	Seeding Rate (Pounds pure live seed (PLS) per acre)
Western Wheatgrass	Arriba	3.0
Streambank Wheatgrass		2.0
Intermediate Wheatgrass		3.0
Indian Ricegrass	Paloma	2.0
Blue Gramma	Hachita	2.0
Sideoats Grama		2.0
Little Blusteam		2.0
Rocky Mountain Penstemon		1.0
TOTAL PLS/ACRE		**17.0**

2.2 FERTILIZER

A. Agricultural grade nitrogen fertilizer and phosphate fertilizer.

1. Nitrogen fertilizer: Urea (46-0-0).
2. Phosphate fertilizer: mono ammonium phosphate.

2.3 STRAW MULCH

A. Wheat or barley straw.

B. Free of mold or other evidence of decomposition.

C. Free from weed seed.

2.4 HYDROMULCH

A. Mat-Fiber Plus, manufactured by Mat Inc.,12402 Hwy 2, Floodwood, MN 55736, 1 -888-477-3028; Spray Mulch X-80 manufactured by Pacific Wood Fibers, PO Box 2109, Redmond WA 98052; or equal, having the following essential characteristics:

1. Wood cellulose fiber.
2. No germination or growth inhibiting factors.
3. Dyed appropriate color to allow visual metering of application.
4. Evenly dispersed and suspended when agitated in water.
5. Forms blotter like ground cover that readily absorbs water and allows infiltration to underlying soil.

2.5 TACKIFIER

A. Mixture of at least three specially blended compatible hydrocolloids.

1. One hydrocolloid will act as a slippery agent during suspension.
2. Will form loose, long-chain-like film on drying
3. No growth or germination inhibiting factors.
4. Hydrates and disperses in circulating water to form homogeneous slurry.
5. Equilibrium air dry moisture content at time of manufacture of 8 percent, plus or minus 2 percent.
6. Minimum water holding capacity: 6-1/2 times weight of dry material.

PART 3 EXECUTION

3.1 SEEDBED PREPARATION

A. Complete prior to seeding, and mulching or hydromulching.

B. Scarify or harrow and rake application area to minimum depth of four inches.

C. Remove stiff clods, lumps, roots, litter, stones, and other foreign material greater than 6 inches in size from the surface. Dispose of removed materials in accordance with Section 31 23 39 – Disposal of Excavated Materials. Fill or smooth topsoil surface to remove rills, gullies and depressions.

D. Protect prepared application surfaces from erosion and washouts. Repair damaged surfaces as required.

3.2 FERTILIZING

A. Apply nitrogen fertilizer uniformly at a rate of 30 pounds of nitrogen content per acre (65 pounds per acre of Urea).

B. Apply phosphate fertilizer uniformly at a rate of 50 pounds of P_2O_5 content per acre.

C. When fertilizer applied before seeding, disc or harrow fertilizer into top three inches of soil.

3.3 SEEDING

A. Apply seed and mulch everywhere that soil disturbance occurs within project limits and not designated on the plans to receive other material surfacing. Seed and mulch to be applied by one of the following methods:

1. Broadcast seeding followed by mulching or hydromulching.
2. Drilling seed followed by mulching.
3. Hydroseeding followed by hydromulching.

B. Apply seed mixture at rates specified in Table 32 92 20 Seed Mixture Dam Embankment, Borrow, Stockpile, Staging, and Downstream Areas.

C. Seed only between June 15 to August 30 or between November 1 to December 15 of each year.

3.4 BROADCAST SEEDING

A. Broadcast seed only in areas not accessible for drilling or hydroseeding.

B. For all methods of broadcast seeding, the seeding rates in Table 32 92 20 shall be doubled.

C. Apply seed and fertilizer separately.

D. Mechanical broadcasting:

1. Equipment:

a. Centrifugal type.

b. Pull type similar to fertilizer spreader.

2. Designed and regulated to apply seed uniformly at proper rate per acre.

E. Hand Broadcasting:

1. By hand broadcaster.

2. By hand.

3. Uniformly applied.

F. Cover seed with soil to depth of 1/4-inch to 1/2-inch immediately after broadcasting.

1. Use hand rake or float.

2. Do not use log chain or similar device.

3.5 DRILLING SEED

A. Regulate drill to uniformly distribute seed at rate specified and cover with soil depth of 1/4-inch to 1/2-inch.

B. Apply seed and fertilizer separately.

C. Drill crosswise to general slope where possible to safely operate equipment.

3.6 MULCHING

A. Spread within 2 days of spreading seed.

B. Rate: 2 tons per acre uniformly spread

C. Anchor with threader.

1. Operate crosswise to slope.

2. Depth: 3 to 4 inches.

3. Interval: 6 to 12 inches across slope.

3.7 HYDROSEEDING

A. Seed slurry:

1. Mix to keep homogeneous.
2. Ingredients:
    a. Water
    b. Seed
    c. Wood cellulose fiber mulch:
        1) Rate: 1,000 pounds per acre at 10 percent moisture content.
        2) Add to water slurry after seed.
    d. Fertilizer may be applied with hydroseeding.
3. Maximum time between batching slurry and application: 1 hour.

B. Spray apply seed slurry mix uniformly.

C. Use mulch coloring as metering agent.

D. Apply seed slurry before mulch slurry.

3.8 HYDROMULCHING

A. Mulch slurry:

1. Mix to keep homogeneous.
2. Ingredients:
    a. Water.
    b. Tackifier.
    c. Wood cellulose fiber mulch: 3,000 pounds per acre at 10 percent moisture content.
    d. Nitrogen fertilizer may be applied with hydromulching.
3. Maximum time between batching slurry and application: 1 hour.

B. Spray apply mulch slurry mix uniformly.

C. Use mulch coloring as metering agent.

D. Apply mulch slurry within 24 hours after applying seed.

3.9 SEED ESTABLISHMENT

A. Re-grade and re-seed eroded areas with specified seed mix as approved by the COR.

B. Seeding shall be done between June 15 to August 30 or between November 1 to December 15.

C. The contractor shall employ state of the art seeding mixing and planting methods to insure a uniform seed distribution of the specified plant species across the entire area to be re-seeded.

END OF SECTION

This page intentionally left blank.

SECTION 33 05 16

PRECAST COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes precast concrete utility structures:

1. Box culverts.
2. Headwalls and Wingwalls.
3. Manholes and vaults.

B. Related Sections:

1. Section 03 11 00 - Concrete Formwork.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-In-Place Concrete: Concrete type for manhole and structure foundation slab construction.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Precast Concrete Utility Structures:

1. Basis of Payment: Lump sum incidental to the related Bid Items.
2. Payment Includes: Excavating, concrete foundation slab, concrete structure sections, anchorage to existing rock.

1.3 REFERENCES

A. American Association of State Highway Transportation Officials:

1. AASHTO M306 - Drainage Structure Castings.
2. AASHTO S99-HB - Standard Specifications for Highway Bridges.

B. American Concrete Institute:

1. ACI 318 - Building Code Requirements for Structural Concrete.
2. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
3. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

C. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
3. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
6. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
7. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
8. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
9. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
10. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
11. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
12. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
13. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
14. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
15. ASTM C33 - Standard Specification for Concrete Aggregates.
16. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
17. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
18. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
19. ASTM C150 - Standard Specification for Portland Cement.
20. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
21. ASTM C192/C192M - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

22. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
23. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
24. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
26. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
27. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
28. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
29. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
30. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
31. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

E. National Precast Concrete Association:

1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

F. SSPC: The Society for Protective Coatings:

1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.4 DESIGN REQUIREMENTS

A. Design structures for minimum loads in accordance with ASTM C857 and ASTM C890.

1. Box Culvert Roof Live Load: AASHTO S99-HB HS20 including impact load.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal.

B. RSN 33 05 16-1, Shop Drawings:

1. Indicate structure locations, elevations, sections.

C. RSN 33 05 16-2, Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Comply with precast concrete manufacturer’s instructions for unloading, storing and moving precast structures. Lift structures from designated lifting points.

C. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE UTILITY STRUCTURES

A. Precast Concrete Utility Structures: Reinforced precast concrete.

2.2 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C33, except gradation requirements do not apply.

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Furnish materials in accordance with Arizona Department of Transportation standards.

B. Air Entrainment: ASTM C260.

C. Chemical Admixtures: ASTM C494/C494M.

2.4 CONCRETE REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, deformed bars, galvanized finish.

B. Reinforcing Steel Finishes:

1. Galvanized Finish: ASTM A767/A767M, Class II.

C. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic.

2.5 CONCRETE MIX

A. Select proportions for normal weight concrete in accordance with ACI 318. and ACI 211.1.

B. Provide concrete to the following criteria:

1. Compressive Strength: 4,000 psi at 28 days.
2. Water Cement Ratio:
   a. Concrete Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
3. Air Content:

Maximum Aggregate Size inches	Air Content, Percent	
	Severe Exposure	Moderate Exposure
3/8 inches	6.0 to 9.0	4.5 to 7.5
1/2 inches	5.5 to 8.5	4.7 to 7.0
3/4 inches	4.5 to 7.5	3.5 to 6.5
1 inches	4.5 to 7.5	3.0 to 6.0
1-1/2 inches	4.5 to 7.0	3.0 to 6.0

C. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process.

1. Do not use calcium chloride.

2.6 FABRICATION

A. Fabricate precast concrete utility structures in accordance with ACI 318. and NPCA Quality Control Manual for Precast Plants.

B. Fabricate precast concrete utility structures to size, configuration and openings as indicated on Drawings.

C. Construct forms to provide uniform precast concrete units with consistent dimensions.

D. Clean forms after each use.

E. Install reinforcing by tying or welding to form rigid assemblies. Position reinforcing to maintain minimum 1/2 inch cover. Secure reinforcement to prevent displacement when placing concrete.

F. Position and secure embedded items to prevent displacement when placing concrete.

G. Deposit concrete in forms. Consolidate concrete without segregating aggregate.

H. Provide initial curing by retaining moisture using one of the following methods:

1. Cover with polyethylene sheets.
2. Cover with burlap or other absorptive material and keep continually moist.
3. Apply curing compound in accordance with manufacturer's instructions.

I. Provide final curing in accordance with manufacturer's standard.

J. Remove forms without damaging concrete.

2.7 CONCRETE FINISHES

A. Formed Surfaces Not Exposed to View: As formed.

B. Unformed Surfaces: Finish with vibrating screed or hand float.

1. Permitted: Color variations, minor indentations, chips, and spalls.
2. Not Permitted: Major imperfections, honeycomb, or other defects.

2.8 SOURCE QUALITY CONTROL

A. Perform the following tests for each 150 cy of concrete placed, with minimum one set of tests each week.

1. Slump: ASTM C143/C143M.
2. Compressive Strength: [[ASTM C31/C31M] [ASTM C192/C192M]] and ASTM C39/C39M.
3. Air Content: ASTM C231 or ASTM C173/C173M.
4. Unit Weight: ASTM C138/C138M.

B. Visually inspect completed precast structures for defects.

1. Repair defects affecting exposed to view surfaces to achieve uniform appearance.

2. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.

C. Make test results available to COR upon request.

2.9 FINISHING - STEEL

A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify correct size and elevation of excavation.

C. Verify subgrade [and bedding] is properly prepared, compacted and ready to receive Work of this section.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

C. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.

3.3 QUALITY CONTROL

A. Obtain precast concrete utility structures from single source.

B. Perform structural design in accordance with ACI 318.

C. Preform Work in accordance with NPCA Quality Control Manual for Precast Plants.

D. Conform to the following for material and fabrication requirements:

1. Single Cell Box Culverts: ASTM C1433.
2. Other Structures: ASTM C913.

E. Perform welding in accordance with the following:

1. Structural Steel: AWS D1.1.
2. Reinforcing Steel: AWS D1.4.

F. Perform Work in accordance with Arizona Department of Transportation standards.

G. Maintain one copy of each document on site.

3.4 INSTALLATION

A. Install underground precast utility structures in accordance with ASTM C891.

B. Lift precast concrete structures at lifting points designated by manufacturer.

C. When lowering structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

D. Install precast concrete base to elevation and alignment indicated on Drawings.

END OF SECTION

SECTION 33 11 01
DUCTILE IRON PIPE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. 36-inch Ductile Iron Pipe:

1. Measurement: Length of Pipe installed.
   a. Length along pipe centerline between ends in place.
   b. No allowance for lap at joints.
2. Payment: Linear foot price offered in the schedule for Furnish and Install Outlet Pipe.

1.2 REFERENCE, SPECIFICATIONS, CODES AND STANDARDS

A. American National Standards Institute (ANSI)

1.	ANSI C 104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2.	ANSI C 105	Polyethylene Encasement for Ductile-Iron Pipe Systems
3.	ANSI C 110	Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids
4.	ANSI C 111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5.	ANSI C 150	Thickness Design of Ductile-Iron Pipe
6.	ANSI C 151	Ductile-Iron Pipe, Centrifugally Cast for Water
7.	ANSI C 153	Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service
8.	ANSI C 600	Installation of Ductile-Iron Water Mains and their Appurtenances

B. American Water Works Association (AWWA)

1.	AWWA A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2.	AWWA A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems.

3.	AWWA A21.10	Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids.
4.	AWWA A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5.	AWWA A21.50	Thickness Design of Ductile-Iron Pipe.
6.	AWWA A21.51	Ductile-Iron Pipe, Centrifugally Cast for Water.
7.	AWWA A21.5	Ductile-Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in for Water Service

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 33 11 01-1, Approval Plans:

1. Shop Fabricated Piping:
    a. Detailed pipe fabrication or spool drawings showing pipe details, special fittings and bends, dimensions, coatings, and other pertinent information.
    b. Layout drawings showing location of each pipe section and each special length; number or otherwise designate laying sequence of each pipe.

C. RSN 33 11 01-2, Certificates:

1. Furnish manufacturers certificates of compliance for all pipe and other products or materials furnished under this Section. Certifications of compliance shall include:
    a. Ductile iron pipe in accordance with the requirements of AWWA C151 and these specifications.
    b. Cement-mortar lining of ductile iron pipe, specials and fittings in accordance with the requirements of AWWA C104 and these specifications.
    c. Polyethylene encasement for ductile iron piping in accordance with AWWA C105 (if specified).
    d. Rubber gasket joints for ductile iron pressure pipe and fittings in accordance with the requirements of AWWA C111 and these specifications.

D. RSN 33 11 01-3, Installation and Sequencing Plan:

1. Detailed plan for sequencing of ductile iron pipe installation and encasement.
    a. Pipe restraint details to be developed by a Professional Engineer prior to encasement of ductile iron pipe.

b. Sequencing plan for the encasement of pipe to be provided to and approved by the COR.

1.4 QUALITY CONTROL

A. Inspection: All pipe shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards, as supplemented by the requirements herein.

B. Plant Access: During the manufacture of the pipe, the COR or their designated agent shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.

D. Factory Hydrostatic Test: All pipe shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds.

PART 2 PRODUCTS

2.1 GENERAL

A. Standards: Ductile iron pipe shall conform to AWWA C151, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents, and all specials and fittings shall be provided as required under the Contract Documents.

B. Markings: Upon request, the CONTRACTOR shall require the MANUFACTURER to legibly mark specials in accordance with the laying schedule and marking diagram.

C. Laying Lengths: Pipe laying lengths shall be provided in 18-foot nominal lengths with allowable trim pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

2.2 DUCTILE IRON PIPE

A. Minimum Pipe Class: Ductile iron pipe shall conform to AWWA C151. All pipe shall have a minimum pressure rating of 250 psi.

B. Wall Thickness: Minimum wall thickness shall be 0.50 inches for 36 inch diameter ductile iron pipe.

2.3 PIPE JOINT DESIGN

A. General: Ductile Iron Pipe and fittings shall be furnished with push-on joints.

B. Push-on Joints: Push-on joints shall conform to AWWA C111. Unless otherwise specified gasket material shall be standard styrene butadiene copolymer (SBR). Push-on joints shall be Tyton, as manufactured by U.S. Pipe, or pre-approved equal. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less. Standard allowable joint deflection for 4"–36" pipe shall be 5^{o}.

2.4 FITTINGS

A. General: Fittings shall be ductile iron in accordance with AWWA C 110, AWWA C 153, or AWWA C 606, latest revisions.

B. Cement Lining: Fittings shall be internally lined with cement mortar in accordance with AWWA C 104. The lining thicknesses shall be equal to or greater than those for comparable size pipe.

C. Buried Service Fittings: Fittings, sizes 4" – 36", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure.

2.5 CEMENT-MORTAR LINING

A. Cement-Mortar Lining for Shop Application: Except otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104, Portland cement mortar. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired or replaced with lining conforming to these Specifications.

B. Lining Thickness: The minimum lining thickness shall be as follows:

Nominal Pipe Dia. (in.)	Minimum Lining Thickness (in)
36	5/32

C. Seal Coat or Non-Seal Coat Cement-Mortar Lining: Ductile iron pipe, specials, and fittings shall be lined with cement-mortar lining with an asphaltic seal coating, 1 mil, in accordance with AWWA C104.

2.6 EXTERIOR COATING

A. Buried Ductile Iron Pipe: The exterior of ductile iron pipe, special, and fittings shall be coated with a 1-mil asphaltic coating in accordance with AWWA C151, Section 51-9.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify size, material, joint types, elevation, and horizontal location of pipe alignment.

B. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

3.2 PREPARATION

A. Notify COR at least 3 days prior to field fabrication of pipe or fittings.

B. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

C. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Join pipe and fittings in accordance with manufacturer's instructions unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Cement Lined Ductile Iron Piping:

1. Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

2. Dressing Cut Ends:

   a. General: As required for the type of joint to be made.

   b. Rubber Gasketed Joints: Remove sharp edges or projections

   c. Push-On Joints: Bevel, as recommended by pipe manufacturer.

3.4 INSTALLATION – BURIED PIPE

A. Placement:

1. Keep trench dry until pipe laying and joining are completed.

2. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire pipe run and all joints.

3. Provide adequate support to prevent deflections in excess of specified tolerances. Pipe shall have adequate internal bracing to prevent excessive deflection of the pipe cross section.

4. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.

5. All pipe shall be accurately set to the lines, grades and dimensions shown on the Drawings. Measure for grade at pipe invert, not at top of pipe.

6. Prevent foreign material from entering pipe during placement.

7. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.

8. Lay pipe downgrade with bell ends pointing in direction of laying.

9. After joint has been made, check pipe alignment and grade.

10. Restrain or otherwise anchor pipes to prevent pipe movement, deflection, or buoyancy during encasement concrete placement.

11. Provide concrete encasement in accordance Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Tolerances:

1. Deflection From Horizontal Line: Maximum 1/2 inches.

2. Deflection From Vertical Grade: Maximum ¼ inch.

3. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.

4. Pipe Cover: Minimum 3 feet, unless otherwise shown.

5. Circumferential Pipe Deflection: Maximum 5 percent of pipe diameter.

3.5 WALL PENETRATIONS

A. The pipe shall be connected to a wall thimble cast in the wall of the intake structure.

B. No thrust rings are required where the upstream or downstream ends of the outlet works pipe connects to a concrete structure.

3.6 VENT CONNECTIONS

A. Do not install vent connections smaller than 3-inch nominal pipe size.

B. Threaded Pipe Tap Connections:

1. Ductile Iron Piping: Connect only with service saddle.

2. Limitations: Threaded taps in pipe barrel are unacceptable.

3.7 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: Leakage testing shall be performed as follows and prior to encasement of the pipe:

1. Block off upstream and downstream ends of pipe in a manner consistent with pressure testing.

2. Expel air from outlet works during filling.

3. Apply and maintain a minimum test pressure of 35 psi with a hydraulic force pump.

4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.

5. The maximum allowable leakage for the 36-inch diameter ductile iron outlet works pipe shall be no greater than 0.3 gallons per hour.

6. Correct leakage greater than allowable, and retest as specified.

7. Visible leakage greater than a drip rate is not allowable.

END OF SECTION

This page intentionally left blank.

SECTION 33 11 18
HDPE PIPE FOR INTAKE AIR VENT AND INSTRUMENTATION LINES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in schedule for Construct Outlet Works Structures.

    a. Includes cost of placing and securing pipe and locator tape within the forms prior to placing concrete.

1.2 PROJECT CONDITIONS

A. HDPE pipe for intake air vent.

B. HDPE pipe for instrument lines within outlet works tower walls.

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D 3350-10a	Polyethylene Plastic Pipe and Fittings Materials
2.	ASTM F 714-10	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on outside diameter
3.	ASTM F 2206-11	Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
4.	ASTM F 2620-09	Heat Fusion of Polyethylene Pipe and Fittings

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittals.

B. RSN 33 11 18-1, Approval Plans:

1. Work plans for approval.
2. Describe equipment and methods to be used to store and handle pipe, clean existing pipe, and join pipe sections.
3. Include manufacturer’s instructions for making butt fusion joints.

C. RSN 03 11 18-2, Certifications:

1. Manufacturer's certification that raw materials and pipe meet specification requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Prevent damage to pipe and fittings during unloading, storing, transporting, and laying.

B. Transport fittings with padded bolsters between the pipes. Use heavy padding under ties.

C. Store and handle pipe in accordance with manufacturer’s recommendations.

PART 2 PRODUCTS

2.1 HDPE PIPE

A. Pipe: ASTM F 714, SDR or DR indicated on drawings. NPS 20, Schedule 80 (1.031 inch wall thickness)

B. Material: PE 3408 polyethylene material conforming to ASTM D 3350, Cell Classification 345464C or 345464E.

C. Joining System: Butt fusion joints.

2.2 FITTINGS AND COUPLINGS

A. Couplings and connections at structures and encasements: Fabricated from HDPE.

B. HDPE fittings: In accordance with ASTM F 2206 and as shown on drawings.

PART 3 EXECUTION

3.1 AIR VENT PIPE AND PIPE FOR HYDRAULIC LINES INSTALLATION

A. Install and join pipe in accordance with manufacturer’s recommendations, ASTM F 585, and as indicated on drawings.

B. Join pipe by heat fusion in accordance with ASTM D 2620 and manufacturer’s instructions. Examine joints for defects.

C. Removal of interior beads from air vent pipe and pipe for instrumentation lines is not required.

D. Maintain in correct position and alignment during installation and subsequent construction operations.

E. Attach locator tape to air vent pipe and instrumentation line pipes prior to placing concrete.

F. Keep pipe interior free of embankment materials, dirt, and foreign material.

3.2 CONTRACTOR FIELD QUALITY TESTING

A. Hydrostatic Test:

1. Contractor shall perform hydrostatic test in presence of COR.
2. HDPE embedded pipe shall be joined before hydrostatic test. Use clean water with temperature of 70 degrees F or less.
3. Maintain pressure in pipe for 3 hours and examine installation for leaks during test.
4. Allowable leakage: None
5. Correct defects identified by test in manner approved by manufacturer and COR.
6. Provide all pressure testing heads, pumps, gauges and other equipment necessary to perform tests.

END OF SECTION

This page intentionally left blank.

SECTION 33 42 13

PIPE CULVERTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Chlorinated Polyvinyl Chloride (CPVC) pipe culvert installation at the location indicated on the Drawings shall be in accordance with the requirement s of the Section 501, Pipe Culvert and Storm Drains, of the 2008 or the most recent edition of the Standard Specifications of Arizona Department of Transportation. However Section 501 was modified to include the additional items as follows.

1.2 SUMMARY

A. Section Includes:

1. Chlorinated Polyvinyl Chloride pipe culvert.
2. Bedding and backfilling.
3. Slope stabilization at pipe ends.

B. Related Sections:

1. Section 31 20 00 – Structure Backfill.
2. Section 31 37 00 - Riprap.
3. Section 31 23 02 – Compacting Earth Materials.
4. Section 32 15 10 – Gravel surfacing.

1.3 MEASUREMENT AND PAYMENT

A. Pipe Culvert:

1. Basis of Payment: Lump sum item incidental to the “Relocate and Reconstruct BIA Road 8077” bid item.
2. Payment Includes: Excavation, hand trimming excavating; removing soft subsoil, bedding fill, compacting; pipe, fittings and accessories assembled; repair of damaged coating; Type 3 riprap, non-woven geotextile under riprap, anchors and other accessories, riprapping.

1.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, 305- to 915-mm (12- to 36-In.) Diameter.

2. AASHTO T99 - Standard Specification for the Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 in.) Drop.

3. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D1784-06 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

3. ASTM F441/F441M-12 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

C. State of Arizona Department of Transportation, 2008 Standard Specification.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal.

B. RSN 33 42 13-1, Product Data: Submit data on pipe, fittings and accessories.

C. RSN 33 42 13-2, Manufacturer's Certificate: Certify Products meet or exceed the requirements of ASTM F441.

D. RSN 33 42 13-3, Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

PART 2 PRODUCTS

2.1 CPVC PIPE CULVERT

A. CPVC:

1. Shape: Circular with nominal diameter of 24 inches.

2. Schedule: 40.

3. Type IV, Grade I CPVC compound with a minimum Cell Classification of 23447 per ASTM D1784.

2.2 BEDDING AND COVER MATERIALS

A. Bedding: Aggregate base course as per Subsection 501-3.02 of the 2008 Standard Specifications of Arizona Department of Transportation.

B. Pipe culvert backfilling and cover compaction shall be in accordance with the requirements of Section 31 20 00, Structure Backfill.

2.3 ACCESSORIES

A. Pipe Ends:

1. Type 3 rock riprap at both ends as specified in Section 31 37 00.
2. Use non-woven geotextile under the riprap.
3. Anchor the geotextile to the subgrade by the anchor stakes.
4. Flare outlet to spread the flow.

PART 3 EXECUTION

In addition to the requirements of the Subsection 501-3 of the Standard Specifications of Arizona Department of Transportation, the contractor shall comply with the following requirements at time of construction.

3.1 EXAMINATION

A. Administrative Requirements:

1. Verification of existing conditions before starting work.

B. Verify excavation base, cut dimensions, and placement elevations as in BIA Road 8077 construction dictated on the Drawings.

3.2 PREPARATION

A. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

B. The date of pipe installation shall be in accordance with the BIA Road 8077 construction time. No cutting or trenching is allowed after the completion of BIA Road 8077.

3.3 EXCAVATION AND BEDDING

A. Excavate culvert trench to 12 inches below pipe invert. Hand trim excavation for accurate placement of pipe to elevations indicated on the drawings.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

D. Trench width: as specified on the Drawings.

3.4 INSTALLATION - PIPE

A. Install in accordance with manufacturer’s recommendations

B. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

C. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope as indicated on the Drawings.

D. Install cover at sides and over top of pipe.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

F. Do not displace or damage pipe when compacting.

3.5 PIPE ENDS

A. Place Type 3 riprap rocks at pipe ends and at embankment slopes as indicated on the Drawings.

3.6 QUALITY CONTROL

A. Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Material Testing: In accordance with ASTM F441.

C. Pipe: Flame Spread rating < 25 and a Smoke Development rating < 50 when tested and listed for Surface Burning Characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.

D. Compaction Testing: In accordance with AASHTO T180.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 46 36

TOE DRAINS AND INSPECTION WELLS

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. 12-inch Diameter Slotted PVC Pipe:

1. Measurement: No measurement will be made for this item.
2. Payment: Lump sum price offered in the schedule for Furnish and Install Toe Drains.

B. 12-inch Diameter Non-slotted PVC Pipe:

1. Measurement: No measurement will be made for this item.
2. Payment: Lump sum price offered in the schedule for Furnish and Install Toe Drains.

C. Inspection Wells:

1. Measurement: No measurement will be made for this item.
   a. Includes:
      1) Precast reinforced concrete manhole sections.
      2) Cast in place concrete bases.
      3) Flow measurement devices incorporated in manholes.
      4) Hatches.
      5) Ladders.
2. Payment: Lump sum prices offered in the schedule for Furnish and Install Precast Concrete Culverts, Wingwalls, Headwalls and Manholes and Furnish and Install Miscellaneous Metalwork.

D. Drain Cleanouts:

1. Measurement: No measurement will be made for this item.
2. Payment: Lump sum price offered in the schedule for Furnish and Install Toe Drains.
   a. Includes steel pipe and locking cap and cover.

E. Quantities:

1. Filter Sand Material: Include in quantities measured for Filter Sand in accordance with Section 31 24 12 - Sand Filter.

2. Gravel Drain Material: Include in quantities measured for Gravel Drain in accordance with Section 31 24 16 - Gravel Drain.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1.	AASHTO M 252-08	Corrugated Polyethylene Drainage Pipe
2.	AASHTO M 294-08	Corrugated Polyethylene Pipe, 300- to 1200-mm Diameter
3.	AASHTO SSHB-02	Standard Specifications for Highway Bridges, Seventeenth Edition

B. ASTM International (ASTM)

1.	ASTM A 53/A 53M-08	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2.	ASTM A 760/A 760M-06	Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
3.	ASTM C 33/C 33M-08	Concrete Aggregates
4.	ASTM C 478-09	Precast Reinforced Concrete Manhole Sections
5.	ASTM C 923-08	Resilient Connections Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
6.	ASTM C 990-08	Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible joint Sealants
7.	ASTM D 1785-99	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
8.	ASTM D 2466-99	Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
9.	ASTM D 3350-08	Polyethylene Plastic Pipe and Fittings Materials
10.	ASTM F 477-08	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
11.	ASTM F 714-08	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
12.	ASTM F 2206-11	Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock

C. Bureau of Reclamation (USBR)

1. USBR Tentative Standard for Large Diameter Polyethylene and Polyvinyl-Chloride Corrugated Drainage Tubing and Foamed Smooth Wall ABS Drain Pipe, January 1981.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 33 46 36-1, Approval Data:

1. Excavation plan:

a. Method for supporting open trench walls.

2. Pipe Data:

a. Details and materials for pipe connections and anticipated field fabricated joints.

3. Installation plan:

a. Manufacturer’s installation instructions.

b. Method for connecting new pipes to existing pipes and inspection wells.

c. Method to protect pipe and hold pipe in place during backfill.

d. Method for working backfill material under haunches.

e. Method for cleaning pipe after installation.

f. If the Contractor proposes to use construction equipment that exerts a load greater than H-20 loading on the top of the pipe, submit details of the proposed methods, crossing location, equipment type, loading conditions, and other pertinent details.

4. Testing and video inspection plan:

a. Details, procedures, and sequences of testing and video inspection of drain and outfall.

C. RSN 33 46 36-2, Certifications:

1. Manufacturer's certification that raw materials and pipe meet specification requirements.

2. Certifications that filter and drain materials meet specifications.

D. RSN 33 46 36-3, Samples:

1. Three, 1 foot long samples of each size of perforated pipe and nonperforated pipe sampled from each lot of pipe to be used in work.

2. Label each sample with project name, specifications number, manufacturer=s name, product name, date of manufacture, and manufacturer=s lot identification number.

3. Deliver samples to COR.

E. RSN 33 46 36-4, Survey Reports:

a. Location (northing, easting, station, offset, and elevation) of pipe, inspection wells and weir plates.

F. RSN 33 46 36-5, Final Inspection Video:

1. DVD format with audio recording documenting video inspection of drains.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pipe:

1. Store and handle in accordance with manufacturer's recommendations.

2. Do not use rope, cable, or chain slings for handling pipe. Canvas slings not less than 12 inches wide may be used for handling pipe.

3. Protect pipe from damage and prevent dirt from getting inside pipe when lowering pipe into trench, laying pipe, and positioning pipe.

PART 2 PRODUCTS

2.1 POLYETHYLENE PIPES

A. Slotted and Non-Slotted PVC Pipe:

1. Pipe Material: Type I, Grade I Polyvinyl Chloride (PVC) compound with Cell Classification of 12454-B per ASTM D1784.

2. Wall Thickness: Dimension ratio of 18.

3. Schedule 80.

4. Color: White.

B. Pipe Slots:

1. Cut slots in accordance with following:

a. Type A – Sand Blanket Drain Pipe

1) Six rows of perpendicular slots at 1/2-inch spacing conforming to AASHTO M 294.

2) Slot Width: 0.015 inch.

3) Slot Length: 2.2 inch.

4) Inlet area: 4.0 square inches per foot of pipe.

5) Evenly distribute slots in rows around length and circumference of pipe.

6) Remove burrs from slots.

b. Type B – Zoned Blanket Drain Pipe

1) Six rows of slots at 2-inch spacing conforming to AASHTO M 294.

2) Slot Width: 0.125 inch.

3) Slot Length: 2.2 inch.

4) Inlet area: 30 square inches per foot of pipe.

5) Evenly distribute slots in rows around length and circumference of pipe.

6) Remove burrs from slots.

C. Joining System: Butt fusion joints.

D. Fittings:

1. Includes bends.
2. In accordance with ASTM F 2206.
3. Material: Same as specified for pipe.

2.2 OUTFALL SCREEN

A. Stainless steel wire cloth:

1. Stainless steel, Type 304 or 316.
2. Mesh openings per linear inch: 2 by 2
3. Wire diameter, minimum: .080 inches

B. Bands for screen:

1. Stainless steel, Type 304 or 316.
2. Thickness, minimum: 10 gauge.
3. Width, minimum: 1/2 inch

2.3 DRAIN CLEANOUT

1. CMP pipe: ASTM A 760, Type I.
   a. Corrugations: 2-2/3-inch by 1/2-inch, annular or helical.
   b. Sheet thickness: 16 gauge
2. Fabricate cover in accordance with Section 05 50 00 – Metal Fabrications and Drawing No. 40-D-6720.

2.4 INSPECTION WELLS

A. Precast reinforced concrete manhole sections:

1. Riser sections: ASTM C 478.

a. Lifting devices:

1) Eyebolts, hooks, other devices cast into risers to facilitate lifting and positioning, and to provide balanced lift.

2) Designed for adequate strength with a factor of safety to carry anticipated loads during handling and installing of riser sections.

b. Make openings for pipe inlets and outlets at locations shown on drawings.

2. Joint sealants: ASTM C 990

B. Connections to inlet and outlet pipe: Resilient connector in accordance with ASTM C 923.

C. Base slab:

1. Cast-in-place or precast reinforced concrete slab.

2. Dimensions and reinforcement shown on drawings.

3. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

D. Weir divider wall: In accordance with Section 03 30 00 – Cast-In-Place Concrete.

E. Staff gauge:

1. Style C manufactured by Stevens Water Monitoring Systems, Inc.5465 SW Western Ave., Suite F, Beaverton, OR 97005; or equal, with the following essential characteristics:

a. Porcelain enameled 18 gage iron or steel.

b. 2-1/2 inches wide.

c. Markings and holes shown on Drawing No. 40-C-71.

1) Black numbers on white background.

2) Graduated to hundredths of a foot and marked at every tenth of a foot and every foot.

3) Holes: Grommeted.

F. Cast or Precast Concrete Cover Sections:

1. Cast reinforced concrete cover.

2. Dimensions are 8-feet inside diameter by 10-inches thick as shown on drawing. Reinforcement shall be No. 4 reinforcing bars at 6 inch spacing each way on each face.

3. Recessed lifting tabs as shown on drawing.

4. In accordance with Section 03 30 00 – Cast-In-Place Concrete.

G. Ladders: In accordance with Section 05 50 00 – Metal Fabrications.

H. Toe Drain Inspection Well Access Cover:

1. "Single Leaf Access Door – Type S" single leaf access door manufactured by The Bilco Co., PO Box 1203TR, New Haven CT 06505; or equal, having the following essential characteristics:

a. 36-inch by 30-inch extruded aluminum frame.

b. 1/4-inch Aluminum diamond plate cover.

c. Torsion/cam operating mechanism.

d. Standard slam lock.

e. Removable square key wrench.

f. Automatic hold open arm.

g. Continuous neoprene cushion.

h. Steel cast hinges

i. Lock strike.

I. Joint sealants: RU-106 – RUBR-NEK LTM, manufactured by Henry Company – Sealant Division, 909 North Sepulveda Blvd., El Segundo, CA 90245, www.henry.com, or equal with the following essential characteristics:

1. Vulcanized butyl rubber sealant.

2. Specific gravity at 77^0 F 1.2 to 1.35.

3. Conforms to ASTM C 990-06.

2.5 SLOTTED PVC SCREEN & CAP (Stilling Well)

A. Slotted PVC screens

1. 4-inch nominal diameter 3-feet 9-inches in length.

2. 6 rows of 0.020-inch slots to within 1-inch of each end.

3. 4-inch nominal diameter pipe caps.

4. ASTM D-2466 Schedule 40 PVC slip-on type.

2.6 SLOTTED PVC SCREEN MOUNTING BRACKET

A. In accordance with Section 05 50 00 – Metal Fabrications.

a.

2.7 PULLBOXES

A. Underground composite enclosure model number PC1730BB12 and cover number PC1730CG00 manufactured by Quazite, 3621 Industrial Park Drive, Lenoir TN 37771; or equal, having the following essential characteristics:

1. Open bottom heavy duty pull boxes with two mouseholes.
2. Concrete gray in color.
3. Rated for at least 7,500 pounds over a 10-inch by 10-inch area.
4. Temperature tested to minus 50 degrees F.
5. Compressive strength shall be 11,000 pounds per square inch, minimum.
6. Overall boxes size: 17-inches by 30-inches by 12-inches tall, with open base.
7. Heavy duty bolt on cover with gasket and 2 bolts.

B. Penta-head bolts part number 80023 as supplied by Quazite, 3621 Industrial Park Drive, Lenoir TN 37771; or equal, having the following essential characteristics:

1. Stainless steel.
2. Tamper- and corrosion-resistant screws.
3. Only a penta socket can install or remove.

C. Penta-head socket number 82920 as supplied by Quazite, 3621 Industrial Park Drive, Lenoir TN 37771; or equal, having the following essential characteristics:

1. $^{3}/_{8}$" square drive.
2. 2" in length.

2.8 CONDUIT

A. Nonmetallic High-density Polyethylene Flexible:

1. Nominal inside diameter: 2-inches
2. Pre-lubricated
3. Extruded flexible high-density polyethylene resin type.
4. Smooth wall.
5. Does not retain coiled shape when removed from roll.
6. Color: Orange.

2.9 FILTER SAND AND GRAVEL DRAIN MATERIALS

A. Gradations of filter sand and drain material will be verified in-place after compacting Filter.

B. Sand Filter shall meet the specifications of Section - 31 24 12 Sand Filter.

C. Gravel Drain shall meet the specifications of Section - 31 24 16 Gravel Drain.

PART 3 EXCECUTION

3.1 PIPE INSTALLATION

A. Install pipe at locations indicated on drawings or as directed by the COR.

B. Lay pipe to the elevations, lines, and grades shown on the drawings or as approved.

C. Cap or plug ends of pipe during periods of no work.

D. Protect pipe ends from damage. Remove or replace broken, cracked, or unsuitable pipe and replace at no additional cost to the Government.

E. Before and during assembly of a joint, keep all parts free of mud, oil, or grease. Keep the pipe interior free from deposits of mud, sand, gravel, or other foreign matter and in good working condition until the contract is complete and accepted.

F. Joining pipe:

1. The couplings shall have close fit with the pipe and shall maintain alignment of the pipe and prevent separation of the joints.

G. Angle points and curvilinear drain alignments:

1. Construct bends using manufacturer’s standard pipe bends.
2. Making curvilinear alignments in the field by pulling pipe into radius bends will not be allowed.

H. Cover outfall ends of drain pipe with stainless steel screen. Securely attach to end of pipe with stainless steel bands.

I. Attach locator tape to entire length of all pipe runs.

J. Keep excavations dry.

3.2 INSPECTION WELL INSTALLATION

A. After cast-in-place slab has cured for at least 7 days, secure riser section in mortar to base slab and sealed with approved sealant to provide a watertight joint.

B. Install riser sections and cover with joint sealants.

C. Install pipe entrances in accordance with manufacturer’s instructions.

D. Install ladders and covers in accordance with Section 05 50 00 - Metal Fabrications.

E. Tolerance:

1. Deviation for vertical for installed well: 1/2-inch in 10 feet.

3.3 BACKFILL

A. Maintain pipe grade and alignment during placement of material adjacent to and over pipe. Provide complete circumferential support for pipe to prevent uneven pressures and unacceptable ring deflections.

B. Use special compaction techniques adjacent to pipe in accordance with Section 31 23 02 - Compacting Earth Materials.

C. Fill trenches above drain materials.

D. Do not backfill until installed pipe has been inspected and approved by the COR.

E. Do not permit equipment travel over pipe until backfill material has been placed to a minimum depth of 3 feet over the top of the pipe, or to a greater depth when recommended by the pipe manufacturer.

1. After minimum earth covers are in place, the maximum equipment loading allowed over the pipe shall be H-20 loading in accordance with the AASHTO SSHB.

2. Before using construction equipment that exerts a load larger than H-20 loading on the top of the pipe, submit details of the proposed methods, crossing location, equipment type, and loading conditions to COR for approval.

3.4 CLEANING DRAIN PIPE

A. Maintain inside of pipes clean during construction.

B. Before performing final video inspection, clean drain lines and outfalls to remove deposits of mud, sand, gravel or other foreign matter.

3.5 VIDEO INSPECTIONS

A. Perform inspections at the following locations and intervals:

1. Final video inspection

a. After completing earthwork placement over toe drain to final line and grade.

B. Video Camera:

1. Closed-circuit television video camera specifically designed and built for pipe inspection.

2. Capable of accessing pipe installed on a 0.44 slope.

3. Capable of negotiating corners and bends.

4. Equipped with 360-degree radial view rotating head and zoom lens.
5. Operable in 100 percent humidity.
6. Include footage indicator and audio recording to allow documentation of locations and problems along pipe.
7. Capable of recording images in color.
8. Capable of providing 1,000 feet of tether.
9. Operated and controlled via the cable tether.

C. Lighting for Video Inspection:

1. Allow clear, focused image of entire periphery of pipe, observable on television monitor.
2. Include variable intensity control, remotely controlled from the monitoring station.
3. Adjust lighting to minimize glare.

D. Perform inspection in presence of COR. Notify COR, in writing, of date and time of inspection at least 5 days before inspection.

E. Rate of camera movement along pipe, maximum: 30 feet per minute.

F. Record one reach of pipe per video tape. One reach of pipe shall be one continuous section as indicated on drawings.

G. Provide convenient access for Government personnel to view monitoring during inspection.

H. Record inspection on CD in DVD format.

I. Mark each CD and CD with date; time; pipe segment location; contract name and number; and Contractor name, address, and phone number.

J. Document camera location by superimposing continuous distance record on recorded image.

K. Provide voice-over recording of date, time, and pipe segment location on tape.

L. Document obstructions and anomalies observed in pipe as part of audio record.

M. Clean and flush deposits of mud, sand, gravel or other foreign matter encountered during the final video inspection. After cleaning, re-inspect the pipe to assure no deposits of mud, sand, gravel or other foreign matter remain in the pipe.

END OF SECTION

This page intentionally left blank.

SECTION 34 71 13
GUARDRAIL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Guardrails along BIA Road 8077 at the locations indicated on the Plans shall be in accordance with requirements of the Section 905 of the 2008 or the most recent edition of the Standard Specifications of Arizona Department of Transportation.

B. Guardrails shall comply with the details as shown on the Drawings and the manufacturer's specifications.

1.2 MEASUREMENT AND PAYMENT

A. List of items covered by this section includes:

1. Steel guardrail.
2. Wood posts.
3. Tangent guardrail terminal.
4. Delineations.
5. All required hardware items such as nuts, bolts, anchors, washers and other accessories to end closures and complete in place.
6. All labor, earth work, sleeving through concrete, backfilling and compacting at posts to end closures and complete in place.

B. Basis of Payment: Incidental to the "Relocate and Reconstruct BIA Road 8077" bid item.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M180 - Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail.
2. AASHTO-AGC-ARBTA - A guide to Standardized Highway Barrier Hardware.

B. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A428/A428M - Standard Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles.
5. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
7. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

C. American Wood-Preservers' Association:

1. AWPA C14 - Wood for Highway Construction - Preservative Treatment by Pressure Processes.

D. State of Arizona Department of Transportation, 2008 Standard Specification.

E. MUTCD, 2009, Section 3F.04, Delineator Placement and Spacing.

F. Forest Stewardship Council:

1. FSC Guidelines - Forest Stewardship Council Guidelines.

1.4 SYSTEM DESCRIPTION

A. Guardrail Height, Post Spacing and Foundation Depth: As indicated on Drawings.

B. Guardrail terminal:

1. Tangent type terminal for Test Level 2 manufactured by the indicated brands.

C. Guardrail system over the box culvers:

1. Due to the limited distance (3 feet) between the box culverts and road surface, the number of posts shall be double in order to have 3' 1.5" spacing between posts at locations indicated on the drawings.
2. Install double thick W-beam where guardrail is crossing over the box culvers at locations indicated on the drawings.

D. Delineation system:

1. Install reflector tabs on the W-beams every 6 posts:
    a. Install reflector tabs on the W-beams every other post at Sta. 17+55 to 19+50 and Sta. 22+50 to the end where there are radial sections.
2. Install flexible markers on the wood posts every 6 posts beginning on the post number 10 except:
    a. Install flexible markers on the wood posts every other post from Sta. 7+90 to Sta. 8+45, both sides of BIA Road.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. RSN 34 71 13-1, Shop Drawings: Indicate plan layout, terminals, spacing of components, post foundation dimensions, impact head, anchorage, and schedule of components.

C. RSN 34 71 13-2, Product Data: Submit data on rail, terminals, posts, accessories, hardware and structural capabilities of rail section.

D. RSN 34 71 13-3, Manufacturer's Installation Instructions: Submit installation requirements and post foundation anchor bolt templates.

E. RSN 34 71 13-5, Manufacturer’s Certificate: Certify Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Guardrail Tangent Terminal for Test Level 2:

1. Use one of the following produces:

    a. SKT-350 by Road Systems, Inc.

    b. ET 2000+ by Trinity Industries.

2.2 MATERIALS

A. Qualified materials shall comply with the requirements of the Section 905 and 1012 of the 2008 or the most recent edition of the Standard Specifications of Arizona Department of Transportation as indicated on the Drawings.

B. Guard rail posts and blocks are to be treated, smoothed on four sides (S4S), and SG rated at 1,500 psi minimum, in accordance with AASHTO-AGC-ARBTA

C. Guardrail tangent terminal shall be adequate for Test Level 2.

D. Reflectors:

1. Durable.

2. Bright delineation.

3. Flexible markers shall have suitable application for installing on wood posts.

4. Reflector tabs shall be butterfly bolt-on style and suitable for being installed on the W-beam.

PART 3 EXECUTION

3.1 PREPARATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify location of underground utilities and adjust location of posts to avoid damaging utilities.

3.2 QUALITY CONTROL

A. Quality Requirements: Field inspecting and measurements.

B. Perform work in accordance with Section 905 of the Standard Specifications of Arizona Department of Transportation.

3.3 INSTALLATION

A. Guardrails and guardrail terminals shall be installed in accordance with the requirements of this specification as well as manufacturer's specifications and approved drawing including all details, hardware, hardware quantities and other information.

B. Do not use a wood guardrail post that has a through check, shake, or end slit in the same plane as, or a plane parallel to the bolt hole and extending from the top of the post to within 3 inches of the bolt hole.

C. Guardrail over box culvert:

1. Wood posts spacing shall be 3' 1.5" when guardrail is passing over box culverts approximately from BIA Road Sta. 8+00 to 8+40.
2. Double thick W-beam shall be used where guardrail is crossing over the box culvers as indicated on the Drawings.

D. Drive posts plumb to correct elevations, properly spaced and to line and grade as indicated on Drawings.

E. Wood posts shall be set in dug holes or driven, and the area adjacent to the post shall be backfilled and thoroughly compacted.

F. Attach rails securely to posts with anchoring hardware.

G. Guardrail delineation:

1. Reflector tabs shall be installed on the W-beams with the required spacing.
2. Flexible markers shall be mounted with the required spacing on the top of the wood posts in order to form a continuous delineation.

END OF SECTION

SECTION 35 21 10
TRASHRACK

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Trashracks:

1. Payment: Lump sum price offered in the schedule for Outlet Gates, Bulkhead and Trashrack.

1.2 REFERENCES

A. American National Standards Institute (ANSI)

B. ASTM International (ASTM)

1.	ASTM A 240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip
2.	ASTM A 276	Stainless Steel Bars and Shapes
3.	ASTM F 593	Stainless Steel Bolts, Hex Cap Screws, and Studs
4.	ASTM F 594	Stainless Steel Nuts

C. American Welding Society (AWS)

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals

B. RSN 35 21 10-1, Shop Drawings and Calculations

1. Prepared, signed and sealed by registered structural engineer
2. Show size, type, locations, and finishes for all members, bolts, and welds.
3. Identify welds by AWS standard welding symbols. Indicate net weld lengths.
4. Provide material specifications.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A240 and A276, Type 304 or 304L (Type 304L shall be used for all welded components).

B. Headed Anchors:

1. ASTM F593 and F594, Series 300 Stainless Steel.

2.2 FABRICATION

A. Provide trashracks and associated metalwork as specified below and in accordance with drawings.

B. Details of fabrication are per AWS D1.6 for stainless steel.

2.3 CONTRACTOR SOURCE QUALITY TESTING

A. After fabrication, inspect the trashracks in the shop to ensure that the required dimensions and tolerances have been obtained.

B. Check to ensure that trashracks and support beam rotate freely on their respective hinges without binding.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the trashracks as shown on drawings..

B. The surfaces of all metalwork to be embedded in concrete shall be thoroughly cleaned of all dirt, grease, loose scale, grout, mortar, loose rust, and other foreign substances immediately before concrete is placed.

C. All embedded metalwork to be set accurately in position and supported rigidly to prevent displacement during placing of concrete.

D. Check to ensure that trashrack assembly slides freely into its mounting location without binding.

E. Make any required adjustments to the trashrack to the satisfaction of the COR.

F. After final installation, repair any damage to coatings.

END OF SECTION

SECTION 35 22 15
STAINLESS STEEL SLIDE GATES

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Slide Gates:

1. Payment: Lump sum price offered in the Schedule for Outlet Gates, Bulkhead and Trashrack.

   a. Includes cost of gates, wall thimbles, hydraulic cylinders, gate stems and guides, and manually operated hydraulic power units and hydraulic tubing and fittings.

B. Electrical Operated Hydraulic Power Units (Option Bid Item):

2. Payment: Lump sum price offered in the Schedule:

   a. Includes cost of motors, pumps, valves, gauges and necessary electrical equipment, hydraulic tubing and fittings.

1.2 DESCRIPTION OF WORK

A. Furnishing and installing two 12- by 12-inch stainless steel slide gates, hydraulic actuators, gate stems and guides, wall thimbles, and other miscellaneous gate equipment as specified in this Section, and as shown on the Drawings.

B. Furnishing and installing two 36-by 36-inch stainless steel slide gates, hydraulic actuators, gate stems and guides, wall thimbles, and other miscellaneous gate equipment as specified in this Section, and as shown on the Drawings.

C. Furnishing and installing four manually-operated hydraulic power units, connecting hydraulic fluid lines, shutoff valves, and other miscellaneous equipment for four stainless steel slide gates.

D. Furnishing and installing four electrically-operated hydraulic power units, connecting hydraulic fluid lines, shutoff valves, and other miscellaneous equipment for four stainless steel slide gates. (Optional Bid Item).

1.3 REFERENCES

A. American National Standards Institute (ANSI)

B. American Society of Testing and Materials (ASTM)

1.	ASTM A240	Standard Specifications for Chromium and Chromium-Nickel Stainless Steel Plate, sheet, and Strip for Pressure Vessels and for General Applications
2.	ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
3.	ASTM A193/193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
4.	ASTM A194/194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
5.	ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
6.	ASTM B584	Standard Specification for Copper Alloy Sand Castings for General Applications
7.	ASTM D4020	Standard Specification for Ultra-High- Molecular-Weight Polyethylene Molding and ands Extrusion Materials
8.	ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
9.	ASTM F594	Standard Specification for Stainless Steel Nuts

C. American Water Works Association (AWWA)

1.	AWWA C561	Fabricated Stainless Steel Slide Gates
2.	AWWA C541	Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates

D. American Welding Society (AWS)

1. AWS D1.6 Structural Welding Code –Stainless Steel

E. National Fluid Power Association (NFPA)

1. Standards as referred to herein.

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals. Provide technical submittal, demonstrating that all equipment provided conforms completely to the requirements of this Section.

B. RSN 35 22 15-1, Shop Drawings and Data:

1. Data and Drawings for review and approval prior to fabrication, showing details and materials of the stainless steel slide gates, wall thimbles, gate stems and guides, hydraulic cylinders, manual and electric hydraulic power units, and all data required to locate and install the slide gates and accessories.
2. Detailed dimensional drawings indicating overall dimensions and required clearances.
3. Anchoring and mounting details.
4. Make and model of each equipment assembly and component.
5. Weights of equipment assemblies and components, to include stem and slide weight.
6. Manufacturer's catalog information, descriptive literature, Specifications, and identification of materials of construction.
7. Calculations for each gate and service condition demonstrating that the slide gates, gate stems, and appurtenances are designed for this application and in compliance with this specification. Include the following:
    a. Gate opening and closing thrust forces.
    b. Gate actuator and stem sizing calculations.
    c. Stem guide spacing calculations.
    d. Calculations demonstrating that the wall thimbles are capable of withstanding the exterior water load due to the reservoir head of 50 feet. The calculations shall be stamped and signed by a registered professional engineer.
8. Submit drawings and data showing the system schematic, routing, supports, and fitting and valve locations for the hydraulic fluid line tubing from the hydraulic power units to the slide gate hydraulic cylinders.

C. RSN 35 22 15-2, Quality Control Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's written/printed installation instructions.

D. RSN 35 22 15-3, Operation and Maintenance Manual:

1. Submit five hard copies, which shall include the following:
    a. Approved shop drawings and product data.

b. Significant design criteria.

c. Complete, detailed operating instructions for each piece of equipment.

d. Explanations of all safety considerations relating to operation.

e. Information and instructions for lubrication and adjustments.

f. Maintenance instructions with illustrations as necessary.

g. Recommended schedule of maintenance.

h. Lubrication schedule and table of alternate lubricants.

i. List of special tools and equipment required for maintenance.

j. Recommended spare parts list.

E. RSN 35 22 15-4, Warranties: Provide notarized copies.

1.5 DESIGN REQUIREMENTS

A. Design and fabricate gates and frames in accordance with AWWA C561, and as shown on the Drawings.

B. Hydraulic cylinders shall be designed in accordance with AWWA 541 and NFPA.

C. If there is a conflict between AWWA requirements and this specification, this specification shall govern.

D. Gate and frame seating/unseating Head: 30 feet unseating/0 seating head for the upstream guard gate, and 40 feet seating/0 feet unseating for the three lower regulating gates.

1.6 QUALITY ASSURANCE

A. The stainless steel slide gates shall be furnished by a manufacturer having at least 5 years' experience in the design and fabrication of items of equipment of similar size and pressure.

B. Manufacturer's Qualifications: All equipment of the same general type (e.g., slide gates and hydraulic cylinders) shall be of the same manufacturer.

C. Manufacturer's shop welds, welding procedures, and welders: Qualified and certified in accordance with the requirements of ANSI/AWS D1.6.

D. All equipment shall be rated for the specified reservoir head**.**

1.7 HANDLING, DELIVERY, AND STORAGE

A. Handling and Storage instructions shall accompany each slide gate delivered to the site.

PART 2 PRODUCTS

2.1 STAINLESS STEEL SLIDE GATES

A. GENERAL

1. Furnish and install two 36- by 36-inch hydraulically-operated, flush bottom mounted, stainless steel slide gates, frames, wall thimbles, etc., as further detailed in the following sections and as shown on the Drawings. One slide gate shall be installed on the intake tower at sill elevation 7010.00, with 30 feet of unseating head and 0 seating head. The other slide gate shall be installed at the bottom of the intake tower at sill elevation 7000.00, with 40 feet of seating head and 0 unseating head.
2. Furnish and install two 12- by 12-inch hydraulically-operated, flush bottom mounted, stainless steel slide gates, frames, wall thimbles, etc., as further detailed in the following sections and as shown on the Drawings. The two slide gates shall be installed at the bottom of the intake tower at sill elevation 7000.00, with 40 feet of seating head and 0 unseating head.
3. Slide gate manufacturers: Fontaine USA, Inc., Orange, MA; Golden Harvest, Burlington, WA; and Whipps, Inc., Athol, MA; or approved equal.

B. MATERIALS

1. Slide, Frame, Cover Bars, Yokes, Stem, Flush Bottom Retainer Bar, Retainers, and Wall Thimbles: Stainless Steel, ASTM A240 and A276, Type 304 or 304L (Type 304L shall be used for all welded components).
2. Flush Bottom Rubber Seals: Neoprene, ASTM D2000.
3. Stem Couplings: Bronze ASTM B584.
4. Guides: Ultra High Molecular Weight Polymer (UHMW), ASTM D4020.
5. Assembly Hardware and Fasteners: Series 300 Stainless Steel, ASTM A193 and A194.
6. Anchor Bolts: Series 300 Stainless Steel, ASTM F593 and F594.

C. FRAME AND GUIDES

1. The gate frames for the stainless steel slide gates shall be suitable for flush-bottom style gates, and shall be suitable for mounting on embedded wall thimbles. The flange pattern for the gates frames shall match the bolting pattern for the wall thimbles.
2. The gate frame shall be a rigid, welded unit, composed of guide rails and cross bars with a clear opening, as specified. Suitable reinforcement shall be provided to resist all operating loads.

3. The stainless steel guides shall be of formed plates, standard structural or extruded shapes, with a minimum thickness of ¼ inch, designed and fabricated to withstand the total thrust of the gate slide due to the specified water pressure and high sediment loads. The guides shall be of sufficient length to support two-thirds (2/3) the height of the slide, when the gate is fully open.

4. The frame shall positively retain the polymer (UHMWPE) guide/seal strip. Non loosening (prevailing torque) fasteners shall be used on the gate guide assembly. The guide/seal assembly shall be replaceable. The UHMWPE shall be leaf mounted to allow for replacement.

D. WALL THIMBLES

1. The wall thimbles shall be constructed of stainless steel plates with a minimum thickness of ¼ inch. The wall thimbles for the two 36- by 36-inch and two 12- by 12-inch stainless steel slide gates shall have square flange mounts for the slide gate attachments with square openings to form the flow conduits.

2. The wall thimble for the 36- by 36-inch upstream high-level slide gate shall be type E, 21 inches long, as shown on the Drawings. The downstream flange shall be drilled and tapped to match the bolting pattern for the slide gate, and the upstream flange shall be drilled and tapped to match the bolting pattern for the 36- by 36-inch bulkhead gate (to be supplied by a separate specification).

3. The wall thimble for the 36- by 36-inch downstream low-level slide gate shall be type E, 21 inches long, as shown on the Drawings. The upstream flange shall be drilled and tapped to match the bolting pattern for the slide gate, and the downstream flange shall be made with no holes.

4. The wall thimbles for the two 12- by 12-inch slide gates shall be type E, 21 inches long, as shown on the Drawings. The upstream flanges shall be drilled and tapped to match the bolting pattern for the slide gates, and the downstream, flange shall be made with no holes.

5. The wall thimbles shall be designed to withstand the external water load, due to the reservoir head of 40 feet. Calculations shall be provided to demonstrate the external load capability.

6. The wall thimbles shall be furnished with waterstop rings.

E. SLIDES

1. The slides shall be stainless steel plates reinforced with structural shapes welded to the plate, and have a minimum thickness of 1/4 inch for the slide plate and reinforcing structural members.

2. The slides shall not deflect more than 1/360 of the gate span under maximum head.

3. The slides shall be of the flush-bottom design for effective sealing against a sill plate.

4. The stem connections shall be either the clevis type, with structural members welded to the slide and bolts acting as pivot pins, or threaded and bolted (or keyed) thrust nuts supported in welded nut pockets. The clevis or nut pocket of the gate shall be capable of withstanding at least twice the rated thrust of the hydraulic cylinder.

F. GATE SEALS

1. The gate frames shall be equipped with seats/seals to prevent metal-to-metal contact and restrict leakage.

2. The guides shall incorporate ultra-high molecular weight polyethylene (UHMW) seats/seals on both the upstream and downstream sides of the slide. Each seal/seat shall be shaped to act as both a bearing surface and a seal. The top seal shall be mounted on the frame and be of low friction polymer construction.

3. All frame seats/seals shall be attached with stainless steel retainers and/or stainless steel bolts.

4. The top and side seals shall remain in full contact with the slides for effective sealing at any gate position.

5. The slides shall be provided with a replaceable flush bottom neoprene invert seal.

G. GATE STEMS, COUPLINGS, AND GUIDES

6. Gate stems shall be stainless steel, as specified, designed for tensile strength and column loading for the electric motor-operators specified. The gate stem or cylinder rod shall provide a length/radius of gyration (l/r) not greater than 200.

7. Stem guides shall be provided as necessary to achieve the desired column loading capability.

8. Bronze stem couplings shall be provided to connect stem sections together.

H. FABRICATION

1. Each slide gate disc and frame shall be fully assembled in the shop to ensure that the components fit together properly, with proper clearances and alignment.

I. SHOP INSPECTION

1. Notification: Notify the COR in writing a minimum of 10 calendar days in advance of beginning shop tests.

2. Operating Tests: Each slide gate shall be opened and closed at least two times in the shop to demonstrate that the slide moves freely, and there is no binding or unusual noise. To prevent damage to the gate components, the slide may be operated manually by some shop means to prevent overloading the gate frame prior to installation.

3. COR may make visits to the gate manufacturer’s facilities to review progress of the work. Shop testing shall be done in the presence of the COR, unless waived.

2.2 HYDRAULIC CYLINDERS

A. GENERAL

1. Provide two hydraulic cylinders for the 36- by 36-inch stainless steel slide gates, without position transducers; and two hydraulic cylinders for the two 12- by 12-inch stainless steel slide gates, with position indication transducers.

2. The hydraulic cylinders shall be designed and manufactured in accordance with the requirements of the National Fluid Power Association (NFPA) Standards. The hydraulic cylinders shall be high-pressure, non-cushioned type, suitable for a non-shock operating pressure of at least 2,000 psi.

3. DESIGN REQUIREMENTS

1. The cylinders and appurtenances shall be manufactured of stainless steel type 304, suitable for operation submerged ion 10 feet of reservoir water.

2. The cylinder rods shall be chrome-plated 17-4 PH stainless steel with minimum yield strength of 110,000 psi.

3. The double acting pistons shall be packed for drop tight operation with pressure applied in either direction.

4. Wrench flats shall be provided on the cylinder rods at the connections to the gate stem couplings.

5. The bore and rod diameter of the hydraulic cylinders shall be selected to operate the stainless steel slide gates at a maximum of 1,000 psi hydraulic pressure. The hydraulic cylinders and slide gate components shall be capable of withstanding a maximum hydraulic pressure of 1,500 psi without exceeding normal stresses and deflections.

6. The cylinders shall be provided with ports with tapped holes for connecting to O-ring flanges. The cylinder ports shall be located on the left side, when facing upstream for the 36- by 36-inch high-level slide gate, and on the right side, when facing downstream for the three low-level slide gates.

7. The hydraulic cylinders shall be supported by wall brackets attached to the interior of the concrete walls of the intake structure as shown on the Drawings.

8. The hydraulic cylinders for the two 12- by 12-inch stainless steel slide gates shall be equipped with linear displacement, absolute, non-contact, magnetostrictive position transducers, suitable for submergence in 10 feet of reservoir water. The transducers shall be furnished with watertight electrical connections. The sensor mechanical package shall be mounted inside the hydraulic cylinder and the sensor electronics shall be mounted outside the cylinder. The position sensor shall be furnished with an integral RG Type connector and mating plug, and watertight seal for the reservoir pressure. The output signals shall be transmitted to local position indicator panels and to a remote PLC for remote control. The linear displacement position sensors shall meet the following minimum requirements:

a. Type……..Magnetostrictive Displacement

b. Analog output……..4 to 20 Ma, 1200 Ohm load

c. Resolution…….Infinite

d. Linearity……+ or – 0.02% or + or – 0.05 mm

e. Repeatability…….Same as Resolution

f. OperatingVoltage……...12 Volts D.C.

g. Operating Temperature……..-10 to 120 degrees F

The hydraulic cylinders shall be suitable for operation on biodegradable synthetic hydraulic oil.

2.3 MANUALLY-OPERATED HYDRAULIC POWER UNITS

A. GENERAL

1. Two manually-operated hydraulic power units shall be designed, furnished, and installed for operation of each of two 36- by 36-inch stainless steel slide gates. The hydraulic power units shall be located in the control building on top of the intake structure at elevation 7042.50 feet. The hydraulic power unit shall be designed and fabricated with applicable National Fluid Power Association (NFPA) Standards.

B. HYDRAULIC POWER UNIT DESIGN

1. Each hydraulic power unit shall be designed and fabricated as an integrated, self-contained unit consisting of a manual pump, oil reservoir, relief valve, manual four-way directional control valve, check valves, pressure gauge, pilot check valves, filter, shutoff valves, and provisions for connection to one hydraulically-operated slide gate with stainless steel tubing. The units shall be capable of operation at a high altitude of 7,000 feet and climate of -10 to 120 degrees F.

2. Each manually operated pump shall be a two-speed, dual-pressure pump that automatically shifts from the low-pressure, high volume pump to the high-pressure low-volume pump at 300 pounds per square inch pressure. The pump shall have an operating handle approximately 24 inches long, and be located on the unit approximately 25 inches above the floor of the control building. The operating effort shall not exceed 25 pounds. The manually-operated pump shall be equal to Star Hydraulics, Inc., Model CP-15-1500.

3. The oil reservoirs shall be designed and fabricated to suit the 36- by 36-inch slide gates. The reservoirs shall include a drain, access for inspection and cleaning, a filter-breather assembly, and an oil level sight gauge. The oil reservoirs shall be made with small cross-sectional area, so that as the oil level changes with gate position due to stem displacement, the sight gauge can be calibrated and marked to indicate gate position from 0 to 100 percent open.

4. Provide a manually-operated three-position four-way directional valve on each unit to control the flow of oil to the respective slide gate hydraulic cylinder. The directional valve shall allow oil pressure to open or close the slide gate, while returning oil from the hydraulic cylinder to the reservoir.

5. Provide a 3,000 psi pressure gauge, at least 2-1/2 inches in diameter on each unit.

6. A relief valve shall be provided on each unit to limit the operating pressure in the control system to 1,500 psi. The relief valve shall have an adjustable range from 1,000 to 2,500 psi.

7. A pilot-operated check valve shall be provided on each unit, in the hydraulic line to the bottom port of the hydraulic cylinder, so that the slide gate will not close unless hydraulic pressure is applied to the closing port of the hydraulic cylinder.

8. A pressure filter shall be provided on each unit for pump and valve protection. The pressure filter shall be equipped with a 10-micron filter element, with an internal bypass, and a visual indicator. The filter shall use replaceable elements, and 24 spare elements shall be furnished.

9. Shutoff valves shall be provided on each unit for the connection to the fluid line tubing to the hydraulic cylinders, and for removal and replacement of major hydraulic components. The shutoff valves shall be quarter-turn ball valves, rated for a minimum of 3,000 psi. with steel, stainless steel, Acetal resin, or Buna N seals and a hard chrome-plated ball.

10. The connections from the power units to the slide gate hydraulic cylinders shall be furnished with O-ring flanged fittings for ½-inch, 0.065 inch wall, stainless steel fluid line tubing.

11. The hydraulic oil used for filling the hydraulic control system shall be new, clean, biodegradable synthetic hydraulic oil, rust and oxidation inhibiting, suitable for outdoor applications at a temperature range of -10 to 120 degrees F.

12. Depending upon the overall size of the hydraulic power units, a platform may be required to elevate the units so that the manually-operated pump handles are approximately 36 inches above the floor of the control building.

C. FABRICATION

1. Each hydraulic power unit shall be fabricated and assembled into a complete, self-contained unit, suitable for mounting on a concrete slab.

2. The hydraulic components in the hydraulic power units shall be connected with steel hydraulic fluid line tubing of suitable diameter and wall thickness for 2,000 psi. The directional valve, pilot-operated check valve, pressure filter, and relief valve shall be removable without disturbing the connecting piping.

D. SHOP TESTING

1. The COR shall have free entry at all times while tests are being conducted to ascertain that materials being furnished are in accordance with the Contract

Documents. The power unit manufacturer shall notify the COR a minimum of 14 days in advance of shop tests so that the COR may at his option, witness the tests.

2. Each hydraulic power unit shall be tested in the shop to ensure that it delivers the required oil pressure. Each relief valve shall be set to maintain the specified pressure during testing. Each hydraulic power unit shall be operated during testing to demonstrate that all hydraulic components function properly.

2.4 ELECTRICALLY-OPERATED HYDRAULIC POWER UNITS

A. GENERAL

1. Two electrically-operated hydraulic power units shall be designed, furnished, and installed for the operation of each of two 12- by 12-inch stainless steel slide gates. The hydraulic power units shall be located in the control building on top of the intake structure at elevation 7042.50 feet. The hydraulic power units shall be designed and fabricated with applicable National Fluid Power Association (NFPA) Standards

B. HYDRAULIC POWER UNIT DESIGN

1. The hydraulic power units shall be designed and fabricated as integrated, self-contained units consisting of electric motors, manual and motor-driven hydraulic pumps, filters, directional valves, relief valves, counterbalance valves, pressure switches, pressure gauges, shutoff valves, and necessary electrical equipment. The unit shall be arranged with the oil reservoir on top for positive feed to the hydraulic pumps, with the control valves and pump/motor units located underneath.

2. The oil reservoir shall be design and fabricated in accordance with National Fluid Power Association (NFPA) Standards. The capacity of the oil reservoir for the hydraulic pumping unit should be a minimum of 3 times the pump capacity of the unit provided plus the stem displacement. The oil reservoir and any internal piping shall be fabricated from stainless steel, type 304 or 304L. The oil reservoir shall include a drain, access for inspection and cleaning, a filter breather assembly, and an oil level sight gauge and temperature gauge.

3. The operating pressure produced by the hydraulic power unit shall provide 1,000 to 1,500 psi, as determined by the hydraulic cylinder design. The relief valve shall be set at a maximum of 1,500 psi. The pressure switch set at approximately 200 psi greater than the design operating pressure, to shut off the unit at either end of slide gate travel upon pressure rise.

4. One oil pump shall be provided for each unit, to operate at a maximum of 2,000 psi. The oil pump shall be a rotary, positive displacement type, meeting the pressure and flow requirements stated above, and suitable for operation with the hydraulic oil specified. The oil pump shall be furnished with suitable flanges for attaching to the electric motor, and a coupling guard shall be provided if a flexible coupling is installed. The oil pump shall be provided with suitable shaft bearings and seals to prevent leakage. The oil pump discharge rating will be determined

form the maximum available power from the solar cell/battery pack, and shall not exceed the capacity to operate the 12- by 12-inch slide gates at the rate of 4 inches per minute.

5. The electric motor shall provide the necessary power to operate the hydraulic pumps at the maximum pressure required, without exceeding the nameplate rating. The motor shall operate at 12 volt, direct current, at an altitude of 7,000 feet, and a temperature range of -10 to 120 degrees F. Electric power is supplied by a 12-volt battery and solar panel charging system. The electric motor power rating will be limited by the available power from the solar cell/battery pack, but the motor/pump combination shall provide no more than 4 inches per minute of gate travel.

6. One three-position solenoid-operated four-way directional control valve shall be provided in each unit to control oil flow to the slide gate hydraulic cylinder. The directional valve shall be manufactured so that flow through the valve may be reversed and pressure directed to either of two outlets by energizing the proper solenoid. The four-way directional valve shall be double solenoid operated, spring-centered, with manual pushpins. With both solenoids de-energized, and the directional valve centered, the pressure port shall be blocked, and the cylinder ports shall be open to the reservoir. The directional valve shall have the flow capacity of not less than the maximum output from the oil pump, and shall have a minimum rating of 2,000 psi. The solenoids shall be rated at 12 volts, direct current.

7. Provide a pressure switch to control stopping of the oil pump motor. The switches shall be initially set to actuate at 1,700 psi to stop the oil pump motor, with a maximum pressure rating of 3,000 psi. The operation shall use a stainless steel Bourdon tube, with a calibrated dial and external adjustments.

8. The system relief valve shall be a direct pilot type with an internal drain. The relief valve shall be set initially at 1,500 psi, and have a maximum pressure rating of 3,000 psi, with an adjustable range of 800 to 3,000 psi. The flow capacity shall be not less than the maximum flow capacity of the oil pump.

9. Pilot-operated counterbalance valves shall be provided to prevent drifting of the slide gates. The counterbalance valves shall allow free flow in the one direction, but control flow in the opposite direction, by means of a pilot line. The valves shall be rated at 3,000 psi, with an adjustable range of 500 to 2,800 psi, and shall have a flow capacity of at least the maximum flow of the oil pump.

10. The pressure gauges shall be 2-1/2 inch diameter, 0 to 3,000 psi, with stainless steel Bourdon tube operation. The gauges shall withstand an overpressure of 150 percent, and have an accuracy of 0.25 percent over the entire scale. The housing shall be steel or polycarbonate, with a clear acrylic cover. One pressure gauge shall be installed in the hydraulic pump discharge line, and one gauge shall be installed in each line to the hydraulic cylinder ports.

11. The suction filter shall be a replaceable filter-element type, with one corrosion resistant, 200-mesh wire cloth element. The filter capacity shall be 1.5 times the

rated output of one oil pump, and shall filter all the oil passing through the suction line. An automatic bypass shall limit the pressure drop to less than 2 psi, during cold startup or as a result of contamination buildup. A visual indicator shall indicate when servicing is required. Provide 3 spare elements.

12. The pressure filter shall be a replaceable filter-element type, capable of removing 99.5 percent of particles as small as 5 microns. The filter shall be rated at 3,000 psi, with a capacity of at least the maximum combined output of the oil pump. The filter shall filter all the oil passing through the line. Provide a pressure actuated bypass valve connected in parallel with the full-flow filter to limit the pressure drop to 50 psi, either during cold start up or as a result of contamination. A visual indicator shall indicate when servicing is required. The filter shall be furnished with six spare filter elements.

13. Provide ball-type shutoff valves at the conduit connections at the exterior of the unit, as well as internal locations for isolating filters and other components. The ball valves shall be rated at 3,000 psi, with steel, stainless steel, Acetal resin, or Buna N seals and a hard chrome-plated steel ball.

14. An auxiliary manually-operated hydraulic pump shall be furnished as part of the hydraulic control system. The manually operated hydraulic pump shall be a two-speed, dual-pressure pump that automatically shifts from the low-pressure high-volume pump to the high-pressure low volume pump at 300 psi or more. The pump shall have an operating handle 24 inches long, and an overload relief valve setting of 1,800 psi. The operating effort shall not exceed 25 pounds. The manually-operated pump shall be equal to Star, Model CP-15-2000.

15. Provide a control panel integral with each power unit one set of pushbuttons, gate position panel meter (as described below), and A pressure gauge, visible by an operator standing before the panel. Each pushbutton set shall include an OPEN, CLOSE, and STOP pushbutton, electrically connected so that constant pressure on the desired pushbutton during slide gate operation is not required.

16. Provide panel meters for indicating gate position provided from 4 to 20Ma signals from the hydraulic cylinder transducers. The panel meters shall read from 0 to 100 percent open.

17. Provide any other hydraulic/electric components to furnish a complete hydraulic power unit capable of operating the slide gate as specified.

18. The hydraulic oil used for filling the hydraulic control system shall be new, clean, biodegradable, synthetic, hydraulic oil, rust and oxidation inhibiting, suitable for outdoor applications at a temperature range of -10 to 120 degrees F.

C. FABRICATION

1. The hydraulic power unit shall be fabricated and assembled into a complete, self-contained unit, suitable for mounting on a concrete slab. All electrical wiring shall be installed, to connect to the electrical/hydraulic components in a single

enclosure. Suitable terminals shall be furnished for connection to the on-site electrical system.

2. The hydraulic components in the hydraulic power unit shall be connected with steel hydraulic fluid line tubing of suitable diameter and wall thickness. The directional valves, relief valve, and counter-balance valves shall be subplate or stack mounted for removal and installation without disturbing the connecting piping. All internal piping shall be sized for maximum oil velocity of 15 feet per second in pressure lines, and 5 feet per second oil velocity in suction lines. The piping shall have a wall thickness that provides a 6 to 1 factor of safety, based on burst pressure.

D. SHOP TESTING

1. The Owner's representative shall have free entry at all times while tests are being conducted to ascertain that materials being furnished are in accordance with the Contract Documents. The Contractor shall notify the Owner a minimum of 14 days in advance of shop tests so that the tests maybe witnessed, unless waived.

2. The hydraulic power unit shall be tested in the shop to demonstrate that it delivers the required quantity of oil at the specified pressure. The relief valve shall be adjusted to maintain the specified pressure during testing. The hydraulic power unit shall be operated during testing to demonstrate that all the hydraulic and electrical components are properly adjusted and function accordingly. Discharge from the hydraulic pumps shall be measured individually and combined for a minimum of 15 minutes for each case. Any observed leakage in the piping or components shall be repaired and the unit retested.

2.5 HYDRAULIC FLUID LINES AND FITTINGS

A. The hydraulic fluid line tubing shall be ½-inch O.D. by 0.065 inch wall minimum, seamless stainless steel fluid line tubing, ASTM A269, type 304 or 304L.

B. All tubing couplings, elbows, tees, and other fittings required to complete the installation of the hydraulic control system shall be socket weld, stainless steel type 304 or 304L to match the hydraulic fluid line tubing.

C. Threaded connections will only be allowed at the hydraulic cylinders and at the hydraulic power unit connections using suitable threaded adapters and/or tubing fittings.

D. Shutoff valves shall be provided at each port of the hydraulic cylinders and at the hydraulic power unit connections. The shutoff valves shall be socket weld type, quarter-turn, ball valves, suitable for operation at 3,000 psi., with steel, stainless steel, Acetal resin, or Buna N seals and a hard chrome-plated ball.

E. Suitable supports shall be provided to prevent the fluid line tubing from undue sagging and vibration during slide gate operation.

F. Provide a manifold with a shutoff valve at each hydraulic cylinder, as shown on the Drawings, to allow oil to be flushed and circulated through the tubing without entering the cylinder.

G. Provide O-ring flanged unions on the tubing to the hydraulic cylinders, adjacent to the shutoff valves, so that the cylinders can be removed without draining the hydraulic lines.

H. Provide O-ring flanged unions where necessary for tubing installation and disassembly.

2.6 PAINT AND PROTECTIVE FINISHES

A. Do not paint stainless steel and bronze surfaces of the slide gates and appurtenances or the air vent piping embedded in concrete.

B. Shop finish the manually-operated hydraulic power unit as follows

1. Paint Semi-Gloss Alkyd
   a. Surface preparation: SSPC-SP-6, Commercial Blast Cleaning
   b. First Coat: Alkyd Metal Primer 1.5 - 2.5 mils DFT
   c. Second Coat: Alkyd Semi- Gloss Enamel 1.5 - 2.5 mils DFT
   d. Third Coat: Alkyd Semi- Gloss Enamel 1.5 - 2.5 mils DFT
2. Total DFT 4.5 – 7.5 mils

2.7 SHIPPING

A. The slide gates shall be shop assembled and shipped as assembled units.

B. The hydraulic cylinders, gates stems and guides, and hydraulic power units, shall be shipped separately from the slide gates. The hydraulic oil used for shop testing shall be drained from the manually-operated hydraulic power units prior to shipping.

C. All parts of the slide gates shall be crated, wrapped, and otherwise protected from damage during shipment. Any repairs required, including coatings, will be at no cost to the Government.

D. Drain the hydraulic power unit oil reservoirs and secure moveable components to prevent loss or damage by vibration or rough handling. All parts of the power units shall be crated, wrapped, or otherwise protected from damage during shipment.

E. The hydraulic power units shall be stored indoors prior to shipment and while on site prior to installation.

PART 3 EXECUTION

3.1 SLIDE GATE INSTALLATION

A. Install the stainless steel slide gates, frames, wall thimbles, hydraulic cylinders, gate stems and guides, and accessories in accordance with the manufacturer's shop drawings and approved submitted installation instructions.

B. The wall thimbles shall be embedded in the intake structure concrete walls as shown on the Drawings, prior to installation of the slide gates. The wall thimbles shall be installed so that the slide gates will be plumb in the vertical direction and level in the horizontal direction.

C. Provide blockouts in the intake structure floor, adjacent to and upstream of the slide gate wall thimbles for the three downstream slide gates. The blockout dimensions shall be furnished by the gate manufacturer. The blockouts shall be filled with grout, flush with the intake structure floor and gate sills, after installation of the slide gates is complete.

D. The Contractor shall furnish necessary anchor bolts, sealants, gaskets, fasteners, and other hardware for a complete installation.

3.2 HYDRAULIC CONTROL SYSTEM INSTALLATION

A. The four manually-operated hydraulic power units shall be installed in the control building at the top of the intake structure, as shown on the Drawings, and in accordance with the manufacturer's instructions.

B. The contractor shall furnish and install the hydraulic fluid line tubing from the manually-operated and electrically-operated hydraulic power units to the respective slide gate hydraulic cylinders, providing suitable fittings, adapters, valves, and supports, as shown on the Drawings. The hydraulic fluid line tubing shall be ½-inch O.D. by 0.065 inch wall, stainless steel, type 30-4 or 304L. All connections shall be made by using stainless steel socket weld fittings and couplings. No threaded joints will be allowed, except at the slide gate cylinders and hydraulic power units.

C. The electrical connections for two electrically-operated hydraulic power units shall be completed.

D. The position transducers for the two 12- by 12-inch slide gates shall be electrically connected to the panel meters on the two electrically-operated hydraulic power units.

E. The random length tubing shall be cut, prepared for welding, fitted, thoroughly cleaned, and installed, so that all joints are oil tight. For any threaded joints, a suitable thread compound shall be placed on the third of the thread length nearest the end of the tubing or fitting, and no tape will be allowed.

F. Prior to making the final connections, the fluid line tubing shall be tested for leaks by applying internal; pressure at 2,500 psi for a period of 30 minutes. While the hydraulic fluid line tubing is pressurized, check all connections for leaks. Repair any sources of leaks, and repeat the pressure test.

G. Prior to placing the hydraulic control systems in service, the systems shall be flushed as follows:

H. Provide a temporary hydraulic pumping unit and piping for connection to the fluid line tubing.

I. The temporary pumping unit shall be sized to provide sufficient output to achieve a Reynolds Number of 6,000 in the hydraulic fluid line tubing while flushing, using the hydraulic oil specified for the system. The pumping unit shall have a filter for trapping any debris flushed from the hydraulic lines.

J. Install temporary piping or interconnect the tubing so that the flushing oil can be recirculated back to the pumping unit or temporary oil reservoir.

K. Flush the hydraulic lines for one hour, and check the condition of the filter. If necessary, replace the filter element and flush for another hour. If the filter element remains clean, the flushing is complete. If there is still debris in the filter, continue flushing until the filter remains clean.

L. Following the flush operation, remove the temporary pumping unit and temporary piping, and connect the permanent hydraulic lines to the hand-operated pumping units and respective hydraulic cylinders.

M. The hydraulic control system shall be filled with hydraulic oil, which has been strained through a 10-mesh screen. The hydraulic oil furnished for filling the control system shall be new, clean, biodegradable synthetic hydraulic oil, rust and oxidation inhibiting, suitable for outdoor applications at temperature range of -10 to 120 degrees F. The contractor shall flush the hydraulic power unit reservoirs, and completely fill the entire systems.

N. After installation of the slide gates and hydraulic controls systems is complete, each slide gate shall be operated through two complete open and close cycles while unaltered. Observe the gate operation for any unusual noise or vibration. Record the hydraulic control system, pressure required to operate each slide gate.

O. If the reservoir elevation permits, operate each slide gate through two complete open and close cycles while under the available reservoir head at the time of testing. Observe the gate operation for any unusual noise or vibration. Record the hydraulic control system pressure required to operate each slide gate. Measure the leakage through the gates in the closed position to determine if the slide gates meet the leakage requirements of AWWA C561.

P. Touch up any painted surfaces on the hydraulic power units that may have been damaged during installation with the same coating used for the initial coating.

3.3 QUALITY ASSURANCE

A. Manufacturer Inspection

1. The Contractor shall provide for the services of the side gate manufacturer's factory trained personnel to conduct a site visit and inspection of the completed gate installation. The site visit shall be coordinated by the Contractor installing the slide gates.
2. The factory trained personnel shall:
    a. Check the complete installation.
    b. Make necessary adjustments on the slide gates and/or hydraulic control system.
    c. Conduct field testing.
    d. Provide a certificate of proper installation, indicating that the slide gates are installed and functioning properly.
3. The slide gate manufacturer's representative shall be available to provide technical direction through installation, startup tests, and instruction for operating personnel.

END OF SECTION

SECTION 35 22 16

STAINLESS STEEL BULKHEAD GATE

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

A. Bulkhead Gate:

1. Payment: Lump sum price offered in the Schedule for Furnish and Install Outlet Gates, Bulkhead and Trashrack.

a. Includes cost of gate, gate frame, and suspension system.

1.2 DESCRIPTION OF WORK

A. Furnishing and installing one 36-by 36-inch stainless steel bulkhead gate, gate frame, and suspension system, as specified in this Section, and as shown on the Drawings.

1.3 REFERENCES

A. American National Standards Institute (ANSI)

B. American Society of Testing and Materials (ASTM)

1. ASTM A240 Standard Specifications for Chromium and Chromium-Nickel Stainless Steel Plate, sheet, and Strip for Pressure Vessels and for General Applications
2. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
3. ASTM A193/193M Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
4. ASTM A194/194M Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
5. ASTM D2000 Standard Classification System for Rubber Products in Automotive Applications
6. ASTM D4020 Standard Specification for Ultra-High- Molecular-Weight Polyethylene Molding and ands Extrusion Materials
7. ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
8. ASTM F594 Standard Specification for Stainless Steel Nuts

C. American Water Works Association (AWWA)

1. AWWA C561 Fabricated Stainless Steel Slide Gates

D. American Welding Society (AWS)

1. AWS D1.6 Structural Welding Code –Stainless Steel

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals. Provide technical submittal, demonstrating that all equipment provided conforms completely to the requirements of this Section.

B. RSN 35 22 16-1, Shop Drawings and Data:

1. Data and Drawings for review and approval prior to fabrication, showing details and materials of the stainless steel bulkhead gate, gate frame, suspension system, and all data required to locate and install the bulkhead gate and accessories.
2. Detailed dimensional drawings indicating overall dimensions and required clearances.
3. Anchoring and mounting details.
4. Make and model of each equipment assembly and component.
5. Weights of equipment assemblies and components, to include stem and slide weight.
6. Manufacturer's catalog information, descriptive literature, Specifications, and identification of materials of construction.

C. RSN 35 22 16-2, Quality Control Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's written/printed installation instructions.

D. RSN 35 22 16-3, Operation and Maintenance Manual:

1. Submit five hard copies, which shall include the following:

a. Approved shop drawings and product data.
b. Significant design criteria.
c. Complete, detailed operating instructions for each piece of equipment.
d. Explanations of all safety considerations relating to operation.
e. Maintenance instructions with illustrations as necessary.

E. RSN 35 22 16-4, Warranties: Provide notarized copies.

1.5 DESIGN REQUIREMENTS

A. Design and fabricate gates and frames in accordance with AWWA C561, and as shown on the Drawings.

B. If there is a conflict between AWWA requirements and this specification, this specification shall govern.

C. Bulkhead Gate and frame seating/unseating Head: 40 feet seating/0 unseating.

1.6 QUALITY ASSURANCE

A. The stainless steel bulkhead gate shall be furnished by a manufacturer having at least 5 years' experience in the design and fabrication of items of equipment of similar size and pressure.

B. Manufacturer's shop welds, welding procedures, and welders: Qualified and certified in accordance with the requirements of ANSI/AWS D1.6.

C. All equipment shall be rated for the specified reservoir head.

1.7 HANDLING, DELIVERY, AND STORAGE

A. Handling and Storage instructions shall accompany each slide gate delivered to the site.

PART 2 PRODUCTS

2.1 STAINLESS STEEL BULKHEAD GATES

A. GENERAL

1. Furnish and install one 36- by 36-inch stainless steel bulkhead gate, frame, and suspension system, as further detailed in the following sections and as shown on the Drawings. The bulkhead gate shall be installed on the intake tower at sill elevation 7010.00, with 30 feet of seating head and 0 unseating head.

B. MATERIALS

1. Bulkhead Gate, Frame, Cover Bars Flush Bottom retainer Bar, Retainers, and Suspension System: Stainless Steel, ASTM A240 and A276, Type 304 or 304L (Type 304L shall be used for all welded components).
2. Flush Bottom Rubber Seals: Neoprene, ASTM D2000.
3. Guides: Ultra High Molecular Weight Polymer (UHMW), ASTM D4020
4. Assembly Hardware and Fasteners: Series 300 Stainless Steel, ASTM A193 and A194.
5. Anchor Bolts: Series 300 Stainless Steel, ASTM F593 and F594.

C. FRAME AND GUIDES

1. The gate frame for the stainless steel bulkhead gate shall be suitable for a flush-bottom style gate, and shall be suitable for mounting on an embedded wall thimble. The flange pattern for the gate frame shall match the bolting pattern for the wall thimble.
2. The gate frame shall be a rigid, welded unit, composed of guide rails and cross bars with a clear opening, as specified. Suitable reinforcement shall be provided to resist all operating loads.
3. The stainless steel guides shall be of formed plates, standard structural or extruded shapes, with a minimum thickness of ¼ inch, designed and fabricated to withstand the total thrust of the gate slide due to the specified water pressure and high sediment loads. The guides shall be provided with some means of guiding the bulkhead into place while it is being lowered into position by divers.

4. The frame shall positively retain the polymer (UHMWPE) guide/seal strip. Non loosening (prevailing torque) fasteners shall be used on the gate guide assembly. The guide/seal assembly shall be replaceable. The UHMWPE shall be leaf mounted to allow for replacement.
5. A rigid stainless steel invert member of the flush bottom type shall be provided across the bottom of the opening.
6. A rigid tops seal member shall be provided across the top of the opening.

D. WALL THIMBLE MOUNTING

1. The bulkhead gate frame shall be designed to attach to the upstream flange of the wall thimble furnished and installed for the upper level 36- by 36-inch stainless steel slide gate.
2. The frame bolting pattern shall match the bolting pattern of the upstream wall thimble.

E. BULKHEAD GATE

1. The bulkhead gate shall be fabricated from a stainless steel plate reinforced with structural shapes welded to the plate, and have a minimum thickness of 1/4 inch for the slide plate and reinforcing structural members.
2. The bulkhead gate shall not deflect more than 1/360 of the gate span under maximum head.
3. The bulkhead shall be of the flush-bottom design for effective sealing against a sill plate.
4. The bulkhead gate will be installed and removed by divers, and shall have provisions for lifting and lowering the bulkhead gate by means of a hoist installed in the control building at the top of the intake structure. A means of attaching a hoist hook to the bulkhead gate, which can easily be attached and removed, shall be provided.
5. In addition, the bulkhead gate will be stored inside the intake tower control room. Provisions shall be made for suspending the gate from a suspension system that is separate from the hoisting and lowering cable.

F. GATE SEALS

1. The gate frame shall be equipped with seats/seals to prevent met-to-metal contact and restrict leakage.
2. The guides shall incorporate ultra-high molecular weight polyethylene (UHMW) seats/seals on both the upstream and downstream sides of the gate. Each seal/seat shall be shaped to act as both a bearing surface and a seal. The top seal shall be mounted on the frame and be of low friction polymer construction.
3. All frame seats/seals shall be attached with stainless steel retainers and/or stainless steel bolts.
4. The top and side seals shall remain in full contact with the slides for effective sealing at any gate position.
5. The bulkhead gate shall be provided with a replaceable flush bottom neoprene invert seal.

G. SUSPENSION SYSTEM

1. The bulkhead gate is to be stored inside the intake tower control room.
2. A supporting beam or hook system shall be provided to suspend the gate for long periods of time between installations.
3. The suspension system shall be separate from hoist attachment used for raising and lowering the bulkhead gate, and shall not interfere with the installation or removal of the gate.
4. The suspension system shall be fabricated from stainless steel, and shall be attached to the intake structure with stainless steel fasteners.

H. FABRICATION

1. The bulkhead gate and frame shall be fully assembled in the shop to ensure that the components fit together properly, with proper clearances and alignment.
2. The suspension system shall be assembled in the shop and trial fit to the bulkhead gate.

I. SHOP INSPECTION

1. Notification: Notify the COR in writing a minimum of 10 calendar days in advance of beginning shop tests.
2. Operating Tests: The bulkhead gate shall be inserted and removed at least two times in the shop to demonstrate that the slide moves freely, and there is no binding or unusual noise.
3. The suspension system shall be attached to the bulkhead gate to demonstrate proper fit and ease of operation.
4. COR may make visits to the gate manufacturer's facilities to review progress of the work. Shop testing shall be done in the presence of the COR, unless waived.

2.2 PAINT AND PROTECTIVE FINISHES

A. Do not paint the bulkhead gate, suspension system, and appurtenances.

2.3 SHIPPING

A. The bulkhead gate shall be shop assembled and shipped as an assembled unit.

B. The suspension system shall be shipped as an assembled unit or as multiple units.

C. All parts of the bulkhead gate and suspension system shall be crated, wrapped, and otherwise protected from damage during shipment. Any repairs required, will be at no cost to the Government.

PART 3 EXECUTION

3.1 BULKHEAD GATE INSTALLATION

A. Install the stainless steel bulkhead gate, frame, suspension system, and accessories in accordance with the manufacturer's shop drawings and approved submitted installation instructions.

B. The bulkhead gate frame shall be attached to the upstream flange of the upper level stainless steel slide gate wall thimble embedded in the intake structure concrete walls as shown on the Drawings.

C. The suspension system shall be installed at the top of the intake structure, under the control building overhang, as shown on the Drawings. The suspension system shall be carefully aligned for proper support and ease of handling during installation and removal of the bulkhead gate.

D. The Contractor shall furnish necessary anchor bolts, sealants, gaskets, fasteners, and other hardware for a complete installation.

E. The bulkhead gate shall be lowered into the closed position, using the control building hoist, to demonstrate that the bulkhead gate can be easily installed in the gate frame using the available equipment.

F. The bulkhead gate shall be raised from the closed position into the storage location, using the control building hoist, and then attached to the suspension system.

G. With available reservoir head available during construction, the bulkhead gate shall be installed and tested for leakage. The leakage shall not exceed the requirements of AWWA C561 for stainless steel slide gates.

3.2 QUALITY ASSURANCE

A. Manufacturer Inspection

1. The Contractor shall provide for the services of the bulkhead gate manufacturer's factory trained personnel to conduct a site visit and inspection of the completed gate installation. The site visit shall be coordinated by the Contractor installing the bulkhead gate.

2. The factory trained personnel shall:

a. Check the complete installation.
b. Make necessary adjustments on the bulkhead gate.
c. Conduct field testing
d. Provide a certificate of proper installation, indicating that the bulkhead gate is installed and functioning properly.

3. The bulkhead gate manufacturer's representative shall be available to provide technical direction through installation, startup tests, and instruction for operating personnel.

END OF SECTION

SECTION 51 00 00
INFORMATION AVAILABLE TO OFFERORS

PART 1 GENERAL

1.1 ORDER OF PRECEDENCE

A. In case of differences between sections in Section 51 00 00 - Information Available to Offerors and sections in other divisions of the specifications, the requirements in the other divisions will govern.

1.2 ELEVATION DATUM

A. Elevation datum presented on figures herein is NGVD29, except as noted. Elevation datum used for current construction drawings is NAVD88. At the Tsaile Dam location, elevation NAVD88 is equal to elevation NGVD29 plus 3.7 feet.

1.3 FLOOD PEAK AND VOLUME DATA

A. Estimated flood peak flows (cfs), volumes (ac-ft), and reservoir pool elevation (feet – NAVD88) are provided below for cofferdam sizing. Reservoir elevation assumes a starting elevation of 7012 at the onset of the flood event.

Flood Frequency	Peak Flow (cfs)	Volume (ac-ft)	Max. Flood Elev. (ft)
2 year, 24 hour	350	266	7014.0
5 year, 24 hour	590	500	7015.5
10 year, 24 hour	970	783	7017.5
25 year, 24 hour	1680	1283	7021.0
50 year, 24 hour	2410	1761	7024.0
100 year, 24 hour	3300	2334	7027

1.4 RESERVOIR DATA

A. Figures showing reservoir water surface level with time and inflow with time are presented herein.

1.5 EXISTING OUTLET WORKS INTAKE MODIFICATIONS

A. A drawing showing the 1982 modifications made to the outlet works intake structure is presented herein.

1.6 RESERVOIR BATHYMETRY

A. A figure showing reservoir bathymetry upstream of the reservoir within the construction disturbance limits is presented herein, and is based on NAVD88 elevation datum.

1.7 DIVERSION CONCEPT SEQUENCE

A. Three figures showing a diversion concept sequence are presented herein, and are based on NAVD88 elevation datum. It is the responsibility of the Contractor to verify the suitability of the proposed diversion concept sequence, and develop any modifications or changes as needed.

PART 2 PRODUCTS

Not Used

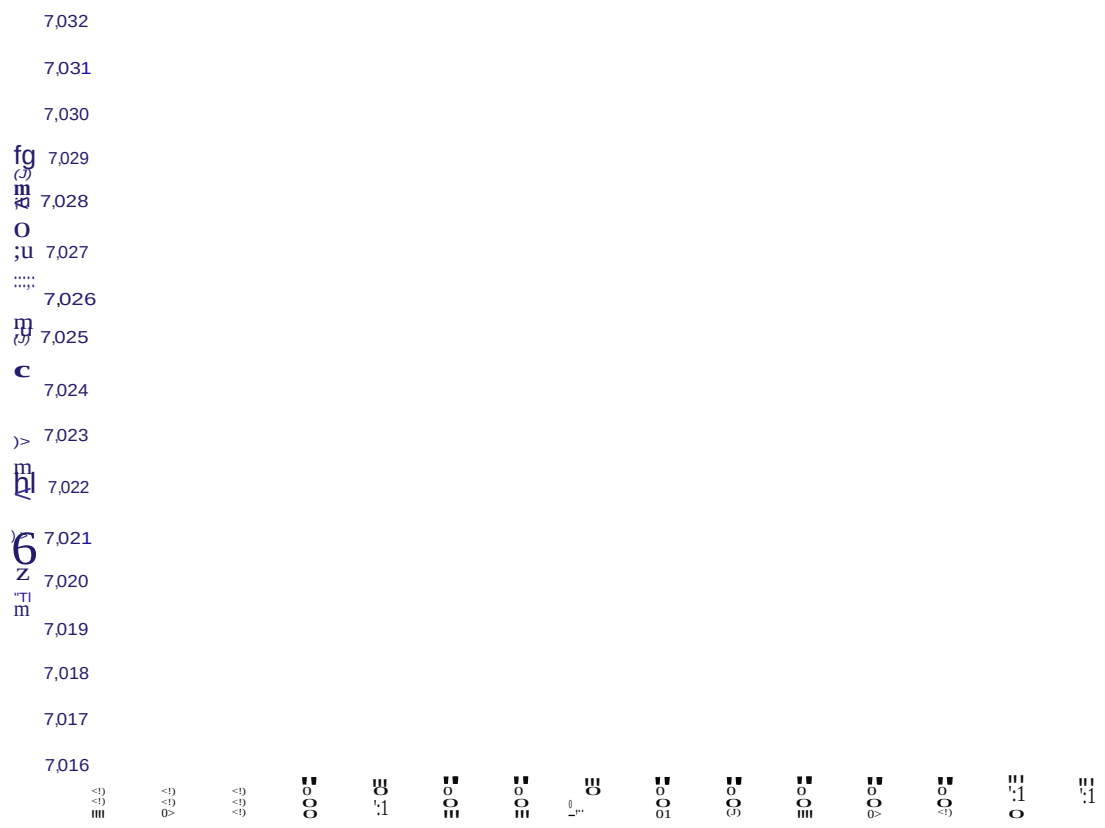
PART 3 EXECUTION

Not Used

TSAILE DAM

Reservoir Elevation

Reservoir



William Pressel

INSTRUMENTATION AND INSPECTIONS GROUP - DENVER (TSC)

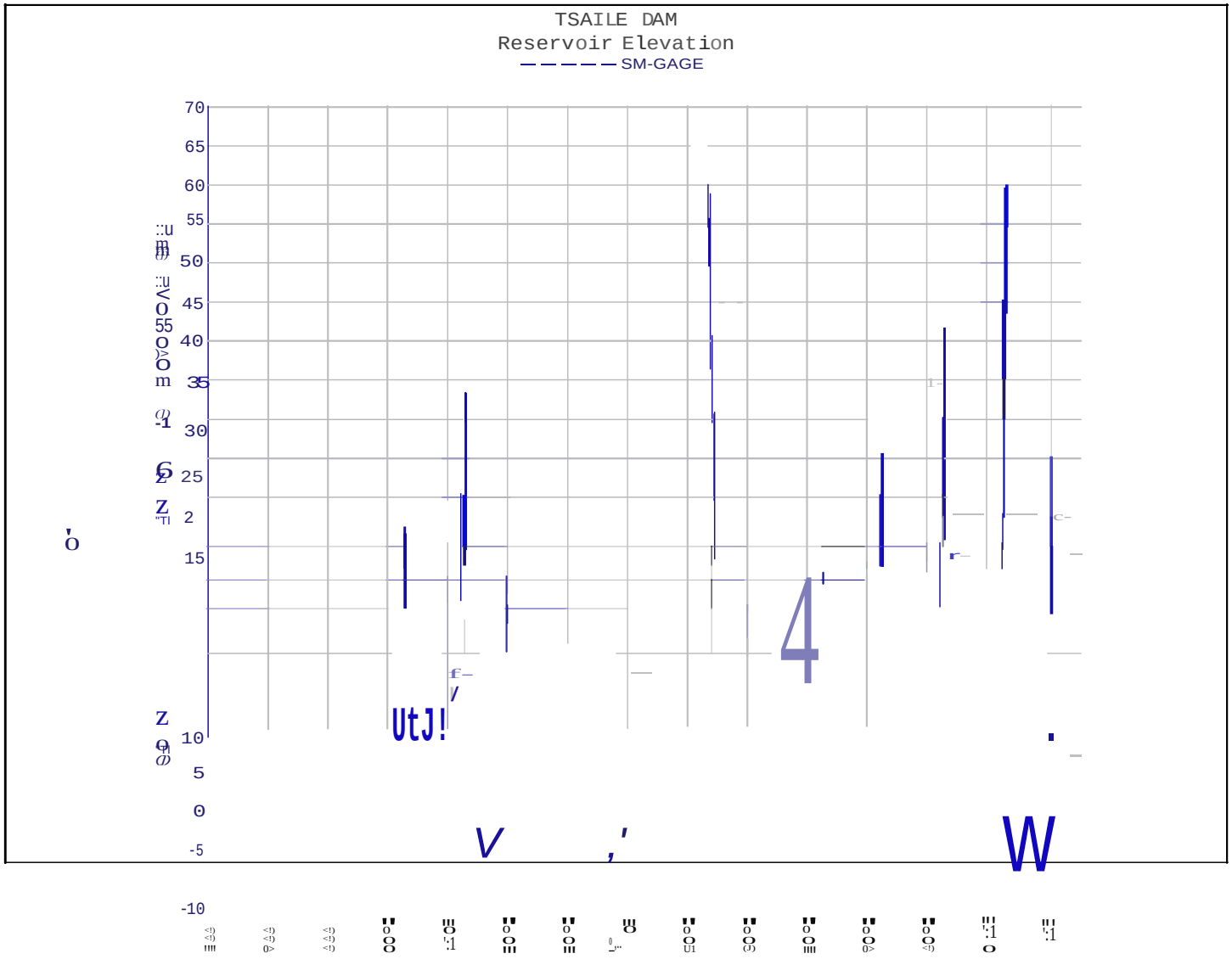
Reservoir

08/02/2011 ;11

TSAILE DAM

Reservoir Elevation

SM-GAGE

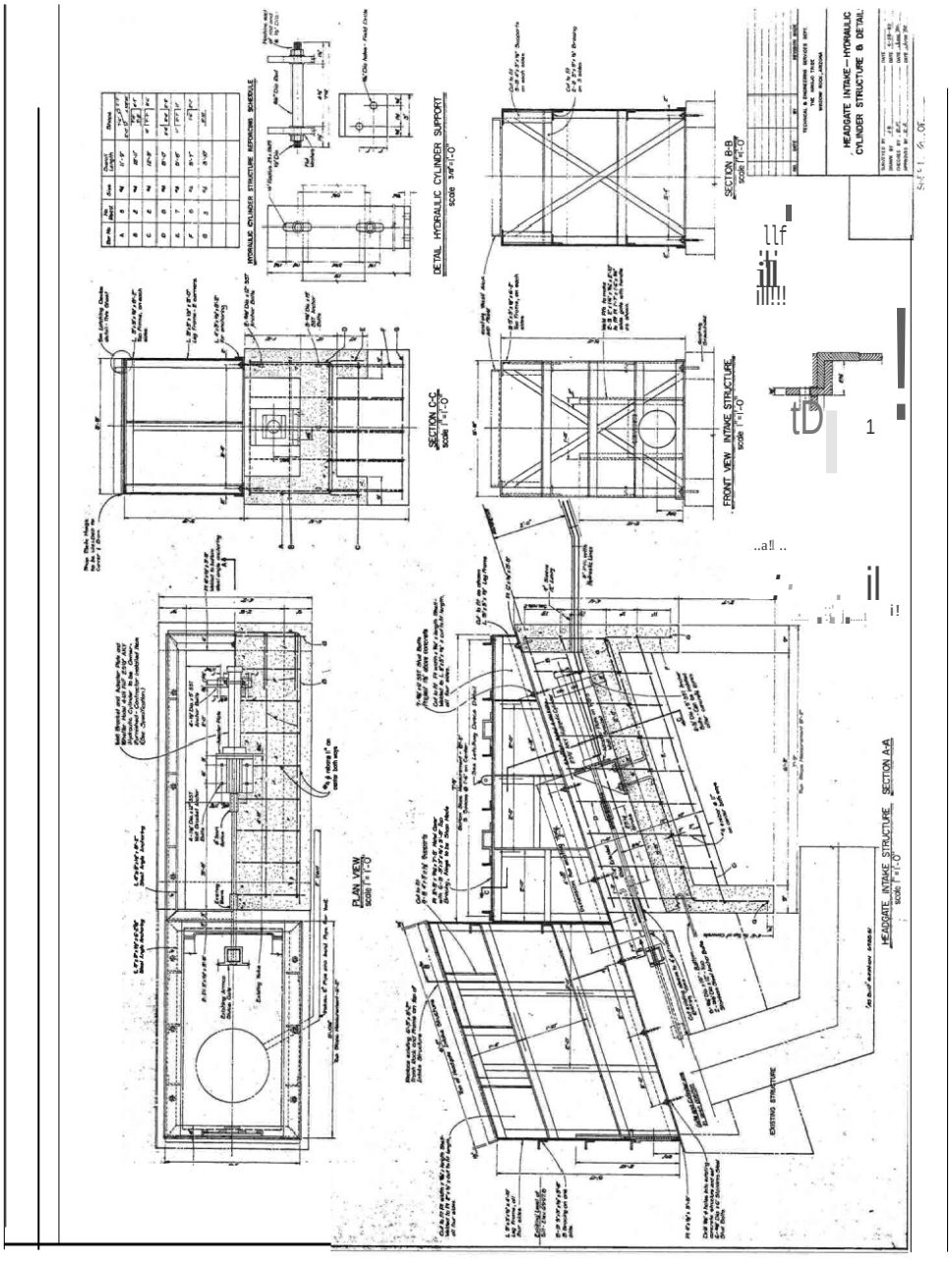


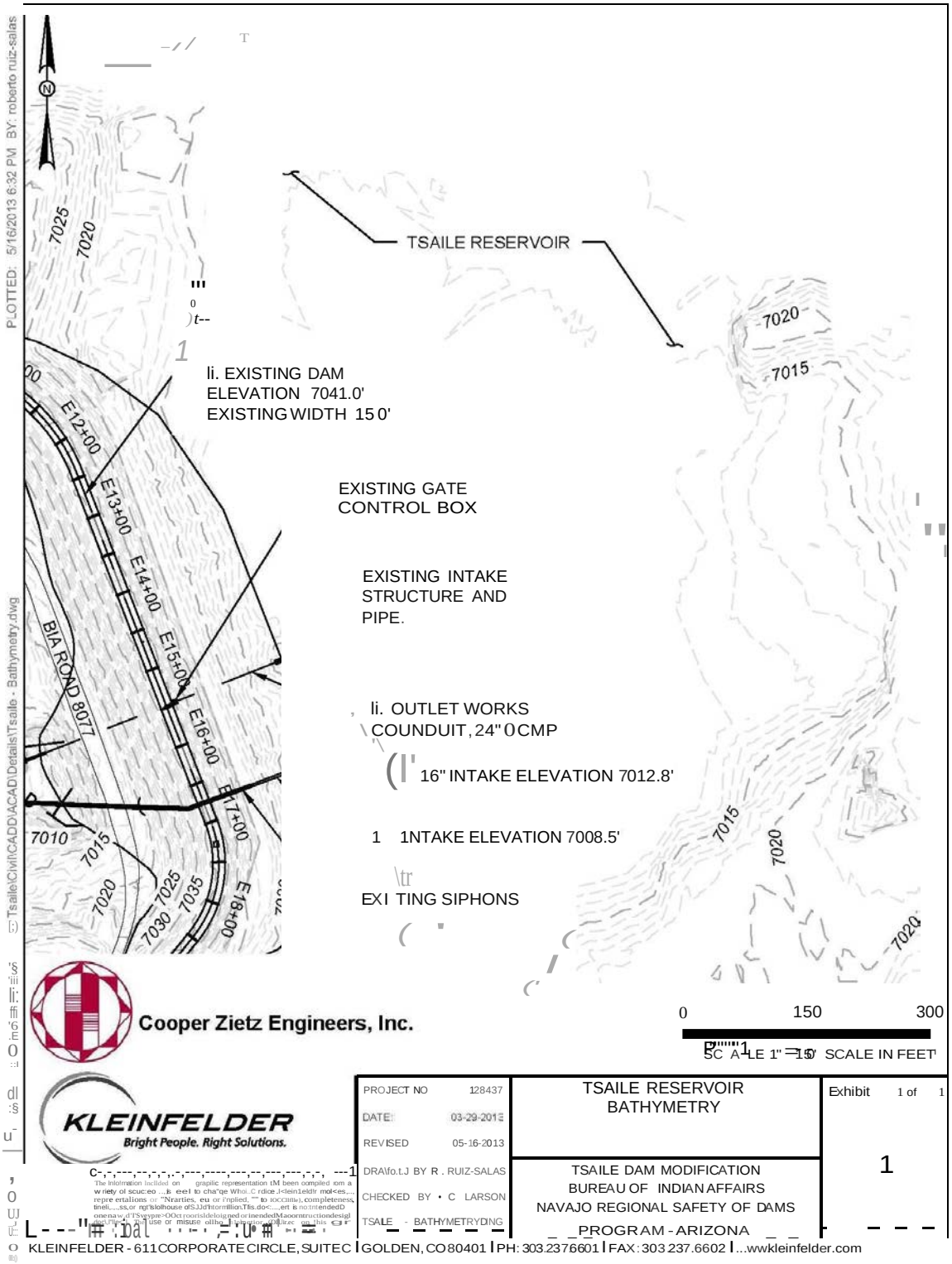
William Dressel

INSTRUMENTATION AND INSPECTIONS GROUP - DENVER (TSC)

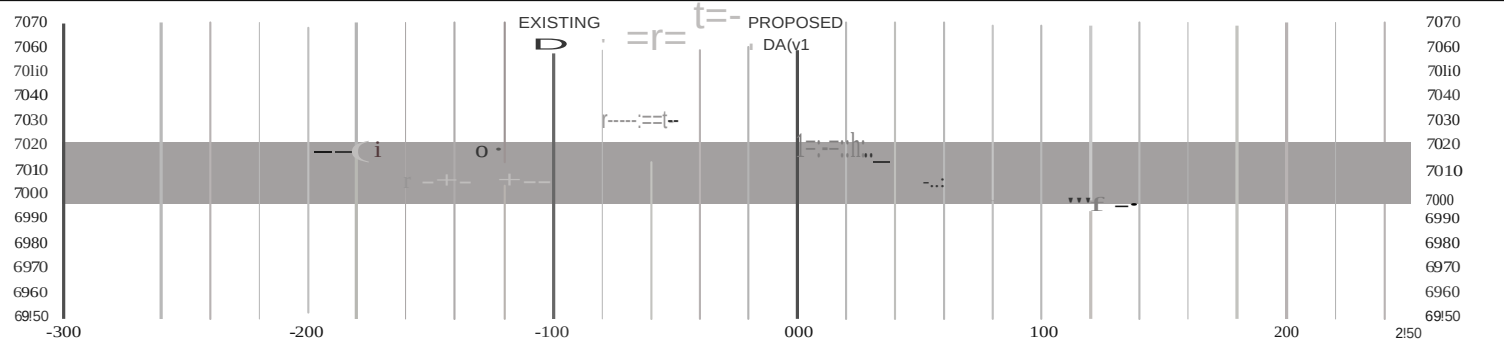
Reservoir

08/02/2011;11


HEADGATE INTAKE — HYDRAULIC CYLINDER STRUCTURE & DETAIL
DETAIL HYDRAULIC CYLINDER SUPPORT
SECTION B-B
SECTION C-C
FRONT VIEW INTAKE STRUCTURE
PLAN VIEW
SECTION A-A
HEADGATE INTAKE STRUCTURE
EXISTING STRUCTURE


TSAILE RESERVOIR
li. EXISTING DAM
ELEVATION 7041.0'
EXISTING WIDTH 15 0'
EXISTING GATE
CONTROL BOX
EXISTING INTAKE
STRUCTURE AND
PIPE.
li. OUTLET WORKS
COUNDUIT, 24" 0 CMP
16" INTAKE ELEVATION 7012.8'
1NTAKE ELEVATION 7008.5'
EXI TING SIPHONS
BIA ROAD 8077
E12+00
E13+00
E14+00
E15+00
E16+00
E17+00
E18+00
7010
7015
7020
7025
7030
7035
0
150
300
SCALE 1" = 150' SCALE IN FEET
Cooper Zietz Engineers, Inc.
KLEINFELDER
Bright People. Right Solutions.
PROJECT NO 128437
DATE: 03-29-2013
REVISED 05-16-2013
DRAWN BY R. RUIZ-SALAS
CHECKED BY C LARSON
SCALE - BATHYMETRY/DING
TSAILE RESERVOIR
BATHYMETRY
TSAILE DAM MODIFICATION
BUREAU OF INDIAN AFFAIRS
NAVAJO REGIONAL SAFETY OF DAMS
PROGRAM - ARIZONA
Exhibit 1 of 1
1
KLEINFELDER - 611 CORPORATE CIRCLE, SUITE C | GOLDEN, CO 80401 | PH: 303.237.6601 | FAX: 303.237.6602 | ...wwkleinfelder.com

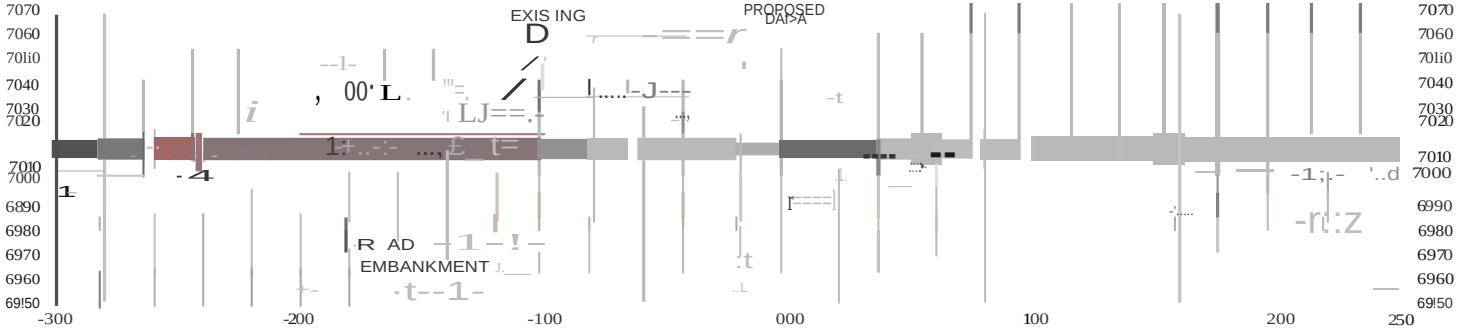
CAD FILE G_chents\Bureau Of Indian Affairs\128437 Tsaile\CIVIICADDIACAD\Production Drawings\ExhJbots\Tsaile_D,version Concept Sequence.dwg PLOTIED 11118/20131.27 PM BY roberto ruiz-salas



EXCAVATE UPPER PORTION OF EXISTING DAM AT SLOPE OF 15H:1V TO ELEVATION 7010 ±, AND THEN CUT AT 2H:1V TO EXISTING GROUND. A CONNECTION TO THE EXISTING INTAKE STRUCTURE AND OUTLET CONDUIT (NOT SHOWN) HAS BEEN MADE PREVIOUSLY FOR DRAINING THE RESERVOIR.

C) CONSTRUCTION STAGE 1

Scale: NTS



CONSTRUCT TEMPORARY ROAD EMBANKMENT UP TO APPROXIMATELY ELEVATION 7020 AS SHOWN ON THE DRAWNG WITH SIDE SLOPES AS NOTED AND A CREST WDTH OF 24FT. INSTALL SALVAGED SIPHON PIPES OR A CMP AT APPROXIMATELY ELEVATION 7010 AND NEAR THE LOCATION OF THE NEW OUTLET WORKS INTAKE TOWER, AND WITH A CONTROL GATE ON THE UPSTREAM END OF THE PIPE(S).

e CONSTRUCTION STAGE 2

Scale: NTS

LEGEND

PROPOSED PROFILE AT STAGE

EXISTING GROUND AT STAGE

ESTIMATED BEDROCK

EXCAVATED MATERIAL AT STAGE

FILL MATERIAL AT STAGE

Cooper Zietz Engineers, Inc.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.	128437
DRAWN BYR.	RUIZ-SALAS
CHECKED BY:	C. LARSON
DATE	11-1&2013
REVISED:	

DIVERSION CONCEPT SEQUENCE
TSAILE DAM MODIFICATION

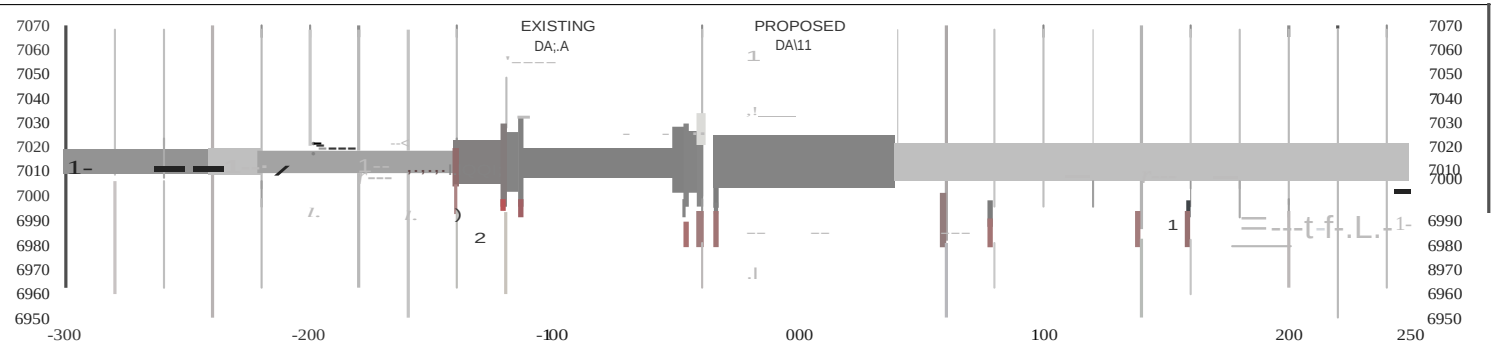
BUREAU OF INDIAN AFFAIRS
NAVAJO REGION SAFETY OF
DAMS PROGRAM- ARIZONA

PLATE

A

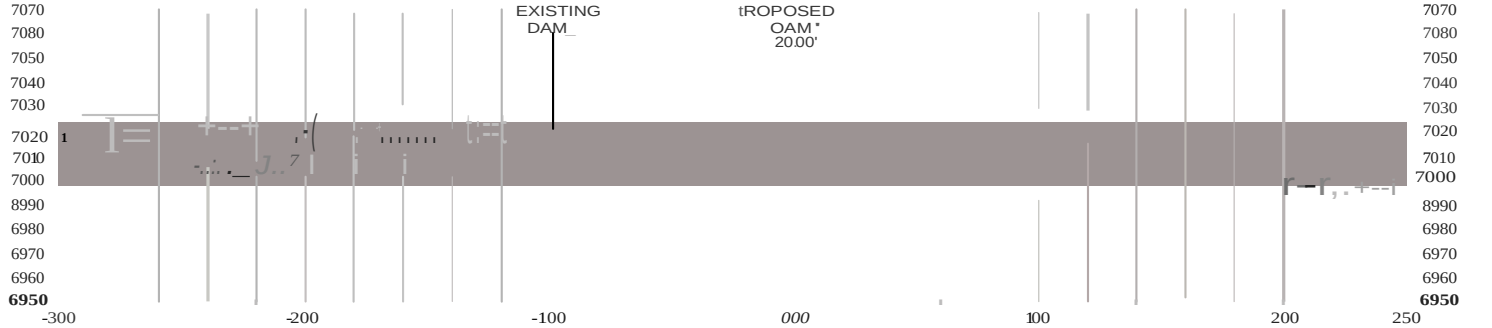
PAGE: t of 3

KLEINFELDER - 611 CORPORATE CIRCLE, SUITE C | GOLDEN, CO 80401 | PH: 303.237.6601 | FAX: 303.237 6602 | www.kleinfelder.com



MOVE TRAFFIC TO THE TEMPORARY ROAD EMBANKMENT. EXCAVATE ENTIRE EXISTING DAM DOWNSTREAM.LEAVING A CUT SLOPE BELOW THE BENCH CUT NO STEEPER THAN 2H:1V IN EXISTING DAM EMBANKMENT. PREPARE CENTRAL AND DOWNSTREAM PORTIONS OF FOUNDATION DOWN TO BEDROCK PER PLANS AND SPECIFICATIONS. OUTLET WORKS INTAKE TOWER, OUTLET CONDUIT, AND TERMINAL STRUCTURE CAN BE UNDER CONSTRUCTION AT OUTSET OF EXISTING DAM REMOVAL AND DURING FOUNDATION PREP.

e CONSTRUCTION STAGE 3
Scale. NTS



CONSTRUCT NEW DAM EMBANKMENT IN ACCORDANCE WITH PLANS AND SPECIFICATIONS UP TO ELEVATION OF NEW ROADWAY ON DOWNSTREAM SLOPE (APPROXIMATE ELEVATION 7026.5) AND TO TOP OF DAM AT NOMINAL ELEVATION 7041. LEAVE A 1.5H:1V TEMPORARY EMBANKMENT SLOPE FACE ON UPSTREAM SIDE TO CATCH DOWNSTREAM TOE OF COFFERDAM AT BEDROCK ELEVATION. TRANSFER TRAFFIC TO DOWNSTREAM FACE OF DAM. TRANSFER DIVERSION TO NEW OUTLET WORKS AND REMOVE EXISTING CMP OUTLET CONDUIT WHEN INTAKE TOWER WALL HEIGHT IS ABOVE APPROXIMATELY ELEVATION 7015, CONDUIT IS INSTALLED AND ENCASED. AND TERMINAL STRUCTURE IS COMPLETE.

4 CONSTRUCTION STAGE 4
Scale. NTS

LEGEND

PROPOSED PROFILE AT STAGE
EXISTING GROUND AT STAGE
ESTIMATED BEDROCK
EXCAVATED MATERIAL AT STAGE
FILL MATERIAL AT STAGE

Cooper Zietz Engineers, Inc.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.	128437
DRAWN BY	R. RUIZ-SALAS
CHECKED BY	C. LARSON
DATE	11-18-2013
REVISED:	

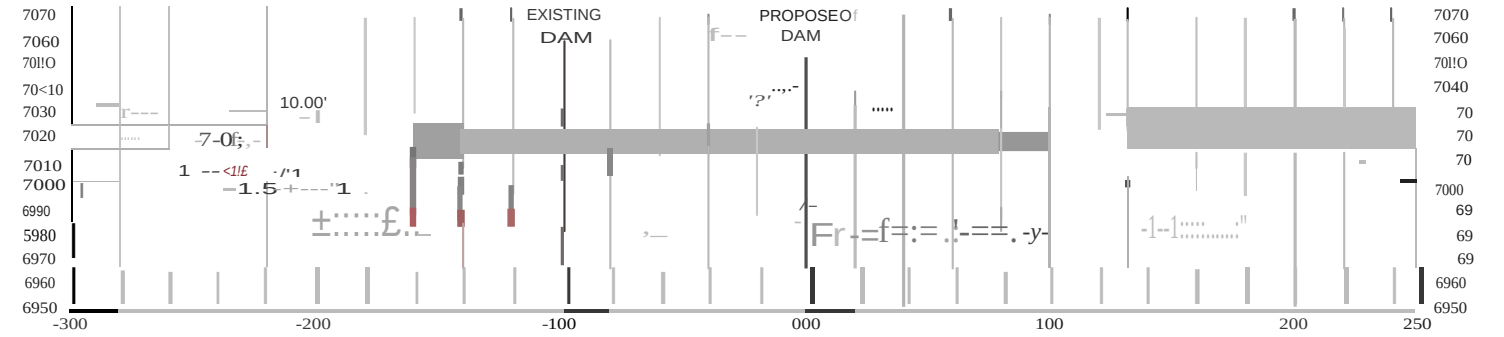
DIVERSION CONCEPT SEQUENCE
TSAILE DAM MODIFICATION

BUREAU OF INDIAN AFFAIRS
NAVAJO REGION SAFETY OF
DAMS PROGRAM- ARIZONA

PLATE
B

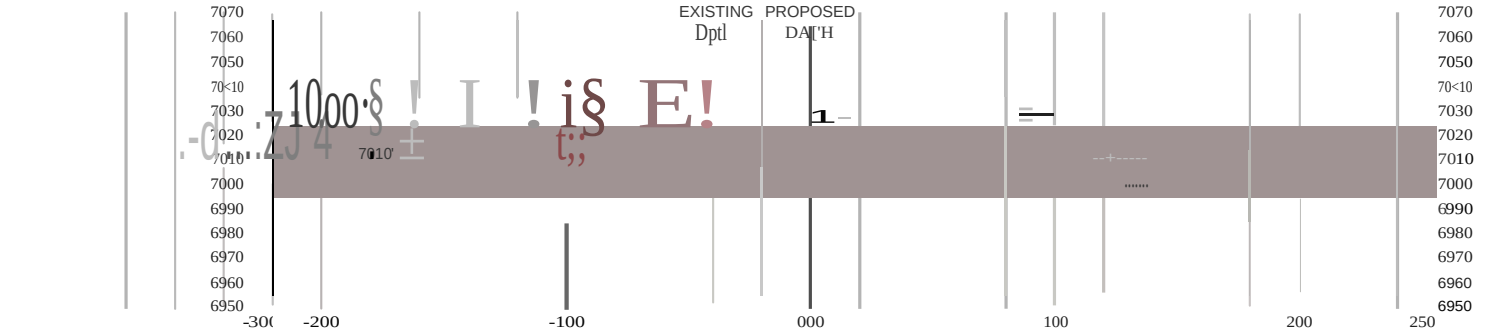
KLEINFELDER - 611 CORPORATE CIRCLE, SUITE C | GOLDEN, CO 80401 | PH: 303.237.6601 | FAX: 303.237.6602 | www.kleinfelder.com

CAD FILE G_chents\Bureau Of Indian Affairs\128437 Tsaile\CIVIICADDIACAD\Production Drawings\ExhJbots\Tsaile_D,version Concept Sequence.dwg PLOTIED 11118/20131·37 PM BY roberto ruiz-salas



EXCAVATE MOST OF THE TEMPORARY ROAD/COFFERDAM, INCLUDING REMOVAL OF OR COMPLETE FILLING IMTH CONCRETE OF THE UPSTREAM REMNANT OF THE OLD OUTLET PIPE. LEAVE IN PLACE A PORTION OF THE OLD UPSTREAM EMBANKMENT TOE TO FORM A REMNANT COFFERDAM HAVING A CREST AT ELEVATION 7010 AND CREST \MOTH OF 10 FEET. UPON FINAL GRADING TO ELEVATION 7010. CONSTRUCT A TEMPORARY WATER CONTROL BERM OF MATERIAL TO A HEIGHT SPECIFIED BY THE CONTRACTOR AS SHOWN HATCHED TO PROVIDE TEMPORARY FLOOD PROTECTION .COMPLETE THE REMAINDER OF THE FOUNDATION PREPARATION UNDER THE UPSTREAM ZONE 2 SHELL

(!) CONSTRUCTION STAGE 5
Sca e.NTS



FINISH PLACING THE UPSTREAM DAM ZONES AND STABILITY BERM. UPON COMPLETION. REMOVE TEMPORARY WATER CONTROL BERM AND EXCAVATE THE REMNANT COFFERDAM /ROAD TO THE GRADES SHOWN ON THE PLANS.

® CONSTRUCTION STAGE 6
Scae.NTS

LEGEND

PROPOSED PROFILE AT STAGE
EXISTING GROUND AT STAGE
ESTIMATED BEDROCK
EXCAVATED MATERIAL AT STAGE
FILL MATERIAL AT STAGE

Cooper Zietz Engineers, Inc.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.	128437
DRAWN BYR.	RUIZ-SALAS
CHECKED BY:	C. LARSON
DATE	11-l&-2013
REVISED:	

DIVERSION CONCEPT SEQUENCE
TSAILE DAM MODIFICATION

BUREAU OF INDIAN AFFAIRS
NAVAJO REGION SAFETY OF DAMS PROGRAM- ARIZONA

PLATE C

PAGE: 3 of 3

KLEINFELDER - 611 CORPORATE CIRCLE, SUITE C | GOLDEN, CO 80401 | PH: 303.237.6601 | FAX: 303.237.6602 | www.kleinfelder.com

END OF SECTION

SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.1 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform the COR of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.

B. In accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction, in case of discrepancies, written specifications take precedence over drawings unless otherwise specified.

1.2 PROJECT CONDITIONS

A. Where there are minor differences as determined by the COR between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.3 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in the drawing list are included to show existing features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.

B. If there are differences as determined by the COR between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.4 COPIES OF DRAWINGS

A. One set of full-size (22 inches by 34 inches) drawings, except standard drawings, will be furnished to the Contractor.

1.5 LIST OF DRAWINGS

A. Drawings listed in Table 52 00 00A - List of Drawings, are made a part of Section C - Description/Specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	G-1	COVER SHEET, LOCATION MAP AND LIST OF DRAWINGS
2	G-2	GENERAL ABBREVIATIONS AND LEGEND
3	G-3	GENERAL CONSTRUCTION NOTES
4	G-4	PLAN OF BORROW AREAS AND STAGING AREA
5	G-5	HYDRAULIC INFORMATION
6	C-1	PLAN OF EXISTING CONDITIONS AND DEMOLITION
7	C-2	PLAN OF RECENT EXPLORATIONS
8	C-3	SUBSURFACE PROFILES
9	C-4	SUBSURFACE PROFILES
10	C-5	GENERAL PLAN OF MODIFICATIONS
11	C-6	FOUNDATION EXCAVATION PLAN AND GROUTING
12	C-7	EXCAVATION SECTION AND GROUTING DETAIL
13	C-8	EXCAVATION SECTIONS AND DETAILS
14	C-9	EMBANKMENT PROFILE
15	C-10	EMBANKMENT MAXIMUM SECTION
16	C-11	ABUTMENT SECTIONS
17	C-12	OUTLET WORKS CHANNEL PLAN AND PROFILE
18	C-13	TOE DRAIN PLAN
19	C-14	TOE DRAIN PROFILES
20	C-15	GETOECHNICAL INSTRUMENTATION PLAN

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
21	C-16	TOE DRAIN DETAILS
22	C-17	TOE DRAIN DETAILS
23	C-18	TOE DRAIN DETAILS
24	C-19	CIVIL DETAILS
25	C-20	GEOTECHNICAL INSTRUMENTATION DETAILS
26	C-21	BIA ROAD 8077 SITE PLAN
27	C-22	BIA ROAD 8077 PLAN AND PROFILE
28	C-23	BIA ROAD 8077 PLAN AND PROFILE
29	C-24	BIA ROAD 8077 PLAN AND PROFILE WITH CULVERT CROSSING
30	C-25	BIA ROAD 8077 CULVERT CROSSING DETAILS
31	C-26	BIA ROAD 8077 SPILLWAY CROSSING DETAILS
32	C-27	BIA ROAD 8077 CHANNEL CROSSING DETAILS
33	C-28	10’ ACCESS ROAD PLAN AND PROFILE
34	C-29	TEMPORARY ROAD SITE PLAN
35	C-30	TEMPORARY ROAD PLAN AND PROFILE
36	C-31	TEMPORARY ROAD PLAN AND PROFILE
37	C-32	TEMPORARY ROAD PLAN AND PROFILE AND ROAD SECTIONS
38	C-33	OUTLET WORKS PLAN AND PROFILE
39	C-34	TEMPORARY CONSTRUCTION SIGNAGE AND PERMANENT SIGNAGE
40	C-35	BIA ROAD 8077 GUARDRAIL DETAILS
41	C-36	EROSION AND SEDIMENT CONTROL NOTES
42	S-1	STRUCTURAL NOTES

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
43	S-2	STANDARD STRUCTURAL DETAILS
44	S-3	STANDARD STRUCTURAL DETAILS
45	S-4	STANDARD STRUCTURAL DETAILS
46	S-5	STANDARD STRUCTURAL DETAILS
47	S-6	OUTLET WORKS PLAN AND ELEVATION
48	S-7	INTAKE TOWER PLANS
49	S-8	CONTROL ROOM PLANS & DETAILS
50	S-9	INTAKE TOWER SECTIONS
51	S-10	CONTROL ROOM SECTIONS & ELEVATIONS
52	S-11	OUTLET DISSIPATION STRUCTURE
53	S-12	DETAILS
54	S-13	DETAILS
55	S-14	DETAILS
56	S-15	DETAILS

END OF SECTION

SECTION 53 10 00
GEOLOGIC INVESTIGATIONS

PART 1 GENERAL

1.1 GENERAL

A. General:

1. The geologic descriptions, drawings, logs of subsurface explorations, water level data, and test data in these specifications include information and records of geologic investigations for the work, and are the geologic data upon which the design of this work is based. These data supersede any previous versions which may be available for examination by bidders. Only the data that are specific to the needs of these specifications are included in these specifications. These data are contained in Section 53 10 00 - Records of Geologic Investigations.

2. Selected samples recovered during investigations were tested at the Four Corners Construction Office materials laboratory in Farmington, New Mexico and/or the Kleinfelder Inc. materials laboratory in Golden, Colorado. Summaries of Physical Properties Test Results from laboratory tests performed on these samples are contained in Section 53 20 00 - Records of Geologic Investigations. Bidders are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties, which the bidder believes to be significant. Bidders wishing to visit the site, or take samples at the site should make arrangements with the COR.

3. Copies of the following reports and memoranda, which contain pertinent information on the area, site geology, and materials properties, may be examined at the office of the COR. Bidders wishing to inspect the reports and memoranda should contact COR.

   a. [1] "Tsaile Dam Final Design Investigations" Bureau of Indian Affairs, Safety of Dams Program, Navajo Indian Reservation, Arizona, prepared by Bureau of Reclamation, Upper Colorado Region, Four Corners Construction Office, Durango, Colorado, June 2011.

   b. [2] "Tsaile Dam – Field Investigations Report for the Deficiency Verification Analysis (DVA) Stage 2 – Volume 1 and Volume 2", Bureau of Indian Affairs, Navajo Area Safety of Dams, Navajo Indian Reservation, Arizona, prepared by Bureau of Reclamation, Farmington Construction Office, Farmington, New Mexico, November 2004.

   c. [3] "Phase II Study and Evaluation of Tsaile Dam, Apache County, AZ,", Engineers Testing Laboratories, Inc., Geotechnical Division, Phoenix, Arizona, February 15, 1980.

d. [4] "Design Report, Tsaile Dam Modifications, Bureau of Indian Affairs, Navajo Region Safety of Dams Program, Tsaile, Arizona" , Kleinfelder West, Inc., Golden, Colorado, DATE TBD.

e. [5] "Geotechnical Data Report, Tsaile Dam Modifications, Bureau of Indian Affairs, Navajo Region Safety of Dams Program, Tsaile, Arizona" , Kleinfelder West, Inc., Golden, Colorado, January 18, 2013

f. [6] "Geotechnical Evaluation Report", Tsaile Dam Modifications, Bureau of Indian Affairs, Navajo Region Safety of Dams Program, Tsaile, Arizona" , Kleinfelder West, Inc., Golden, Colorado, DATE TBD.

4. The geologic logs of drill holes, test pits, water-level data, and other available geologic information represent the conditions encountered during the investigations. The water-level data show the conditions at the particular time or times the information was obtained and may not indicate variations such as those caused by drought, precipitation, changes in the surface elevation of nearby reservoirs, irrigation or flooding.

5. The geologic drawings portray generalized geologic conditions. The geologic logs of explorations should be consulted for specific details. Engineering geology and geotechnical considerations are discussed in Article 1.05. For a discussion of water occurrence, see Article 1.06.

6. General geologic unit definitions, explanations of geologic symbols, and geologic notes are contained in Section 53 10 00 - Records of Geologic Investigations.

7. The location of explorations and cross sections for the work are included on the project drawings.

8. Surficial materials recorded in all geologic exploration logs included were classified under ASTM D 2487 and ASTM D 2488, respectively. Copies of the above procedures are available for review at the office of the COR.

9. BIA has established standard descriptors and descriptive criteria for rock and standard descriptors and descriptive criteria for discontinuities. These standards are available for review at the office of the COR.

1.2 REFERENCES

A. ASTM International (ATSM)

1. ASTM D 2487-06 Classification of Soils for Engineering Purposes (Unified Soil Classification).

2. ASTM D 2488-06 Description and Identification of Soils (Visual-Manual Procedure).

B. Bureau of Reclamation (USBR)

1. Engineering Geology Field Manual, Volume 1, Second Edition, U.S. Department of the Interior, Bureau of Reclamation, 1998.

2. Ground Water Manual, Second Edition, U.S. Department of the Interior, Bureau of Reclamation, 1995.
3. USBR EM – Earth Manual, Part 2, Third Edition (1990).
4. Procedure No. and Title
   a. USBR 5000-86 Determining Unified Soil Classification (Laboratory Method).
   b. USBR 5005-86 Determining Unified Soil Classification (Visual Method).

1.3 GEOLOGIC INVESTIGATIONS

A. Geologic investigations conducted at Tsaile Dam are listed below, and available logs of investigations are contained in Section 53 20 00 - Records of Geologic Investigations.

B. Previous Investigations:

1. In 1979, 10 borings through the embankment and underlying alluvium and rock foundation were conducted by a private company, Engineering Test Laboratories, Inc. for the Bureau of Indian Affairs. Standard penetration tests (SPT) were conducted in three of the borings. Laboratory testing was conducted on representative embankment and foundation samples, including index and shear strength testing. Four pinhole tests were conducted to evaluate the dispersive properties of select fine-grained samples. Compaction test were conducted on embankment materials. Geologic data is documented in a geotechnical report, dated February 15, 1980 [3].
2. In the fall of 1999, laboratory tests were conducted on samples collected from the surface of the dam crest, the overburden above the left toe drain, at the left and right toe drain, and two locations along the siphon road. Chemical analyses were conducted on four water samples collected from the toe drains and outlet works CMP. These investigation data results are insignificant to current project and have been omitted from further discussion.
3. In 2004, five borings were advanced through the embankment and underlying foundation alluvium to rock or to refusal. Two borings were advanced through the stability berm on the downstream toe. Three borings were advanced on the dam access road, located on top of the downstream berm. SPT were conducted in the foundation alluvium within all borings. Representative samples were laboratory tested to obtain gradation and standard soil index properties. Geologic data is documented in a Deficiency Verification Analysis (DVA) report, dated November 2004 [2].

C. Recent Investigations:

1. In the fall of 2010 and spring of 2011, investigations were conducted to evaluate the suitability of two proposed borrow areas, to acquire geologic surface data around the dam, and to evaluate the subsurface geologic conditions at a proposed

pedestrian bridge. Geologic data is documented in a report, dated June 2011 [1]. Geologic investigations are listed below. Geologic data collected is summarized under the site geology.

a. 20 test pits were excavated and 11 hand auger holes were advanced in a proposed borrow area located about 2,000 feet south of the dam. Representative samples were laboratory analyzed for gradation, physical properties, and compaction characterization.

b. Two test pits were excavated on the northwest-side of the reservoir at a proposed borrow area.

c. One test pit was excavated on the right-side (north) of the spillway near a proposed abutment for a pedestrian bridge.

d. Three hand auger holes were advanced along the proposed pedestrian bridge alignment at the spillway.

e. Geologic surface mapping was conducted along the dam, spillway and downstream of the dam.

1.4 REGIONAL GEOLOGY

A. Tsaile dam is situated at the head of Canyon del Muerto on the Defiance Plateau. The Defiance Plateau is a sinuous monoclinal uplift, which extends from Fort Defiance, Arizona northward to the Utah border and is about 35 miles wide in the Tsaile Dam area. Rocks ranging in age from Permian to Cretaceous are exposed over most of the Defiance Plateau. Regional bedrock dip is 2° to 3° toward the northeast. Pleistocene-age alluvial deposits overlie bedrock in the valley bottoms. The surficial deposits are unconsolidated sand with lesser amounts of clay, silt, and gravel.

B. The Monitor Butte Member of the Upper Triassic-age, Chinle Formation (TRc) constitutes the bedrock at the dam site and consists primarily of gray to light brown sandstone with minor amounts of shale and mudstone (siltstone and claystone). The sandstone forms the cliffs downstream of the dam site and the shale and claystone generally form the gentle slopes north and west of the dam. The bedrock is generally horizontally bedded with bedding dips averaging about 5° to the southeast. No significant geologic structure is found at the damsite.

1.5 SITE GEOLOGY

A. At the damsite within the reservoir, Recent Lakebed Sediments (Qlb) have been deposited since the first filling of the reservoir. Lakebed sediments (may also be called reservoir sediments) are about 25 feet thick (locally less or greater thicknesses) near the outlet works intake structure. These sediments have not been sampled but are likely fine-grained silt and clay deposits with lesser amounts of sand.

B. At the damsite, Quaternary Alluvium (Qal) composed of mostly brownish-gray fine sand with minor amounts of silt, clay, and subrounded gravel and cobbles overlie the sandstone.

At the dam site, Chinle Formation sandstone (TRc) is encountered in each of the borings reaching the foundation rock and is the only unit geologic mapped in exposed outcrops downstream of the dam. The Monitor Butte Member of the Upper Triassic-age Chinle Formation is composed of sandstone with interbeds of shale, claystone and siltstone. Sandstone forming the abutments near the downstream toe of the dam strikes N20°E to N25°E and dips 5° to 10° toward the southeast. The sandstone is fine- to medium-grained, thinly to moderately bedded (1- to 8-inches-thick), slightly fractured, moderately (W5) to slightly (W3) weathered; moderately soft (H5) near the soil contact to hard (H3) where more cemented, and exhibits several prominent near vertical joint sets. Joints strike N55°E to N85°W and dip 72°SE to 81°NE; and are widely to very widely spaced (approximately 1.0 to 5 feet), moderately continuous (C3), tight to moderately wide (no visible separation to 30mm) and moderately rough (R3). Canyon walls are near vertical to overhanging near the contact with valley alluvium. Approximately 30 Schmidt hammer readings were taken on the left and right abutments resulting in an approximate average estimated compressive strength of 3750 psi.

Decomposed (W9) to intensely weathered (W7) interbeds of siltstone and claystone are encountered in some of the borings from 1979. The interbeds were incorrectly interpreted as alluvium units in the geologic logs, which the geologic occurrence would be very unlikely.

C. The spillway channel is excavated into soil and sandstone. The spillway channel has about 0 to 2 feet of soil covering sandstone.

D. Dam Site Stratigraphy:

1. Man-made Fill:

a. Embankment (Fill; Zones 1, 2, 3, and Riprap and Rockfill Zone): The embankment materials used to construct the embankment are composed of a mixture of clay, silt, and sand. The upstream riprap and rockfill zone contains cobble- and boulder-sized material.

Zone 1 forms the upstream shell and zone 3 forms the downstream shell. Dam documentation states that these zones are comprised of the same material. Zone 3 material was sampled by two borings, DH-04-3 and DH-04-4, in the DVA investigations [2]. Based on this limited data, zone 3 has a wide range of soil classifications ranging from fat clay to clayey sand.

Zone 2 forms the dam core and was sampled by several borings in the 1979 investigations [3]. Seven borings (No. 1 through No. 5, No. 9, and

No. 10) encountered zone 2 material. The geologic logs show visual classifications and report that the top 6.5 to 9.5 feet of the embankment (average of about 8 feet below the crest) are classified as Lean Clay with Sand (CL)s to Sandy Lean Clay s(CL). Sand percentages range from about 20 to 40 percent, fines (silt and clay particles) range from about 60 to 80 percent, with a trace of gravel-sized material. About 8 feet below the crest, zone 2 material is classified as a Silty Lean Clay with Sand (CL-CH)s, with about 10 to 20 percent sand, and about 80 to 90 percent fines.

No gradation data was found that describes the gradation of the upstream riprap and rockfill zone. A 1-1/2-foot-thick riprap layer protects the upstream face from the crest to elevation 7022. Below this elevation, a 12-foot-wide rockfill zone was placed against zone 1 shell material.

b. Stability Berm (Berm): A stability berm was constructed on the downstream channel section of the dam, during 1982 dam modification. A report documenting modification construction was not prepared. During the DVA investigations, two borings (DH-04-5 and DH-04-6) were advanced through the stability berm [2]. The berm material was classified as a Clayey Sand with Gravel (SC)g, with about 45 percent fines, about 30 to 40 percent sand, and about 15 to 25 percent gravel.

E. Borrow Area Site Geology: Soils at borrow areas A1 and A2 are predominately deposited in an alluvial setting, with lesser amounts of soil derived from weathered in-place rock units. Chinle Formation sandstone with interbedded claystone and siltstone underlies the soil deposits and crops out at the surface around the edges of borrow areas A1 and A2 [1]. Claystone interbeds are encountered in one test pit in borrow area A1, and in three test pits in borrow area A2.

1. Borrow Area A1: Soils encountered are predominately Lean to Fat Clay with Sand (CL)s to (CH)s; Sandy Lean Clay s(CL); and lesser amounts of Poorly Graded Sand with Clay SP-SC. Moisture content generally increased with depth and soils became wet within one foot of encountering groundwater.

   Borrow Area A1 is investigated with test pits TPTS-10, TPTS-12 through -19 and hand auger holes HATS-1, -8, and -11, during the recent investigations [1]. Bedrock was encountered in test pits TPTS-10, -12 and -13 at depths between 1.9 and 3.5 feet.

2. Borrow Area A2: Soils in borrow area A-2 generally have a greater coarse grained component than soils in A-1. Soils encountered were Lean Clay with Sand (CL)s, Sandy Lean Clay s(CL), and zones of Clayey Sand SC.

   Borrow Area A2 was investigated with test pits TPTS-1 through 9 and hand auger holes HATS-2 through -7, -9 and -10, during recent investigations [1]. Composite samples of excavated Chinle Formation and overlying alluvium were collected from test pits TPTS-6 and -9. Samples were classified as Clayey Sand with Gravel (SC)g in TPTS-6, and Clayey Gravel with Sand (GC)s in TPTS-9. Bedrock was encountered in hand auger holes HATS-3 through -7, and in test pits

TPTS-1, -2, -3, -6, -7, -7A and -9. Top of bedrock ranged in depth from 1.0 foot in HATS-7 to 6.0 feet in TPTS-7 and TPTS-7A. In most pits the backhoe was able to excavate an additional foot of rock. Moisture content generally increased with depth.

F. Borrow Site A1 and A2 Stratigraphy:

1. Quaternary-age:

   a. Alluvium (Qal): Soil deposits are described above.

2. Triassic-age:

   a. Chinle Formation (TRc): Sandstone units have the same physical properties characterization as detailed in Dam Site Stratigraphy description above. Claystone and siltstone interbeds are also encountered below the alluvium within borrow areas A1 and A2. Claystone and siltstone interbeds have the same bedding strike and dip as reported for sandstone. The claystone and siltstone is mostly aphanitic to fine-grained, have laminated bedding (less than 10mm), intensely weathered (W7), and are very soft (H7).

1.6 WATER AND GROUNDWATER OCCURRENCE

A. The water-level and groundwater-level data within the recent and past reports show the conditions at the particular time or times the information was obtained and may not indicate variations such as those caused by periods of drought or increased rainfall, seasonal fluctuations in rainfall, or applications of irrigation water. Contractors are encouraged to conduct groundwater-level investigations prior to starting construction and borrow excavation activities.

1. Dam Site Surface Water and Groundwater: Surface water is encountered within the channel downstream of the outlet works. It is assumed that groundwater-levels will be at elevations of standing water in the channel and higher elevations (possibly following bedrock contours) in soil deposits adjacent the channel. Groundwater exiting bedding and fracture planes and seepage from soil deposits into the excavated slopes and invert is anticipated. Dewatering and unwatering is anticipated to be required prior to placing embankment fill along some portions of the excavated foundation.

2. Outlet Works Intake Structure Groundwater: Excavation of the lakebed sediments around the outlet works intake structure and alluvium founding the current structure will likely encounter saturated sediment and soil conditions for a long time period after the reservoir is lowered. Dewatering and/or unwatering is anticipated to be required for intake modifications.

3. Borrow Areas A1 and A2 Groundwater: Groundwater was encountered in five of the nine test pits excavated in borrow area A1 at depth ranging from 7.9 to 11.7 feet below the groundsurface at the time/date the test pits were excavated. Groundwater was encountered in three of nine test pits excavated in borrow area

A2 at depths ranging from 4.7 to 11.9 feet below the groundsurface at the time/date the test pits were excavated. The groundwater profile across the borrow areas is irregular. It is anticipated that materials excavated near or below groundwater-levels would require additional material processing to dry the soils to meet specification standards for embankment fill.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 53 20 00
RECORDS OF GEOLOGIC AND SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.1 TSAILE DAM DRAWINGS

G1. 1743-529-9 General Geologic Legend, Explanation and Notes
G2. 1743-529-3 Location Map
G3. 1743-529-4 Surface Geology
G4. 1743-529-5 Borrow Areas A-1 and A-2 – Limits of Borrow and Location of Exploration (shows the limits for borrow areas during investigation only)
G5. 1743-529-7 Geologic Section A-A', B-B', and C-C'.
G6. OA55-529-7 Location of Explorations and Geologic Sections
G7. OA55-529-8 Geologic Section A-A'
G8. OA55-529-9 Geologic Section B-B'
G9. OA55-529-10 Geologic Section C-C'
G10. OA55-529-11 Geologic Section D-D'

1.2 GEOLOGIC LOGS

A. Drill Holes:

G11. DH-04-3, Sheet 1 of 3
G12. DH-04-3, Sheet 2 of 3
G13. DH-04-3, Sheet 3 of 3
G14. DH-04-4, Sheet 1 of 4
G15. DH-04-4, Sheet 2 of 4
G16. DH-04-4, Sheet 3 of 4
G17. DH-04-4, Sheet 4 of 4
G18. DH-04-4A, Sheet 1 of 3
G19. DH-04-4A, Sheet 2 of 3
G20. DH-04-4A, Sheet 3 of 3
G21. DH-04-5, Sheet 1 of 2
G22. DH-04-5, Sheet 2 of 2
G23. DH-04-6, Sheet 1 of 2
G24. DH-04-6, Sheet 2 of 2

B. Test Pits:

G25. TPTS-1, Sheet 1 of 1
G26. TPTS-2, Sheet 1 of 1
G27. TPTS-3, Sheet 1 of 1
G28. TPTS-4, Sheet 1 of 1
G29. TPTS-5, Sheet 1 of 1
G30. TPTS-6, Sheet 1 of 1

G31. TPTS-7, Sheet 1 of 1
G32. TPTS-7A, Sheet 1 of 1
G33. TPTS-8, Sheet 1 of 1
G34. TPTS-9, Sheet 1 of 1
G35. TPTS-10, Sheet 1 of 1
G36. TPTS-11, Sheet 1 of 1
G37. TPTS-12, Sheet 1 of 1
G38. TPTS-13, Sheet 1 of 1
G39. TPTS-14, Sheet 1 of 1
G40. TPTS-15, Sheet 1 of 1
G41. TPTS-16, Sheet 1 of 1
G42. TPTS-17, Sheet 1 of 1
G43. TPTS-18, Sheet 1 of 1
G44. TPTS-19, Sheet 1 of 1
G45. TPTS-20, Sheet 1 of 1

C. Hand Auger Borings:

G46. HATS-1, Sheet 1 of 2
G47. HATS-1, Sheet 2 of 2
G48. HATS-2, Sheet 1 of 1
G49. HATS-3, Sheet 1 of 1
G50. HATS-4, Sheet 1 of 1
G51. HATS-5, Sheet 1 of 1
G52. HATS-6, Sheet 1 of 1
G53. HATS-7, Sheet 1 of 1
G54. HATS-8, Sheet 1 of 1
G55. HATS-9, Sheet 1 of 1
G56. HATS-10, Sheet 1 of 1
G57. HATS-11, Sheet 1 of 1
G58. HATS-SP1, Sheet 1 of 1
G59. HATS-SP2, Sheet 1 of 1
G60. HATS-SP3, Sheet 1 of 1

D. Laboratory Test Data (Borrow Areas A1 and A2):

G61. Summary of Laboratory Test Results – TABLE 1
G62. Summary of Laboratory Test Results – TABLE 2
G63. Summary of Laboratory Test Results – TABLE 3

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This page intentionally left blank.