ADDENDUM #1
Parks and Open Space
FLOOD – CONSTRUCTION SERVICES FOR LAKE 4, WEST LAKE AND A-FRAME DAM REHABILITATION

BID # 7033-19

April 25, 2019

The attached addendum supersedes the original Information and Specifications regarding BID #7033-19 where it adds to, deletes from, clarifies or otherwise modifies. All other conditions and any previous addendums shall remain unchanged.

DELETE
SUBMITTAL INSTRUCTIONS:
BIDs are due at the Administrative Services Information Desk or email box (preferred) listed below, for time and date recording on or before **10:00 a.m. Mountain Time on Wednesday, May 22, 2019.** A bid opening will be conducted at 3:00 p.m. Mountain Time at county offices.

INSERT
SUBMITTAL INSTRUCTIONS:
BIDs are due at the Administrative Services Information Desk or email box (preferred) listed below, for time and date recording on or before **10:00 a.m. Mountain Time on Wednesday, May 22, 2019.** A bid opening will be conducted at 11:00 a.m. Mountain Time at county offices.

ADD:
Exhibit A: DOL Wage Determination

DELETE
BCC Provisions Attachment J
Pages 6 & 7

INSERT
BCC Provisions Attachment J
Pages 6 & 7, as attached. (Exhibit B)

Exhibit C:
Pre-Bid Sign-in Sheet

Exhibit D. Below is a summary of the changes included in the updated Lake 4 Outlet Pipeline Replacement Construction Drawings and Specifications. The updated Lake 4 Outlet Pipeline Replacement Construction Drawings and Specifications are included in this Addendum as Exhibit D. The Plans and Specifications included in Exhibit D supersede Attachment D: Lake 4 Outlet Pipeline Replacement Construction Drawings and Specifications.

1. Sheet 2: Station form NEW 18" HDPE IN TRENCH changed from 3+42 to -3+42.
2. Sheet 3: Addition of Penetration Detail to A-Frame Box Culvert. Detail 1 on Sheet 8.
3. Sheet 5: CONNECT TO ACCESS TOWER PIPE INV ELEV changed from 5137.00 to 5136.00 (TO BE VERIFIED IN THE FIELD).
4. Sheet 10: Addition of callout to well Detail. Detail 7 on Sheet 11.
5. Sheet 11: Addition of Detail 7 DRY WELL DETAIL.
6. Sheet 11: Addition of TRACER WIRE & MARKER DETAIL.
7. Attachment A: Superseded with updated Attachment A.
8. Specification 01 11 00: Superseded with updated Specification 01 11 00 Summary of Work.
9. Specification 01 29 00: Superseded with updated Specification 01 29 00 Payment Procedures.
10. Specification Cover: Date updated from August 2018 to November 2018.

PLEASE NOTE ON THE DRAWINGS IN THE ATTACHMENT THE STAMP AND SIGNATURE ARE MISSING DUE TO TECHNICAL CONVERSION ISSUES, BUT THE STAMP AND SIGNATURE ARE ON THE ORIGINAL PLANS WITH BOULDER COUNTY.

Submittal Instructions:

BIDs are due at the Administrative Services Information Desk or email box (preferred) listed below, for time and date recording on or before **10:00 a.m. Mountain Time on May 22, 2019**. A bid opening will be conducted at **11:00 a.m**. Mountain Time at county offices.

Your response can be submitted in the following ways. Please note that email responses to this solicitation are preferred, but are limited to a maximum of 25MB capacity. NO ZIP FILES ALLOWED. Electronic Submittals must be received in the email box listed below. Submittals sent to any other box will NOT be forwarded or accepted. This email box is only accessed on the due date of your questions or proposals. Please use the Delivery Receipt option to verify receipt of your email. It is the sole responsibility of the proposer to ensure their documents are received

before the deadline specified above. Boulder County does not accept responsibility under any circumstance for delayed or failed email or mailed submittals.

Email purchasing@bouldercounty.org; identified as **BID #7033-19** in the subject line.

-OR-

US Mail **One (1)** unbound copy of your submittal, printed double-sided, 11 point, on at least 50% post-consumer, recycled paper must be submitted in a sealed envelope, clearly marked as **BID # 7033-19**, to the **Administrative Services Information Desk located at 1325 Pearl Street, Boulder, CO 80302.**

All bids must be received and time and date recorded at the Administrative Services Information Desk by the above due date and time. Sole responsibility rests with the Offeror to see that their bid is received on time at the stated location(s). Any bid received after due date and time will be returned to the bidder. No exceptions will be made.

The Board of County Commissioners reserve the right to reject any and all bids, to waive any informalities or irregularities therein, and to accept the bid that, in the opinion of the Board, is in the best interest of the Board and of the County of Boulder, State of Colorado.

RECEIPT OF LETTER
ACKNOWLEDGMENT

April 25 2019

Dear Vendor:

This is an acknowledgment of receipt of Addendum #1 for BID #7033-19, FLOOD – Construction Services for Lake 4, West Lake and A-Frame Dam Rehabiltation.

In an effort to keep you informed, we would appreciate your acknowledgment of receipt of the preceding addendum. Please sign this acknowledgment and email it back to purchasing@bouldercounty.org as soon as possible. If you have any questions, or problems with transmittal, please call us at 303-441-3525.

Thank you for your cooperation in this matter. This information is time and date sensitive; an immediate response is requested.

Sincerely,

Boulder County Purchasing

Signed by: _____ Date: _____

Name of Company_____

End of Document

Federal Wage Rate Decision Number CO20180012

General Decision Number: CO190002 04/12/2019 CO2

Superseded General Decision Number: CO20180012

State: Colorado

Construction Type: Heavy

Counties: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld Counties in Colorado.

HEAVY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/04/2019
1	02/01/2019
2	02/22/2019
3	04/12/2019

ASBE0028-001 07/01/2018

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems)	$ 31.73	14.23

BRCO0007-004 01/01/2019

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON AND WELD COUNTIES

	Rates	Fringes
BRICKLAYER	$ 29.52	10.48

BRCO0007-006 05/01/2018

EL PASO AND PUEBLO COUNTIES

	Rates	Fringes
BRICKLAYER	$ 25.88	10.34

ELEC0012-004 09/01/2018

PUEBLO COUNTY

	Rates	Fringes
ELECTRICIAN		
Electrical contract over $1,000,000	$ 27.70	12.30+3%
Electrical contract under $1,000,000	$ 24.85	12.30+3%

ELEC0068-001 06/01/2018

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER, AND WELD COUNTIES

	Rates	Fringes

ELECTRICIAN.....$ 35.80 15.45

---

* ELEC0111-001 03/01/2019

	Rates	Fringes
Line Construction:		
Groundman	$ 20.41	13.75%+$6.20
Line Equipment Operator	$ 28.98	13.75%+$6.20
Lineman and Welder	$ 44.92	25.25%+$5.75

ELEC0113-002 06/01/2018

EL PASO COUNTY

	Rates	Fringes
ELECTRICIAN	$ 31.80	15.90

ELEC0969-002 01/01/2019

MESA COUNTY

	Rates	Fringes
ELECTRICIAN	$ 24.80	9.84

ENGI0009-001 05/01/2017

	Rates	Fringes
Power equipment operators:		
Blade: Finish	$ 27.92	10.10
Blade: Rough	$ 27.60	10.10
Bulldozer	$ 27.60	10.10
Cranes: 50 tons and under	$ 27.75	10.10
Cranes: 51 to 90 tons	$ 27.92	10.10
Cranes: 91 to 140 tons	$ 28.55	10.10
Cranes: 141 tons and over	$ 29.82	10.10
Forklift	$ 27.22	10.10
Mechanic	$ 28.08	10.10
Oiler	$ 26.84	10.10
Scraper: Single bowl under 40 cubic yards	$ 27.75	10.10
Scraper: Single bowl, including pups 40 cubic yards and over and tandem		

bowls.....$ 27.92 10.10
Trackhoe.....$ 27.75 10.10

IRON0024-003 01/01/2019

	Rates	Fringes
Ironworkers: Structural	$ 29.85	21.76

LABO0086-001 05/01/2009

	Rates	Fringes
Laborers:		
Pipelayer	$ 18.68	6.78

PLUM0003-005 06/01/2017

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PLUMBER	$ 39.08	16.44

PLUM0058-002 07/01/2018

EL PASO COUNTY

	Rates	Fringes
Plumbers and Pipefitters	$ 32.75	14.85

PLUM0058-008 07/01/2018

PUEBLO COUNTY

	Rates	Fringes
Plumbers and Pipefitters	$ 32.75	14.85

PLUM0145-002 07/01/2016

MESA COUNTY

	Rates	Fringes

Plumbers and Pipefitters.....$ 35.17 11.70

PLUM0208-004 06/01/2016

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PIPEFITTER	$ 37.10	16.62

SHEE0009-002 07/01/2018

	Rates	Fringes
Sheet metal worker	$ 34.02	17.49

TEAM0455-002 07/01/2018

	Rates	Fringes
Truck drivers:		
Pickup	$ 21.41	4.32
Tandem/Semi and Water	$ 22.04	4.32

SUCO2001-006 12/20/2001

	Rates	Fringes
BOILERMAKER	$ 17.60	
Carpenters:		
Form Building and Setting	$ 16.97	2.74
All Other Work	$ 15.14	3.37
Cement Mason/Concrete Finisher	$ 17.31	2.85
IRONWORKER, REINFORCING	$ 18.83	3.90
Laborers:		
Common	$ 11.22	2.92
Flagger	$ 8.91	3.80
Landscape	$ 12.56	3.21
Painters:		
Brush, Roller & Spray	$ 15.81	3.26

Power equipment operators:

Backhoe	$ 16.36	2.48
Front End Loader	$ 17.24	3.23
Skid Loader	$ 15.37	4.41

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in

the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION

Exhibit B

II. APPLICABLE PROVISONS CHECKLIST

Check all boxes that apply for this procurement/contract, then refer to applicable sections throughout this document.

Type of Contract:

☐ Professional Services ☒ Construction

Solicitation Type:

☐ Small Purchase (under $150,000 for CDBG-DR projects and $100,000 for FEMA Match projects or more stringent local requirement)

☐ Request for Proposals or Requests for Qualifications above the small purchase limit

☑ Invitation for Bid above the small purchase limit

Applicable Provisions:

☑ Administrative, Contract, or Legal Remedies (all contracts in excess of $150,000)

☑ Termination Clause (all contracts in excess of $10,000)

☑ Equal Employment Opportunity (all construction contracts in excess of $10,000)

☑ Davis Bacon Act (all construction contracts in excess of $2,000 except for new construction, rehabilitation, demolition, or elevation of non-contiguous housing units or 8 or less contiguous housing units)

☑ Contract Work Hours and Safety Standards Act (all contracts in excess of $100,000 that employ mechanics or laborers)

☑ Copeland Anti-Kickback Act (if Davis Bacon applies)

☑ Rights to Inventions Clause (all contracts)

☑ Clean Air Act and the Federal Water Pollution Control Act (all contracts in excess of $150,000)

☑ Debarment and Suspension (all contracts)

☑ Byrd Anti-Lobbying Amendment (all contracts in excess of $100,000)

☑ Procurement of Recovered Materials (all contracts that procure in excess of $10,000 of materials)

☑ Section 3 Clause (all contracts in excess of $100,000)

☑ Energy Efficiency Clause (all contracts)

Applicable Forms:

Forms to be Submitted WITH Contractor's Bid/Proposal

☑ MBE/WBE and Labor Surplus Area Procurement Clause

☑ Form of Statement of Bidder's Qualifications (all bids/proposals)

☑ Wage/Fringe Benefit Certification Form (only if Davis Bacon applies)

☑ Report of Additional Classification and Rate (HUD 4230-A form) (only if Davis Bacon applies)

☑ Bid Bond Certification (5% bond for construction bids over $100,000)

☑ Certificate of Corporate Principal (all bids/proposals)

☑ Certification of Bidder Regarding Equal Employment Opportunity (construction bids over $10,000)

☑ Certification of Bidder Regarding Federal Labor Standards and Davis-Bacon Act (only if Davis Bacon applies)

☑ Certification of Contractor/Subcontractor Regarding Section 3 and Segregated Facilities (only if Section 3 applies)

☑ Certifications of Bidder Regarding Civil Rights (all bids/proposals)

☑ Non-Collusion Affidavit of Prime Bidder (all bids/proposals)

☑ Contractor/Subcontractor's Section 3 Plan (only if Section 3 applies)

☑ Contractor/Subcontractor's Section 3 Tables A & B (only if Section 3 applies)

Forms to be Submitted PRIOR TO Contract Award

- ☑ Certification of Bidder Regarding Section 3 (only if Section 3 applies)
- ☑ Section 3 Certification for Business (only if Section 3 applies)
- ☑ Performance Bond (100% of contract award for all construction contracts over $100,000)
- ☑ Payment Bond (100% of contract award for all construction contracts over $100,000)

Additional Forms for Use DURING Contract Term

- ☑ Certified Payroll Form (only if Davis Bacon applies)
- ☑ Payroll Deduction Authorization Form (only if Davis Bacon applies)
- ☑ Other Deductions on Certified Payroll (only if Davis Bacon applies)
- ☑ Section 3 Monthly Compliance Form (only if Section 3 applies)
- ☑ Employee Data and Certification Form (only if Section 3 applies)
- ☑ Section 3 Posted Notice to Project Residents (only if Section 3 applies)
- ☑ Required Jobsite Posters
  - ☑ Applicable Wage Determination (only if Davis Bacon applies)
  - ☑ Equal Employment Opportunity (construction contracts over $10,000)
  - ☑ Employee Rights Under the Davis-Bacon Act (only if Davis-Bacon applies)

MANDATORY PRE-PROPOSAL CONFERENCE & JOB WALK

Please write legibly. Any addendums or information regarding this Bid/RFP will be sent by email. The information you provide on this document will be used as your official contact information. If we can't read your email address or phone number you risk missing future correspondance regarding this project.

BID #7033-19 FLOOD - Construction Services for Lake 4, West Lake and A-Frame Dam Rehabilitation **PLEASE PRINT**

DATE: 04/22/2019 9:00 am

Please Print

Representatives Name	Company	Address	Phone	E-mail
TOM TANKE	HUDSPETH	4775 S. SANTA FE CIRCLE ENGLEWOOD	303-781-5562	TANKE@HUDSPETHINC.COM
Michael Taylor	HUDSPETH			MTAYLOR@HUDSPETHINC.COM
Claude Murray	RMC Consultants	12295 W 48 Ave Wheat Ridge	303 980 4401	cmurray@rmc-consultants.com
Bruce Hammers	American Civil Constructors	4901 S. Windermere St Littleton	3-730-4526	bhammers@acciwilt.com
John Grubesic	American Civil Constructors	4801 S. Windermere St.	3.419.7079	jgrubesic@acciwilt.com
John Dietzler	Dietzler Construction Corp	100 Gateway Circle Berthoud, Co	303-532-8865	estimating@dietzlerconstruction.com
Pete Saint	Kirkland Construction	2101 Main St, RYE CO	719-489-3385	bids@kirklandconstruction.us
Mike Rachubinski	Lawrence Construction	9002 N. Moore Rd, Littleton	303-791-5642	MRachubinski@lawrence-construction.com
Eugene Jensen	Phillips & Jordan	114 S. Riverbend Drive WY	865-203-8253	EJensen@pandj.com
Jeromy Weiss	ZAK Dirt	14290 Hilltop Rd Longmont, Co 80504	970-535-4657	jweiss@zakdirt.com
Clint Brown	Engineering Analytics	1600 Spectrum Point Rd, Suite 200 Ft Collins 80525	970 488-3111	cbrown@enganalytics.com
TOM EVERED, II	HAMON INFRASTRUCTURE	5670 FRANKLIN, DENVER 80216	303-297-0340	TEVERED@HAMONINFRASTRUCTURE.COM
Colby Reid	Western States Reclamation	3756 Imperial St Frederick	303-833-8824	creid@wsreclamation.com
Eric Petrie	Sema Construction	7353 S. Eagle St, Centennial 80112	303-627-2600	estimating.co@semaconstruction.com
Justin Atherton-Wood	BCPOS			
Prashant KC	BCPOS			
Sean Reynolds	BCPOS			
OBADIAH BROUGHTON	BCPOS			
Ryan Burke	ESCO Construction		720-768-2921	RBurke@ESCOMailbox.com
Mark McLean	Deere & Ault Consultants	600 S. Airport Rd, Suite A205 Longmont	303-651-1468	mark.mclean@deereault.com
JONATHAN HERNANDEZ	CWCB	1313 SHERMAN ST RM 718 DENVER 80203	303 866 3441	JONATHAN.HERNANDEZ@STATE.CO.US
Jude Kolb	American West Construction	275 E. 64TH Ave Denver 80221	720-456-0238	jkolb@trustawc.com
Scott Palmer	Edge Contracting, Inc	1453 Brickyard Road Golden 80403	303 339 1050	spalmer@edgecontracting.com
Katy Bilisoly	Applegate Group Inc	1490 W 121 Ave Denver, CO 80234	303 452 6611	katybilisoly@applegategroup.com
Steve Smith	Applegate Group Inc	"	"	stevesmith@applegategroup.com

MANDATORY PRE-PROPOSAL CONFERENCE & JOB WALK

Please write legibly. Any addendums or information regarding this Bid/RFP will be sent by email. The information you provide on this document will be used as your official contact information. If we can't read your email address or phone number you risk missing future correspondance regarding this project.

BID #7033-19 FLOOD - Construction Services for Lake 4, West Lake and A-Frame Dam Rehabilitation **PLEASE PRINT**

DATE: 04/22/2019 9:00 am

Please Print

Representatives Name	Company	Address	Phone	E-mail
Sean McCormick	Cap excavating	10759 WCR 7	970-980-7367	Sean@Capexcavating.com
Kyle Braly	CAP Ex	10759 WCR 7	720-878-6785	kyle@CAPExcavating.com
Rick Beckarik	N.G EXCAVATION LLC.	14115 MEAD ST UNIT C	970-379-2941	R.BECKARIK ENG-CONSTRUCTION.com
Dylan Braly	CAP Excavating INC.	10759 County RD 7	303-709-9811	dylan@capexcavating.com
Molly O'Donnell	City of Longmont	350 Kimbark Longmont 80501	3036519580	molly.odonnell@longmontcolorado.gov
JONATHAN BIANCARDI	FISCHER CONST.	7460 COUNTY LINE RD	303 785 8655	JAB@FISCHERCONST.com
TIM BEBO	TERRITORY UNLIMITED INC.	3054 S. CTY. RD. 13 LOVELAND CO 80537	303 961 8198	timeterritoryunlimited.com

MANDATORY PRE-PROPOSAL CONFERENCE & JOB WALK

Please write legibly. Any addendums or information regarding this Bid/RFP will be sent by email. The information you provide on this document will be used as your official contact information. If we can't read your email address or phone number you risk missing future correspondance regarding this project.

BID #7033-19 FLOOD - Construction Services for Lake 4, West Lake and A-Frame Dam Rehabilitation **PLEASE PRINT**

DATE: 04/22/2019 9:00 am

Please Print

Representatives Name	Company	Address	Phone	E-mail
JUSTUS BEBO	L M ENTERPRISES, INC.	735 E. HWY 56, BERTHOUD, CO	970-532-3706	jjbebo@lmenterprisesinc.com
DAVID SEEHAFER	KELLEY TRUCKING INC.	6201 MCINTYRE ST GOLDEN	303-279-4150	david.seehafer@kelleytruckinginc.com
Kevin Anderson	Connell Resources Inc	7785 Highland Meadows Pkwy FtCollins,CO	970 214-1601	kanderson@connellresources.com
BILL ANDERSON	Connell Resources, Inc	7785 Highland Meadows, Fort Collins	970-223-3151	banderson@connellresources.com
CARLO ANAMASI FOR	HPM CONTRACTING INC	9200 E. MINERAL AVE CENTENNIAL	720-669-[illegible]	carlo.anamasi@HPMCONTRACTING.COM
MATT ADAMS - POC	" " "	" " " "	720-669-1435	MATT ADAMS@HPM CONTRACTING.COM

HUDSPETH
AN ASRC INDUSTRIAL SERVICES COMPANY

TOM TANKE
Senior Civil Project Manager

HUDSPETH MBE-ANC
4775 S Santa Fe Circle, Englewood, CO 80110
P 303.791.5562 C 303.847.6370
ttanke@hudspethinc.com@hudspethinc.com

ENVIRONMENTAL REMEDIATION AND CONSTRUCTION SERVICES

HAMON
INFRASTRUCTURE

THOMAS O. EVERED
General Manager

C (303) 901-4226
T (303) 297-0340
F (303) 296-9601
tevered@hamoninfrastructure.com

5670 Franklin Street
Denver, Colorado 80216
www.hamoninfrastructure.com

LAWRENCE
An Equal Opportunity Employer

Mike Rachubinski
Sr. Estimator

9002 N. Moore Road
Littleton, Colorado 80125

o : 303.791.5642
c : 303.591.2999
f : 303.791.5647
e : mrachubinski@lawrence-construction.com

www.lawrence-construction.com

AMERICAN WEST
CONSTRUCTION LLC

Jude Kolb
Senior Estimator / Project Manager

275 E 64th Avenue
Denver, CO 80221
jkolb@amwestcon.com
www.amwestcon.com

(303) 455-0838 (office)
(720) 456-0238 (cell)
(303) 455-8148 (fax)

American Civil Constructors
Equal Opportunity Employer

Bruce Hammers
Senior Estimator / Project Manager

Main: 303.795.2582
Direct: 303.730.4526
Fax: 303.347.1844
Cell: 303.888.2719
bhammers@accbuilt.com

Mountain West
4901 S. Windermere St.
Littleton, CO 80120
www.accbuilt.com

Sonny Jensen
Superintendent

office 307.298.2200
cell 865.203.8253
fax 877.202.5083
ejensen@pandj.com

114 S. Riverbend Drive
Douglas, WY 82633
pandj.com

PHILLIPS & JORDAN
A Proven Solution

EDGE
CONTRACTING, INC.
EXCAVATION · DEMOLITION · GRADING · ENVIRONMENTAL

1453 Brickyard Road
Golden, CO 80403
office: 303-339-1050
fax: 303-339-1051

Scott Palmer, P.E.
Director of Construction Services
cell: **303-519-0050**
spalmer@edgecontracting.com

Colby Reid
Reclamation Division Manager
creid@wsreclamation.com

WESTERN STATES
Reclamation, Inc.

Corp Office
3756 Imperial St.
Frederick, CO 80516
Bus: (303) 833-8824
Cell: (303) 908-3525
Fax: (303) 833-4447

Western CO Office
1560 O Road
Loma, CO 81524
Bus: (970) 858-7982
Fax: (970) 858-1213

CO DNR

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Jonathan M. Hernandez, P.E.
Project Manager

P 303 866 3441
x 3234
C 720 376 3406

jonathan.hernandez@state.co.us
1313 Sherman Street Room 718
Denver , CO 80203
www.cwcb.state.co.us

NG CONSTRUCTION AND ENVIRONMENTAL

Rick Becvarik
Project Manager / Estimator
M: 970-379-2941
O: 970-535-4628

Becvarik@ng-construction.com
14115 Mead St. (Unit 3), Longmont, CO 80504

5th Generation of Building in Colorado

FISCHER CONSTRUCTION, INC. — Celebrating 130 Years — Since 1886

Jonathan A. Birnbaum
Director of Business Development

7460 Weld County Road 1
Longmont, CO 80504
jab@fischerconst.com

Office: 303-485-8855
Cell: 303-775-4184
Fax: 303-485-6243

SEMA CONSTRUCTION

Heavy and Highway
General Contractors

Eric Petrie
Project Engineer
7353 S. Eagle Street
Centennial, CO 80112-4223
Phone: (303) 627-2600
Cell: (303) 921-6011
Fax: (303) 627-2626
epetrie@semaconstruction.com

12295 W. 48th Avenue
Wheat Ridge, CO 80033
www.rmc-consultants.net

CLAUDE D. MURRAY, PG, PMP
RESTORATION DIVISION MANAGER

cmurray@rmc-consultants.com
303.980.4101 M:303.898.1948 F:303.980.4107

ENVIRONMENTAL SCIENCE . LAND RESTORATION . TECHNICAL SERVICES

TERRITORY UNLIMITED INC
EST. 2001

TIM BEBO
PRESIDENT

3054 South County Road 13
Loveland, CO 80537-8711

territoryunlimited.com
Tim@territoryunlimited.com

C: 303.961.8198

ZAK dirt

Dan Sewczak
Vice President Operations
DSewczak@ZakDirt.com
cell: 970-215-4254

Jeromy Weiss
JWEISS@ZAKDIRT.com

14290 Hilltop Road • Longmont, CO 80504
970-535-4657 • FAX 970-535-4561
www.ZakDirt.com

Sonny Jensen
Superintendent

office 307.298.2200
cell 865.203.8253
fax 877.202.5083
ejensen@pandj.com

114 S. Riverbend Drive
Douglas, WY 82633
pandj.com

PHILLIPS & JORDAN — A Proven Solution

David Seehafer
Sr. Estimator

6201 McIntyre Street
Golden, CO 80403
Office: 303-279-4150
Fax: 303-279-4799
Cell: 720-289-5562
david.seehafer@kelleytruckinginc.com

CAP
EXCAVATING & DEMOLITION

Expert Quality & Service Since 1989

10759 WCR 7
Longmont, CO 80504
Office: 303.772.2279
Fax 303.772.0727

Sean McCormick
Mobile: 970-980-7367
sean@capexcavating.com

CONNELL

BILL ANDERSON | VICE PRESIDENT OF ESTIMATING

CONNELL RESOURCES, INC.
7785 HIGHLAND MEADOWS PKWY, STE 100 • FT. COLLINS, CO 80528
TEL (970) 223.3151 • FAX (970) 223.3191 • CELL (970) 227.9994
banderson@connellresources.com

HUDSPETH
AN ASRC INDUSTRIAL SERVICES COMPANY

MICHAEL TAYLOR
Business Development

HUDSPETH MBE-ANC
4775 S Santa Fe Circle, Englewood, CO 80110
P 303.791.5562 C 303.204.2635
mtaylor@hudspethinc.com

ENVIRONMENTAL REMEDIATION AND CONSTRUCTION SERVICES

Carlo Anamasi, Jr.
SENIOR EXECUTIVE

HPM, Inc.
9200 E. Mineral Avenue
Suite 355
Centennial, CO 80112

HPM Contracting

720.669.1435 Work
858.218.5713 Mobile

400' COVER →

carlo.anamasi@hpmcontracting.com HPMcontracting.com

DIETZLER
CONSTRUCTION CORP.

John P. Dietzler
Vice President

100 Gateway Circle
Berthoud, CO 80513

P: 303.532.8859
C: 303.905.1143
F: 303.532.8621

jdietzler@dietzlerconstruction.com
www.dietzlerconstruction.com

Attachment D

PROJECT MANUAL

LAKE 4 OUTLET PIPELINE REPLACEMENT

Issued for bid by:

Boulder County Parks and Open Space

Engineer:

DEERE & AULT
CONSULTANTS, INC.

Procurement:

Boulder County Parks and Open Space and
St. Vrain and Left Hand Water Conservancy District

LAKE 4 OUTLET PIPELINE REPLACEMENT
BID SCHEDULE

Item	Description	Quantity	Unit	Unit Price	Extension
1.	**Mobilization, Bonding and Insurance**	1	LS		
2.	**Dewatering Excavations**	1	LS		
3.	**Locate and Survey Existing 18-inch RCP Pipeline**	1	LS		
4.	**Access Manhole #1**	1	LS		
5.	**Access Manhole #2**	1	LS		
6.	**Access Manhole #3**	1	LS		
7.	**Access Manhole #4**	1	LS		
8.	**Electrical Service to Access Manhole #4**	1	LS		
9.	**14-inch HDPE Sliplining of Existing 18-inch RCP Pipeline**	2015	LF		
10.	**18-inch HDPE Cut and Cover Pipeline**	310	LF		
11.	**18-inch DIP Pipe and Fittings**	1	LS		
12.	**Full Pipeline System Pressure Leak Test and Video Inspection**	1	LS		
13.	**North 61st Street Road Crossing**	1	LS		
14.	**Measurement Structure**	1	LS		
15.	**Parshall Flume and Stilling Well**	1	LS		
16.	**Remove Existing Measurement Structure**	1	LS		
17.	**Install Tracer Wire**	1	LS		
18.	**Site Restoration and Revegetation**	1	LS		
				TOTAL	**$**
19.	**Alternate Bid Item – Rock Stabilization Material (provide unit price only)**	1	CY		

Total Bid (in words)_____

_____

Bidder's Company Name:_____

ATTACHMENT A

SUMMARY OF WORK

Furnish all necessary materials, equipment, labor, and any incidental items associated with completing the project described below as detailed in the Construction Documents. The work includes, but is not limited to, the following:

Lake 4 Outlet Pipeline Replacement

The Lake 4 Outlet Pipeline Replacement will include replacing an approx. half mile long, existing 18-inch RCP pipeline, pre-cast concrete access manhole and cast-in-place concrete measurement structure with a new 14-inch and 18-inch HDPE SDR17 pipeline through both sliplining (approx. 2,015 LF) and cut and cover (approx. 310 LF) techniques, with four (4) pre-cast concrete access manholes (including interior HDPE and DIP pipe and fittings), and a cast-in-place concrete measurement structure. The project will include removal of portions of the existing pipeline and removal of the existing measurement structure. More specifically the Work includes, but is not limited to, the following:

- Mobilization to and demobilization from the site of all equipment, personnel, and materials required to complete the work.
- Hiring of a qualified quality control testing firm for field and laboratory testing for soil, concrete, etc.
- State and local permits.
- Coordination with City of Longmont, Power & Communications Dept.
- Traffic control.
- Sediment and erosion control and vehicle tracking control BMPs and maintenance of BMPs throughout the project.
- Clear and grub areas to be excavated.
- Strip and stockpile topsoil from areas to be excavated.
- Dewatering during construction to perform all construction in relatively dry conditions.
- Determine locations and provide excavations to access existing 18-inch RCP pipeline for installing liner pipe and access manholes.
- Provide utility locate of existing 18-inch RCP pipeline with ground marks for surveying between each pair of Access Manholes.
- Survey of utility locate marks to document location of existing 18-inch RCP pipeline between Access Manholes.
- Excavations to access existing 18-inch RCP pipeline for installing liner pipe and access manholes.
- Stockpiling soils from excavations for backfill.
- Installation of sliplined HDPE pipeline including installation of approx. 2,015 LF of 14-inch

diameter HDPE SDR17 butt-fusion welded pipe in an existing 18-inch RCP pipeline including removal of existing 18-inch RCP to provide access for sliplining and access manholes, cleaning 18-inch RCP interior, and grout.

- Installation of cut and cover pipeline pipe and associated pipe fittings, including excavation and stockpiling material, installation of approx. 310 LF of 18-inch HDPE SDR17 with associated fittings, tracer wire and warning tape above outlet pipeline, placement and compaction of pipeline bedding, and backfilling and compaction of pipeline trench soils with stockpiled soils.

- Installation of cut and cover pipeline pipe and associated pipe fittings including pipeline excavation and stockpiling material, installation of 18-inch DIP Class 250 pipe and associated valves and fittings, poly-wrap, and warning tape above outlet pipeline, valve box, placement and compaction of pipeline bedding, and backfilling and compaction of pipeline trench soils with stockpiled soils.

- Locates, support and protection of existing buried gas and telephone utilities in North 61st Street crossing the proposed outlet pipeline trench.

- Removal of existing 72-inch pre-cast concrete access manhole and 18-inch RCP and dispose offsite (unless suitable for fish habitat in Lake 4, West Lake, or A-Frame Reservoir).

- Removal of existing concrete measurement structure and pipe located on the west bank of St. Vrain Creek north of the 61st Street bridge on Oligarchy Irrigation Company property, and dispose offsite (unless suitable for fish habitat in Lake 4, West Lake, or A-Frame Reservoir).

- Installation of four (4) 90-inch diameter pre-cast concrete access manholes along outlet works alignment, including interior DIP and HDPE pipe, valves, fittings, manhole bases, rings, lids, covers, appurtenances, concrete backfill, and soil backfill.

- Provide electrical service to Access Manhole #4, including Unistrut mounting frame, transformer, meter, disconnects, outlets, conduit and enclosures.

- Construction of a reinforced concrete Parshall flume measurement structure including, excavation and subgrade prep, forming, placement of reinforcing steel, water stops, concrete placement, and curing, connection to A-Frame Reservoir box culvert structure, sealant, anchors, grating frame and grating, shear gate and backfill.

- Install FRP Parshall flume in measurement structure including, flume, concrete backfill, stilling well, connecting pipe, and instrument enclosure.

- Pressure (leakage) testing of the Outlet Pipeline joints for each of five (5) segments between structures, and for the entire pipeline upon completion.

- Video inspection of entire pipeline interior upon completion.

- Install tracer wire and terminal posts between pairs of access manholes.

- Re-grading to pre-construction conditions.

- Revegetation of disturbed areas

- As-constructed survey documenting the completed construction providing final elevations, locations of all structures, and inverts, built as part of this project.

ATTACHMENT B
SPECIAL CONDITIONS

PART 1 – GENERAL

1.1 Description

This section is provided to advise the Contractor as to general provisions that are either a modification of, or are in addition to those provisions set forth in the General Conditions. In the event of an apparent conflict between the Special Conditions and the General Conditions, the Special Conditions shall take precedence

Part 2 – SUPPLEMENTS TO THE GENERAL CONDITIONS

2.1 BID SUBMITTAL DOCUMENTS

Refer to Bid Submittal documents

2.2 METHOD OF MEASUREMENT

Refer to Attachment C – Payment Procedures

2.3 BID CONDITION

A. The Contractor shall provide evidence that the Contractor is qualified to perform the work indicated in the Contract Documents. The Contractor and the Contractor's on-site representative who has immediate charge of the project shall each have satisfactorily completed the same responsibilities on a project similar in size and complexity with 1) HDPE sliplining of pipe requiring relatively deep excavation, and 2) manhole interior utility pipe and fittings, within the last 5 years. (Qualification requirements are described in the technical specifications)

B. It is mandatory that the contractor fully completes the Bid Submittal Documents and provide all materials requested herein. The Contractor shall document qualifications as outlined in paragraph 2.3A of this section and submit with the bid submittal documents. Questions regarding Contractor's qualifications will need to be addressed within 24 hours of the bid opening, contractors failing to adequately address qualifications may be considered non-responsive.

C. Contractors that fail to have representative(s) during the Project who meet the qualifications in paragraph 2.3A of this section will be considered to have improper superintendence under paragraph 10.4.1 of the General Conditions.

D. Contractor must demonstrate that the contractor has adequate work force to complete the project in the allotted time frame. Contractors who fail to demonstrate an adequate work force will be considered non-responsible.

2.4 TIME FOR COMPLETION

The Contractor shall fully complete the work in an acceptable and satisfactory manner from 150 calendar days from Notice to Proceed.

2.5 WORK HOURS

Contractor shall not start work before 7:00am or work after 5:00pm without Boulder County approval. Contractor shall give 48 hours' notice to Boulder County Parks and Open Space (BCPOS) for approval to work after 5:00 PM during the work week to complete longer construction activities. Contractor shall give 48 hours' notice to BCPOS for approval to work weekends.

2.6 CONDUCT

A. The Contractor understands that when entering into this contract that they are representing and working for BCPOS.

B. The Contractor and the Contractor's employees will be required to treat adjacent property owners in a professional manner. Non-compliance by the contractor's workforce may result in termination of the contract at the discretion of BCPOS.

2.7 SITE ACCESS

The site shall only be accessed from North 61st Street.

2.8 WORK ON OLIGARCHY IRRIGATION COMPANY PROPERTY AND ACCESS ACROSS CONDON PROPERTY

An existing concrete structure and the terminus of the existing 18-inch RCP, both to be removed as part of this project, are located on private property. The Oligarchy Irrigation Company has agreed to provide access to the structure which access shall be available to the Contractor. The Oligarchy property and the structure may be accessed across a second private property (from 61st Street to the Oligarchy property) owned by Condon by agreement which access shall be available to the Contractor. Impact to the Condon property is limited to accessing the Oligarchy property. Upon removal of the structure and a small portion of the RCP pipeline, Contractor shall restore the Condon access and the Oligarchy property to prior condition. Condon owner will revegetate the access area. Contractor shall coordinate access with the property owners and shall make every reasonable effort to avoid damage of any kind to the properties or any improvement thereon.

2.8 STAGING AREA

BCPOS has designated the staging area that the Contractor can use during construction. The Contractor shall keep all construction items inside the staging area and shall not intrude on any private property.

2.9 LOCATING THE EXISTING LAKE 4 OUTLET PIPELINE

The existing 18-inch RCP pipeline between Lake 4 and St. Vrain Creek to be replaced was approximately located in February 2017, and is the basis for the location of the pipeline as shown on the Plans. The existing pipeline includes deflected joints and bends. A video record of the interior pipe inspection performed at the time will be made available to the Contractor.

It shall be Contractors responsibility to pothole the existing pipeline to ascertain the actual location of the RCP pipeline, and the actual alignment of the RCP pipeline segments planned to remain between the proposed locations of the access manholes. Where indicated on the Plans, the final access manhole locations shall correspond to locations of bends in the existing RCP pipeline. The actual angle of two fabricated HDPE bends, and the locations of castouts in two precast manhole bases are dependent on the actual alignments of the pipeline segments at the access manhole locations.

2.10 LAKE 4 DAM OUTLET WORKS CONNECTION

The west (upstream) terminus of the Lake 4 Outlet Pipeline Replacement HDPE pipeline shall be located so as to be incorporated into the Lake 4 Outlet Tower 2 as shown on plans for the Western Mobile Lake 4 Dam Rehabilitation by Engineering Analytics, Inc.

2.11 WEST LAKE DAM

Lake 4 Outlet Pipeline Replacement, Access Manhole #1 is to be located in the West Lake dam. Accordingly, all earthwork, especially including backfill around the completed manhole must comply with the drawings and specifications for the West Lake Dam, Dam Maintenance and Rehabilitation Construction Plans by Applegate Group, Inc. The details of the Access Manhole #1 in the Lake 4 Outlet Pipeline Replacement plans supersedes that shown on Sheet 20 of 23 of the West Lake Dam Maintenance and Rehabilitation Construction Plans.

2.12 A-FRAME RESERVOIR

The measurement structure shown in these Plans, will be attached to the A-Frame Reservoir spillway box culvert included in the A-Frame Reservoir, Rehabilitation Construction Plans by Applegate Group, Inc. Prior to construction of the Lake 4 Outlet Pipeline cut and cover 18-inch HDPE Pipeline and Measurement Structure shown in the Plans, Contractor must consult with the Engineer to determine whether any adjustments to line and grade are required based on the actual location of the A-Frame Reservoir Spillway box culvert and its cutoff walls.

2.13 U.S. ARMY CORPS OF ENGINEER PERMIT

This project has received a Section 404F Maintenance Exemption, or Nationwide permit(s) from the Department of Army, Corps of Engineers.

LAKE 4 OUTLET PIPELINE REPLACEMENT

BOULDER COUNTY, COLORADO
WATER DIVISION 1, WATER DISTRICT 5
DAMID: 050220

TECHNICAL SPECIFICATIONS

PREPARED FOR:

BOULDER COUNTY PARKS AND OPEN SPACE
5201 ST. VRAIN ROAD
LONGMONT, COLORADO 80503

D&A JOB NO. WR-0155.005.02

NOVEMBER 2018

DEERE & AULT
CONSULTANTS, INC.
600 South Airport Road, Suite A-205
Longmont, CO 80503
(303) 651-1468 • Fax (303) 651-1469
www.deereault.com

TECHNICAL SPECIFICATIONS

Lake 4 Outlet Pipeline Replacement

Technical Specifications
Table of Contents

33 12 00 – Piping Leakage Testing and Video Inspection
33 41 01 – High-Density Polyethylene (HDPE) Pipe
35 20 19 – Valves and Gates, General
35 20 19.23 – Miscellaneous Valves

Division 40 – **Process Interconnections**
40 71 69 – Open Channel Flow Meters

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work for this project consists generally of procurement and installation of all necessary materials, equipment, labor, and any incidental items associated with completing the project described below.

PROJECT DESCRIPTION: Lake 4 Outlet Pipeline Replacement will include replacing an approx. half mile long, existing 18-inch RCP pipeline, pre-cast concrete access manhole and cast-in-place concrete measurement structure with a new 14-inch and 18-inch HDPE SDR17 pipeline through both sliplining (approx. 2,015 LF) and cut and cover (approx. 310 LF) techniques, with four (4) pre-cast concrete access manholes (including interior HDPE and DIP pipe and fittings), and a cast-in-place concrete measurement structure. The project will include removal of portions of the existing pipeline and removal of an existing measurement structure. More specifically the Work includes, but is not limited to, the following:

LAKE 4 OUTLET PIPELINE REPLACEMENT

- Mobilization and demobilization from the site of all equipment, personnel, and materials required to complete the work
- Hiring of a qualified control testing firm for field and laboratory testing for soil, concrete, etc.
- State and local permits
- Coordination with City of Longmont Power and Communications Department
- Traffic control
- Sediment and erosion control and vehicle tracking control BMPs and maintenance of BMPs throughout the project
- Clear and grub areas to be excavated
- Strip and stockpile topsoil from areas to be excavated
- Dewatering during construction to perform all construction in relatively dry conditions
- Determine locations and provide excavations to access existing 18-inch RCP pipeline for installing liner pipe and access manholes.
- Marking and surveying location of existing 18-inch RCP pipeline from Lake 4 dam to existing access manhole near 61st Street
- Stockpiling soils from excavations for backfill
- Installation of sliplined pipeline including installation of approx. 2,015 LF of 14-inch diameter HDPE SDR17 butt-fusion welded pipe in an existing 18-inch RCP pipeline including removal of existing 18-inch RCP to provide access for sliplining and access manholes, cleaning 18-inch RCP interior and grout
- Installation of cut and cover pipeline pipe and associated pipe fittings including, excavation and stockpiling material, installation of approx. 310 LF of 18-inch HDPE SDR17 with associated fittings, tracer wire and warning tape above outlet pipeline, placement and compaction of pipeline bedding, and backfilling and compaction of pipeline trench soils with stockpiled soils
- Installation of cut and cover pipeline pipe and associated pipe fittings including pipeline excavation and stockpiling material, installation of 18-inch DIP Class 250 pipe and associated valves and fittings, poly-wrap, and warning tape above outlet pipeline, valve box, placement and compaction of pipeline bedding, and backfilling and compaction of pipeline trench soils with stockpiled soils
- Locates, support and protection of existing buried gas and telephone utilities in North 61st Street crossing the proposed outlet pipeline trench
- Removal of existing 72-inch pre-cast concrete access manhole and 18-inch RCP and dispose offsite (unless suitable for fish habitat in Lake 4, West Lake, or A-Frame

Reservoir)
- Removal of existing concrete measurement structure and pipe and dispose offsite (unless suitable for fish habitat in Lake 4, West Lake, or A-Frame Reservoir)
- Installation of four (4) 90-inch diameter pre-cast concrete access manholes along outlet works alignment, including interior DIP and HDPE pipe, valves, fittings, manhole bases, rings, lids, covers, appurtenances, concrete backfill, and soil backfill
- Provide electrical service to Access Manhole #4, including Unistrut mounting frame, transformer, meter, disconnects, outlets, conduit and enclosures
- Construction of a reinforced concrete Parshall flume measurement structure including, excavation and subgrade prep, forming, placement of reinforcing steel, water stops, concrete placement and curing, connection to A-Frame Reservoir box culvert structure, sealant, anchors, grating frame and grating, shear gate and backfill
- Install FRP Parshall flume in measurement structure including, flume, concrete backfill, stilling well, connecting pipe, and instrument enclosure
- Pressure (leakage) testing of the Outlet Pipeline joints for each of five (5) segments between structures, and for the entire pipeline upon completion
- Video inspection of entire pipeline interior upon completion
- Installation of tracer wire and terminal posts between each pair of access manholes
- Re-grading to pre-construction conditions
- Revegetation of disturbed areas
- As-constructed survey documenting the completed construction providing final elevations, locations of all structures, and inverts, built as part of this project

1.02 EXPRESSION OF CONTRACTOR RESPONSIBILITY IN THE TECHNICAL SPECIFICATIONS

A. Whenever in the Technical Specifications requirements are expressed with active verbs and no subjects, the words, "The Contractor shall," have been omitted as a matter of style, meaning that the Contractor is the party responsible for taking the action required.

1.03 WORK BY OTHERS

A. Contractor's attention is directed to the Supplementary Conditions for requirements based on work conducted at or adjacent to the Site.
B. Interference with Work On Utilities: Contractor shall cooperate fully with all utility forces of the Owner or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities that interfere with the progress of Work, and shall schedule Work so as to minimize interference with said relocation, altering, or other rearranging of facilities. Contractor's attention is directed to Section 01 50 00 - Protection of Existing Facilities for known requirements regarding utility coordination.
C. Contractor shall provide access to the site to personnel of Boulder County and the St. Vrain and Left Hand Water Conservancy District so that they can maintain and operate their facilities on the Site.

1.04 WORK SEQUENCE

A. Contractor shall schedule and perform Work in such manner to achieve all milestone completion dates. Contractor shall also schedule and perform Work to conform to other dates, times, and time durations required as part of this Work and the work of others. Refer to Section 01 14 00 - Construction Constraints for more requirements regarding sequencing and schedule constraints. Refer also to for important work by others that may affect the Sequence of Work.

1.05 CONTRACTOR USE OF SITE

A. Contractor shall confine its operations to the Work areas indicated on the Drawings.
B. Contractor's use of Site shall be limited to its construction operations, including onsite storage of materials, equipment, parking of Contractor employee vehicles, onsite fabrication facilities, and field offices. Refer to Section 01 55 00 - Site Access and Storage.
C. Restricted areas are not available to Contractor during performance of Work. Contractor shall be prohibited from entering any restricted areas. Restricted areas include areas outside of the

construction easement and permanent easement. Refer to Section 01 55 00 - Site Access and Storage.

D. Night and weekend work may not be performed without written notification from the Project Manager a minimum of 48-hours prior to the start of night or weekend work.
E. No Work shall be allowed on holidays as defined in the Contract Documents.

1.06 OWNER USE OF PROJECT SITE

A. Owner may utilize all or part of the existing Site and existing facilities during the entire period of construction for the conduct of Owner's normal operations, observation of the Work, and for other Owner projects. Cooperate and coordinate with the Engineer to facilitate Owner's operations and projects and to minimize interference with Contractor's operations at the same time. In any event, Owner shall be allowed safe access to all portions of the Site during the period of construction of the Project.

1.07 NOTICES TO OWNERS OF ADJACENT PROPERTIES AND UTILITIES

A. Maintain access to all public and private properties at all times through the use of detours or alternate routes or entrances unless written permission is obtained from the property owner or tenant prior to closing such access.
B. Utilities and other concerned agencies shall be contacted prior to cutting streets or other traffic areas or excavating near underground utilities or pole lines in accordance with Section 01 50 00 - Protection of Existing Facilities.
C. Review with the various utility companies the construction methods, safety procedures, and Work to be done in the vicinity of utilities. When temporary relocation of utilities is necessary, sufficient advance notice shall be given by Contractor to the utility involved, as required by the utility company.

1.08 LINES AND GRADES

A. Work shall be done to the lines, grades, and elevations indicated, within the tolerances below except where otherwise indicated and where dimensions are indicated to be minimum, or specified in other sections of the Contract Documents. Maintain slopes and drainage as indicated. Regardless of tolerance limits, no reverse grading will be permitted. No enclosed depressions or high and low points shall be allowed unless specifically indicated.

Non-grade critical areas (refer to Note 1 below)	± 6-in
Grade critical areas and areas within the 100-year floodplain	± 1-in
Graded dirt roads or pads	± 2-in
Foundations for structures	± 1-in
Paved roads and parking lots	± 1-in
Drainage ditches and swales	± 1-in
Pipelines	± 1-in

B. **Note 1** - Non-Grade Critical Areas: The Contractor may distribute excess native spoils material at properties where grade is non-critical, within the construction limits, and in accordance with specification Section 01 14 00 - Construction Constraints. Grades shall conform to grade tolerances indicated. Non-grade critical tolerances shall not apply to areas within the 100-year floodplain. Areas within the 100-year floodplain shall be restored to original grade to within the tolerances specified, regardless of the classification made in specification Section 01 14 00 - Construction Constraints.
C. Tolerances for finish grades are subject to adjustment as indicated at transition from new to

existing surfaces. Provide uniform grade and match elevations at such transitions.

D. Basic horizontal and vertical control points are established and provided on Drawing 2, General Site Plan. Any additional surveys, layouts, or measurements needed for proper construction of Work shall be performed by Contractor.
E. Keep the Owner informed, a reasonable time in advance, of the times and places at which Contractor wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by the Owner may be done with minimum delay to Contractor.
F. Contractor shall remove and reconstruct Work that is improperly located.
G. Unless otherwise indicated, existing grades and grades prepared by others are accurate only to within one-half of the contour interval for the topography indicated or plus or minus 1-ft, whichever is greater. If no contour interval is indicated, existing grades shall be considered accurate to plus or minus 1-ft. No additional payment will be made for extra grading, excavation, fill, backfill, structural fill, or related materials and Work effort of any kind unless the actual grades at the beginning of the Work differ from those indicated by more than the accuracy limits indicated above.
H. Earthwork quantity estimates shown on the Drawings are estimates only to assist Contractor in work planning. The Contractor is responsible to determine actual quantities required for construction. Any quantity of material that is different than that shown on the Drawings will not be considered cause for additional compensation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 14 00
CONSTRUCTION CONSTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Schedule, sequence, and perform Work in a manner that minimizes disruption to the public and to the operation and maintenance of existing facilities.
B. Incorporate the construction and schedule constraints of this Section into the construction schedules.

1.02 SPECIFIC CONSTRAINTS

A. The listing of constraints provided below does not mean that every constraint or special condition has been identified. Constraints and special conditions listed below do not relieve the Contractor of the responsibility for coordination and planning for completion of the Work in accordance with the Contract.
   1. Coordinate constraints associated with various agency permits and agreements, as indicated in Section 01 41 26 – Permits and Agreements.
   2. Unless otherwise specified, at least 2 weeks prior to the start of any construction activity on or near adjacent private properties, the Contractor and Owner shall meet with adjacent property owners to discuss construction schedule impacts.
   3. Contractor needs to maintain safe access to adjacent properties and existing facilities during all phases of construction.
   4. Project access only allowed from Boulder County road North 61st Street and on project access road and easements as shown in the construction plans.
B. Maintain permanent access to the above mentioned existing facilities.
C. Execute the work while the existing facilities are in operation unless approved in accordance with this Section. Operation of the existing facilities shall not be jeopardized nor shall the efficiency of operation be reduced as a result of performing work.
D. It shall be understood and agreed by the Contractor that the critical events in this Section are not inclusive and that additional items of Work not included may be required to minimize disruption and ensure compliance. Deviation from or modification of these suggested sequences is permitted if techniques and methods known to the Contractor will result in reducing disruption to the facility operation and maintaining operating efficiency. All deviations must be submitted and approved by the Owner seven working days before the work is to start.

1.03 TEMPORARY OUTAGES OR BYPASSES

A. Submit a detailed outage plan, coordinated with the construction schedule, to the Owner a minimum of three (3) weeks in advance of the time that such outages are required, to include: date(s), start time, and duration anticipated for outage; and size and location of temporary facilities (e.g., piping, etc.).
B. Contractor shall not begin an alteration affecting existing facilities until specific written approval has been granted by the Owner.
C. Engineer will coordinate Contractor's planned procedure with the existing facility owners. Engineer has the authority to approve or modify any proposed shutdown procedures if such procedures would adversely impact the existing facility owners.
D. Notify Owner in writing at least one week in advance of the required outage if the schedule for performing the Work has changed or if revisions to the outage plan are required.
E. Provide written confirmation of the shutdown date and time at least 2 days prior to the actual shutdown.
F. Required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall be completed as quickly as possible and shall proceed continuously (24 hours a day and 7 days a week) if necessary to complete modifications and/or connections in the minimum time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

The entire cost of the work and the material necessary to complete all items shown on the Contract Documents or specified herein, shall be included and merged into the pay items in the Proposal Schedule. All payments shall be subject to the conditions of these specifications. Any work shown on the plans and not specifically listed is to be included in these items.

All pay items shall include materials, transportation expenses to the job site, cost of installation, maintenance during construction, guarantees and warranties (if applicable), profit, sales tax, license, permits, and other taxes required for the completion of the project in-place for each item in the Proposal Schedule. Payment for items on a "lineal foot basis" shall be measured upon the horizontal plane after installation, and through all fittings for pipelines. Payment for items will be made after installation.

No additional compensation will be allowed for any item beyond the limits as shown on the Contract Drawings without prior written approval of the Owner. For earthwork items, no adjustment to the extended cost, as bid, will be made unless the measured quantity differs from the bid quantity by greater than 5%.

LAKE 4 OUTLET PIPELINE REPLACEMENT

Bid Item #1 - Mobilization, Bonding and Insurance

1. Includes the mobilization of personnel, equipment, and temporary construction facilities to the project site and their subsequent removal. Provide bonds and insurance, temporary utilities, detailed construction schedule, surveying, and project specific overhead, required to complete the bid items detailed below.

2. Payment will be made at the contract **Lump Sum** price in installments:

    a. 50% when 5% of the job not including mobilization has been completed, including partial payments.
    b. And the final 50% when 50% of the job not including mobilization has been complete, including partial payments.

Bid Item #2 – Dewatering Excavations

1. Measurement and Payment Unit: **Lump Sum**

    No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

    - Obtaining all necessary State and County permits
    - Providing power and pumping equipment
    - Dewatering of excavations to provide suitable working area for installation of pipe, fittings, manholes and structures
    - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #3 – Locate and Survey Existing 18-Inch RCP Pipeline

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Locate existing 18-inch RCP pipeline by excavation at proposed locations of Access Manholes)
   - Locate existing 18-inch RCP pipeline by electronic sensing between Lake 4 Dam and the existing access manhole near 61st Street
   - Mark location of existing pipeline at ground surface with paint or lath as appropriate
   - Survey locations of marks
   - Provide digital survey information to Owner/Engineer
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #4 – Access Manhole #1

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Locate existing 18-inch RCP at intended manhole location
   - Clear and grub all areas to be excavated
   - Strip and stockpile topsoil
   - Excavate and stockpile excavated material
   - Prepare subgrade
   - Delivery and storage of manhole materials
   - Install precast 90-inch manhole base, risers, interior floor, lid, grade rings, iron rings and covers, seal joints with mastic or preformed gaskets, grout joints
     - Total height 24 ft 9 in
   - Determine angle for fabricated HDPE bend
     - Est. 22.5 degrees (nominal)
   - Fabricate HDPE bend
   - Install interior pipe, fittings, valves, supports, grating
   - Install PVC drain pipe and reinforced concrete drain outlet structure
   - Grout HDPE and PVC pipe penetrations through manhole
   - Encase existing RCP and new HDPE in concrete backfill with temperature steel
   - Backfill excavation **using clay core material conforming to the West Lake Dam, Dam Maintenance and Rehabilitation Construction Plans, material and installation specifications, including testing requirements.**
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #5 – Access Manhole #2

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

- Locate existing 18-inch RCP at intended manhole location
- Clear and grub all areas to be excavated
- Strip and stockpile topsoil
- Excavate and stockpile excavated material
- Prepare subgrade
- Delivery and storage of manhole materials
- Install precast 90-inch manhole base, risers, interior floor, lid, grade rings, iron rings and covers, seal joints with mastic or preformed gaskets, grout joints
    - Total height 23 ft 3 in
- Determine angle for fabricated HDPE bend
    - Estimated 11.25 degrees (nominal)
- Fabricate HDPE bend
- Install interior pipe, fittings, valves, supports, grating
- Install PVC drain pipe and reinforced concrete drain outlet structure
- Grout HDPE and PVC pipe penetrations through manhole
- Encase existing RCP and new HDPE in concrete backfill with temperature steel
- Backfill excavation using native materials from excavation
- Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #6 – Access Manhole #3

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Locate existing 18-inch RCP at intended manhole location
   - Clear and grub all areas to be excavated
   - Strip and stockpile topsoil
   - Excavate and stockpile excavated material
   - Prepare subgrade
   - Delivery and storage of manhole materials
   - Install precast 90-inch manhole base, risers, interior floor, lid, grade rings, iron rings and covers, seal joints with mastic or preformed gaskets, grout joints
       - Total height 25 ft 6 in
   - Install interior pipe, fittings, valves, supports, grating
   - Install PVC drain pipe and reinforced concrete drain outlet structure
   - Grout HDPE and PVC pipe penetrations through manhole
   - Encase existing RCP and new HDPE in concrete backfill with temperature steel
   - Backfill excavation using native materials from excavation
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #7 – Access Manhole #4

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Clear and grub all areas to be excavated
   - Strip and stockpile topsoil
   - Excavate and stockpile excavated material

- Remove and dispose of existing 72-inch precast concrete manhole
- Remove and dispose of existing 18-inch RCP pipeline within manhole excavation
    - Remaining 18-inch RCP beyond excavation to be abandoned in-place
- Prepare subgrade
- Delivery and storage of manhole materials
- Install precast 90-inch manhole base, risers, interior floor, lid, grade rings, iron rings and covers, seal joints with mastic or preformed gaskets, grout joints
    - Total height 27 ft 6 in
- Install interior pipe, fittings, valves, supports, grating, Link-Seal
- Core 10-inch diameter opening in side of A-Frame Reservoir box culvert
- Install PVC drain pipe from manhole to A-Frame Reservoir box culvert
- Grout HDPE, DIP and PVC pipe penetrations through manhole
- Grout PVC pipe penetration into A-Frame Reservoir box culvert
- Encase existing RCP and new HDPE in concrete backfill with temperature steel
- Backfill excavation using native materials from excavation
- Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #8 – Electrical Service to Access Manhole #4

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Obtain all necessary permits
   - Install buried conduit and power cables from City of Longmont provided flush-mounted junction box to Access Manhole #4
   - Install Unistrut frame near Access Manhole #4 (location to be provided by Engineer)
   - Install service disconnect, meter, 110V/20A outlet, and 208V/50A outlet, and circuit breakers, all in suitable enclosures, on Unistrut frame
   - Complete all connections to provide 208V, 100 Amp electrical service to Access Manhole #4
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #9 – 14-inch HDPE Sliplining of Existing 18-inch RCP Pipeline

1. Measurement and Payment Unit: **Linear Foot**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Evaluate whether the existing 18-inch RCP with Insituform lining will accept the proposed 14-inch HDPE liner insertion, and if not, remove approx. 40 feet of 18-inch Insituform lined RCP
   - Remove sufficient existing 18-inch RCP at each Access Manhole location to allow access to pipe interior for sliplining
   - Clean existing 18-inch RCP interior
   - Provide 14-inch HDPE SDR17 pipe
   - Butt fusion welding of 14-inch HDPE pipe
   - Insert 14-inch welded HDPE pipe into 18-inch RCP
   - Provide 17-inch O.D. pipe collar/grout stop at each end of liner segments
   - Provide 21-inch O.D. integral pipe collar/wall anchor at each Access Manhole

- Terminate 14-inch HDPE inside each Access Manhole
- Grout 10 LF (approx. 40 gallons) at each end of each liner segment at interface of existing 18-inch RCP and new 14-inch HDPE
- Develop plan for hydrostatic leak test of each completed liner segment and provide for Owner's approval
    - Five (5) segments to be tested individually
- Conduct hydrostatic test of each completed liner segment
- Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #10 – 18-inch HDPE Cut and Cover Pipeline

1. Measurement and Payment Unit: **Linear Foot**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Clear and grub all areas to be excavated
   - Strip and stockpile topsoil
   - Excavate pipe trench and stockpile excavated material
   - Provide 18-inch HDPE SDR17 pipe
   - Butt fusion welding of 18-inch HDPE pipe
   - Attach tracer wire to 18-inch HDPE pipe
   - Bed pipe
   - Install pipe in trench
   - Install concrete thrust blocks at two 45-degree bends
   - Backfill pipe trench and install warning tape in trench
   - Provide tracer wire test station at each end of pipeline
       - One (1) at Access Manhole #4, and one (1) at Measurement Structure for total of two (2)
   - Develop plan for hydrostatic leak test of completed pipeline segment and provide for Owner's approval
   - Conduct hydrostatic test of completed pipeline segment
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #11 – 18-inch DIP Pipe and Fittings

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Clear and grub area to be excavated
   - Excavate pipe trench and stockpile excavated material
   - Provide approx. 18-inch, Class 125 Ductile-iron pipe (DIP) outside Access Manhole #4 and at Measurement Structure
   - Wrap pipe and fittings in polywrap and tape
   - Install 18-inch DIP and fittings, including:
       - Pipe and flexible couplings at Access Manhole #4, and pipe, butterfly valve, Link-Seal, and 90-degree bend at Measurement Structure
   - Install valve box and concrete collar
   - Backfill pipe trench

- Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #12 – Full Pipeline System Pressure Leak Test and Video Inspection

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:
   - Develop plan for pressure leak test of entire complete pipeline from Lake 4 dam to Measurement Structure
   - Conduct pressure leak test of entire completed pipeline
   - Perform video inspection of entire completed pipeline interior
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #13 – North 61st Street Road Crossing

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Obtain all necessary permits
   - Obtain utility locates
   - Traffic control during 18-inch HDPE pipeline installation
     - Payment for pipeline installation shall be in Bid Item #9
   - Protect utilities during 18-inch HDPE pipeline installation
   - Restore gravel road base and surface, matching existing base and surface materials and thicknesses
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #14 – Measurement Structure

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Clear and grub all areas to be excavated
   - Strip and stockpile topsoil
   - Excavate and stockpile excavated material
   - Prepare subgrade
   - Field cut opening in A-Frame Reservoir box culvert
   - Drill, clean holes, and epoxy dowels in place
   - Install Sika-Swell sealant at interfaces with A-Frame Reservoir box culvert
   - Install steel wall sleeve
   - Provide blockout for Parshall flume installation
   - Provide and place reinforcing steel
   - Provide and place angle iron embeds for grating
   - Forming, placing and finishing structural concrete floors, walls and top
   - Applying curing compounds

- Adherence to ACI hot and cold weather concrete placement
- Install manhole steps
- Install 6-inch shear gate
- Install 10 LF of 6-inch SCH 80 PVC from Measurement Structure to 1 CY rock drywell
- Provide and install steel grating with stainless steel anchor bolts and clips
- Backfill excavation using native materials from excavation
- Grade around structure for positive drainage
- Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #15 – Parshall Flume and Stilling Well

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Provide FRP Parshall Flume insert with staff gauge and wingwalls
   - Position, level, secure and brace Parshall Flume to prevent movement or deformation during concrete backfill placement
   - Placing concrete backfill around Parshall flume in two lifts
   - Backfill flume with concrete
   - Provide and install CMP stilling well (set in concrete), PVC pipe to flume (with sand bedding)
   - Provide and attach lockable recorder instrument box to stilling well
   - Backfill excavation using native materials from excavation
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #16 – Remove Existing Measurement Structure

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Obtain all necessary permits
   - Coordinate access with Engineer and property owner
   - Provide erosion control
   - Excavation to access existing structure and pipeline
   - Demolish existing 3 CY concrete structure with steel grate and misc. metalwork and haul to off-site disposal
   - Demolish eight (8) feet of 24-inch RCP and haul to disposal off-site
   - Grout slotted PVC drain into existing RCP
   - Backfill excavation using native materials from excavation
   - Grade area to blend into existing contours
   - Prepare surface of vehicular access for revegetation (revegetation to be by others)
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Bid Item #17 – Install Tracer Wire

1. Measurement and Payment Unit: **Lump Sum**

No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

- From surveyed locations trench and install tracer wire above location of HDPE lined 18-inch RCP between each pair of access manholes
- Install terminal posts/test stations at each end of tracer wire segments between access manholes
- Connect tracer wire to terminal posts/test stations
- Backfill trench
- Regrade soils along trench to blend

Bid Item #18 – Site Restoration and Revegetation

1. Measurement and Payment Unit: **Lump Sum**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Spread excess excavated materials to blend with existing contours
   - Regrade access road to equiv. pre-construction condition or better
   - Spread stockpiled topsoil over all disturbed areas to receive seeding
   - Seed and hydromulch disturbed areas
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

Alternate Bid Item #19 – Rock Stabilization Material

1. Measurement and Payment Unit: **Cubic Yard**

   No separate measurement for payment will be made for submittals, shop drawings, equipment, materials, labor and tools required to complete this bid item. This bid item includes, but is not limited to:

   - Place one (1) foot thickness of rock stabilization material on prepared subgrade
   - Any incidental items associated with completing this bid item as specified herein, shown on the drawings or designated by the Owner/Engineer

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination.
2. Project meetings.
3. Requests for information (RFIs).

1.02 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of others to avoid conflicts and to ensure orderly progress of the Work.

1.03 PROJECT MEETINGS

A. Preconstruction Conference:

1. Project Manager will conduct a meeting within 14 days after the Notice to Proceed to review items stated in the following agenda and to establish a working understanding between the parties as to their relationships during performance of the Work.
2. Preconstruction conference shall be attended by:
    a. Representative(s) of Contractor including Contractor’s superintendent.
    b. Engineer.
    c. Representative(s) of Owner.
    d. At Owner's option, representatives of principal Subcontractors and Suppliers.
3. Meeting Agenda:
    a. Construction schedules.
    b. Phasing.
    c. Critical Work sequencing and long-lead items.
    d. Designation of key personnel and their duties; lines of communication.
    e. Project coordination.
    f. Procedures and Processing of:
        (1) RFIs.
        (2) Field decisions.
        (3) Substitutions.
        (4) Submittals.
        (5) Change Orders.
        (6) Applications for Payment.
    g. Procedures for testing.
    h. Procedures for preparing and maintaining record documents.

B. Site Mobilization and Construction Progress Meetings:

1. Engineer will conduct a meeting within 14 days before mobilization and on a weekly basis after on-site Work begins, and at other times requested by Engineer.

Representatives of the Owner, Engineer, and Contractor shall be present at each meeting. With Engineer's concurrence, Contractor may request attendance by representatives of Subcontractors, Suppliers, or other entities concerned with current program or involved with planning, coordination, or performance of future activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Contractor and each Subcontractor represented shall be prepared to discuss the current construction progress report and any anticipated future changes to the schedule. Each Subcontractor shall comment on the schedules of Contractor and other Subcontractors and advise if their current progress or anticipated activities are compatible with that Subcontractor's Work.

3. If one Subcontractor is delaying another, Contractor shall issue such directions as are necessary to resolve the situation and promote construction progress.

4. Meeting Agenda:

a. Review of construction progress since previous meeting.
b. Field observations, interface requirements, conflicts.
c. Issues which may impede construction schedule.
d. Off-Site fabrication.
e. Delivery schedules.
f. Submittal schedules and status.
g. Site use.
h. Temporary facilities, controls, and services.
i. Hours of Work.
j. Hazards and risks.
k. Housekeeping.
l. Quality and Work standards.
m. RFIs.
n. Status of Change Orders.
o. Documentation of information for payment requests.
p. Corrective measures and procedures to regain construction schedule if necessary.
q. Revisions to construction schedule.
r. Review of proposed activities for succeeding Work period.
s. Review proposed Contract modifications for effects on construction schedule and on completion date.
t. Startup coordination and activities.
u. Other business.

5. Location of Meetings: At or near Project Site.

6. Reporting:

a. Within three working days after each meeting, Engineer will prepare and distribute minutes of the meeting to Owner and Contractor.

b. Contractor shall distribute copies to principal Subcontractors and Supplier.

1.04 REQUESTS FOR INFORMATION (RFI):

A. Procedure: Promptly on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI with the content specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's Work or work of Subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Contract number and title.
5. Name of Engineer.
6. RFI number, numbered sequentially.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Times or the Contract Price, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include drawings, descriptions, measurements, photos, product data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Engineer's Action: Engineer will review each RFI, determine action required, and return it. Allow ten working days for Engineer's response for each RFI. RFIs received after 1:00 p.m. local time will be considered as received the following working day.

1. The following RFIs will be returned without action:
    a. Requests for approval of Submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Times or the Contract Price.
    e. Requests for interpretation of Engineer's actions on Submittals.
    f. Incomplete RFIs or RFIs with numerous errors.
2. Multiple RFIs addressing similar or identical issues may be addressed by Engineer with a single broad response.
3. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again upon Contractor's response and resubmittal.
4. If Contractor believes the RFI response warrants change in the Contract Times or the Contract Price, notify Project Manager in writing within ten days of receipt of the RFI response.

E. On receipt of Engineer's action, update the RFI log and promptly distribute the RFI response to affected parties. Review response and notify Engineer within five days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Electronic log shall contain not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Contractor representative name and telephone number.
4. Name and address of Engineer.

5. RFI number including RFIs that were dropped and not submitted.
6. RFI description.
7. Date the RFI was submitted.
8. Date Engineer's response was received.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 PRODUCTS – NOT USED.

PART 3 EXECUTION – NOT USED.

END OF SECTION

SECTION 01 33 00

CONTRACTOR SUBMITTALS

PART 1 GENERAL

1.1 GENERAL

A. Wherever submittals are required in the Contract Document, submit them to the Construction Manager.

B. Contractor shall be responsible for the accuracy, completeness, and coordination of submittals. Contractor shall not delegate this responsibility in whole or in part to any Subcontractor. Submittals may be prepared by Contractor, Subcontractor, or Supplier, but before submitting it, Contractor shall ascertain that each submittal meets the requirements of the Contract and the Project. Contractor shall verify that there is no conflict with other submittals and shall notify Construction Manager in each case where Contractor's submittal may affect the work of another contractor or the Owner. Contractor shall coordinate submittals of related crafts and Subcontractors.

1.2 ELECTRONIC SUBMITTALS REQUIRED

A. Unless specifically accepted in this specification, by the Owner or elsewhere in the Contract Documents, each submittal shall be made in an electronic format using the designated Electronic Document Management System.

B. Samples shall be submitted via hard copy as described in this Section and using the designated Electronic Document Management System. Other submittals that include large format drawings or very lengthy documents may be considered by the Owner for hardcopy distribution. Hardcopy submittals, except for material samples, will not be accepted by the Owner without prior approval.

C. Each submittal will be an electronic file in the Adobe Acrobat Portable Document Format (PDF). Use the latest version available at the time of execution of the Agreement. Electronic files that contain more than 10 pages in Adobe Acrobat format shall contain internal book-marking from an index page to major sections of the document. PDF files shall be set to open "Bookmarks and Page" view. General information shall be added to each PDF file, including Title, Subject, Author, and Keywords. Adobe 7.0 or higher is required.

1. PDF files shall be unsecured, unencrypted and not password protected.
2. The following actions within Adobe Acrobat shall be allowed:
    a. Printing
    b. Changing
    c. Assembling
    d. Content copying or extraction
    e. Extraction for access
    f. Commenting
    g. Fitting of form fields
    h. Signing
    i. Creation of duplicate information

D. The PDF files shall be set up to print legibly at either 8-1/2” by 11”, 11” by 17”, or 22” by 34” paper sizes. No other paper sizes will be accepted.

E. New electronic files shall be required for each re-submittal.

F. The Owner will reject any submittal that is not electronically submitted.

G. Contractor shall provide the Owner with the authorization to reproduce and/or redistribute each file as many times as necessary for the project.

H. Contractor shall include all costs for preparation of electronic and hard copies of the submittal material in its bid, including all re-submittals, record copies, and final copies.

1.3 SCHEDULE OF SUBMITTALS

A. Refer to Articles 2.05 and 2.06 of the General Conditions for submission of the preliminary and final versions of the Contractor's Schedule of Submittals.

B. The Schedule of Submittals (list) shall be compiled using Microsoft Excel software.

C. The submittal schedule shall contain all submittals required by the Contract Documents as well as any additional submittals that Contractor or Subcontractors may know to exist or wish to include. Contractor's submittal schedule shall include all Subcontractor submittals.

D. The submittal schedule shall allow as steady of a rate of submittals as possible. Long lead items shall be submitted as early as possible.

1.4 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. At the preconstruction conference, Contractor shall submit and discuss the following items:

1. The preliminary Schedule of Submittals.
2. A list of permits and licenses Contractor shall obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.
3. Preliminary and detailed Schedule of Values in accordance with General Conditions.
4. The names and qualifications of the Designated Safety Representative and Designated Competent Persons.

1.5 SHOP DRAWINGS

A. Wherever Shop Drawings are called for in the Contract Documents or where required by the Owner, Contractor shall furnish electronic submittals in PDF as described in this Section.

B. Shop Drawings may include detailed design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. If Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in Colorado, unless otherwise indicated.

C. Organization:

1. A single submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple specification sections will not be acceptable, unless the primary section references other sections for components.
2. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification section paragraph and subparagraph, drawing number, detail number, schedule title, room number, or building name, as applicable.
3. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

D. Format:

1. Minimum sheet size shall be 8-1/2” by 11”. Maximum sheet size shall be 22” by 34”.
2. On the transmittal form, index the components of the submittal and insert tabs into the submittal to match the index.
3. Every page in a submittal shall be numbered in sequence. Each copy of a submittal shall be collated and stapled or bound, as appropriate. The Owner will not collate sheets or copies.
4. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient level of detail shall be presented for assessment of compliance with the Contract Documents.
   a. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.
   b. Time for review will commence from the date of receipt by the Owner for each submittal received by 12:00 noon Mountain Standard Time (MST) on any work Day. For submittals received after 12:00 noon MST, the time for review will commence on the following work Day.
   c. The Owner will return comments or scans of each submittal to the Contractor with comments noted thereon.
   d. It is considered reasonable that the Contractor will make a complete and acceptable submittal to the Owner by the first resubmittal on an item. The Owner reserves the right to withhold monies due to the Contractor to cover additional costs of the Owner’s and Engineer’s review times beyond the first resubmittal.
   e. The maximum review period for each submittal or resubmittal will be 30 days. Thus, for a submittal that requires two resubmittals before it is complete, the maximum review period could be 90 Days.
   f. If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required. Contractor may incorporate the products or implement Work covered by the submittal.
   g. If a submittal is returned marked “MAKE CORRECTIONS NOTED," Contractor may incorporate the products or implement the Work covered by the submittal and implement it according to the Designer's notations, but formal revision and resubmission will not be required.
   h. If a submittal is returned marked "REVISE-RESUBMIT," the Contractor shall not incorporate the products or implement the Work covered by the submittal, but shall revise it and shall resubmit. Resubmittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as “REVISE - RESUBMIT," the submittal as a whole is deemed "AMEND - RESUBMIT," and 10 drawings are required to be resubmitted.
   i. If a submittal is returned marked "REJECTED - RESUBMIT," Contractor shall not incorporate the products or implement the Work covered by the submittal. Either the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or it is a substitution request not submitted in accordance with the General Conditions. In the first two cases, the Contractor shall prepare a new submittal and shall submit the required number of copies. In the latter case, the Contractor shall submit the substitution request according to the General Conditions.
   j. Resubmittal of rejected portions of a previous submittal will not be allowed. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.
   k. Fabrication of an item may commence only after the Owner has reviewed the pertinent submittals and returned copies to Contractor marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated

on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

l. Submittals shall be carefully reviewed by an authorized representative of Contractor prior to submission to the Owner. Each submittal shall be dated and signed by Contractor as being correct and in strict conformance with the Contract Documents and shall include the following statement: “I have verified that the equipment or material in this submittal meets all the requirements specified or shown in the Contract Documents without exception.” In the case of Shop Drawings, each sheet shall be so dated, signed, and certified.

m. The Owner will only accept submittals that have been so verified by Contractor. Non-verified submittals will be returned to Contractor without action taken by the Owner, and any delays caused thereby shall be the total responsibility of Contractor. No changes in the Contract Times will be made for schedule delays resulting from non-compliant submittals.

n. Corrections or comments made on Contractor's Shop Drawings during review do not relieve Contractor from compliance with Contract Drawings and specifications. Contractor is responsible for confirming and correlating quantities and dimensions, fabrication processes and techniques, coordinating Work with the trades, and satisfactory and safe performance of the Work.

1.6 SAMPLES

A. Submit the number of samples indicated by the Specifications. If the number is not indicated, submit not less than three samples. Where the amount of each sample is not indicated, submit such amount as necessary for proper examination and testing by the methods indicated.

B. Individually and indelibly label or tag each sample, indicating the salient physical characteristics and manufacturer's name. Upon acceptance by Designer, one set of the samples will be stamped and dated by the Owner and returned to Contractor, one set of samples will be retained by the Owner, and one set shall remain at the Site in Contractor's field office until completion of Work.

1.7 SURVEY DATA

A. Make available for examination throughout the construction period field books, notes, and other data developed by Contractor in performing the surveys required by the Work and submit such data to the Owner with documentation required for final acceptance of Work.

1.8 QUALITY CONTROL PLAN

A. Prepare and submit a Quality Control Plan for the Work within 20 days after Notice to Proceed. This plan shall comply with Section 01 45 00, Quality Control.

1.9 RECORD DRAWINGS

A. Maintain one set of Drawings at the Site for the preparation of record drawings. On these, mark in red pencil every project condition, location, configuration, and any other change or deviation from the executed, conformed Contract Drawings, including buried or concealed construction and utility features that are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of buried utilities that differ from the locations indicated or that were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or as Contractor is directed, to fully indicate the Work as actually constructed. These record drawings are the Contractor's representation of as-built conditions, shall include revisions made by addenda and change orders, and shall be maintained up-to-date during the progress of the Work. Red pencil shall be used for alterations and notes. Notes shall identity relevant Change Orders by number and

date.

B. This may be accomplished either by the above method or by an electronic overlay method. If the electronic method is used the time constraints still apply but the submittal can be electronic.

C. As frequently as they deem necessary, the Owner and Engineer will review the field marked up drawing sets and determine if a revision needs to be issued. If one is required, submit paper or electronic markups to the designer for update and reissue. At the completion of the work, submit one final set of markups (paper or electronic) for creation of an as-built set of drawings.

D. Disorganized or incomplete record drawings will not be accepted. Contractor shall revise them and resubmit within 10 days.

E. Make record drawings accessible the Owner and Engineer during the construction period. Record drawings will be audited regularly by the Owner and Engineer after the month in which the Notice to Proceed is given as well as on completion of Work. Failure to properly maintain record drawings in an up- to-date condition may result in the withholding of payments due to Contractor at the sole discretion of Owner.

F. Final payment will not be acted upon until the record drawings have been completed and delivered to the Owner. Said record drawings shall be in the form of a set of prints with carefully plotted information overlaid and an electronic form under the latest release of Adobe Acrobat.

G. Information submitted by Contractor will be assumed to be correct, and Contractor shall be responsible for the accuracy of such information

1.10 QUALITY CONTROL (QC) SUBMITTALS

A. Quality control submittals are defined by Section 01 45 00, Quality Control and the Technical Specifications.

B. Unless otherwise indicated, QC submittals shall be submitted:

1. Before delivery and unloading, for the following types of submittals:
   a. Manufacturers' installation instructions
   b. Manufacturers' and Installers' experience qualifications
   c. Ready mix concrete delivery tickets
   d. Design calculations
   e. Affidavits and manufacturers’ certification of compliance with indicated product requirements
   f. Laboratory analysis results
   g. Factory test reports
2. Within 30 days following the event documented for the following types of submittals:
   a. Manufacturers’ field representative certification of proper installation
   b. Field measurement
   c. Field test reports
   d. Receipt of permit
   e. Receipt of regulatory approval

C. Engineer will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.

1.11 OPERATION AND MAINTENANCE (O&M) MANUAL

A. Submit technical operation and maintenance information for each item of mechanical, electrical, and instrumentation equipment in an organized manner in the O&M Manual. It shall be written so that it can be used and understood by the Owner's operation and maintenance staff. All O&Ms Manual materials shall be submitted in electronic and hard copy format. Submittal shall be in Adobe Acrobat format and any drawings shall not exceed 11" by 17" in size and text pages shall be only 8-1/2" by 11" in size.

B. The O&M Manual shall be subdivided first by specification section number; second, by equipment item; and last, by "Category". The following "Categories" shall be addressed (as applicable):

1. Category 1 - Equipment Summary
   a. Summary: A table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
   b. Form: Owner will supply an Equipment Summary Form for each item of mechanical, electrical, and instrumentation equipment in the Work. Fill in the relevant information on the form and include it in Part 1.

2. Category 2 - Operational Procedures
   a. Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:
      1) Installation
      2) Adjustment
      3) Startup
      4) Location of controls, special tools, equipment required, or related instrumentation needed for operation
      5) Operation procedures
      6) Load changes
      7) Calibration
      8) Shutdown
      9) Troubleshooting
      10) Disassembly
      11) Reassembly
      12) Realignment
      13) Testing to determine performance efficiency
      14) Tabulation of proper settings for pressure relief valves, low and high-pressure switches, and other protection devices
      15) List of all electrical relay settings including alarm and contact settings

3. Category 3 - Preventive Maintenance Procedures
   a. Procedures: Preventive maintenance procedures shall include manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by maintaining the equipment in place.
   b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

4. Category 4 - Parts List
   a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
   b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list. Part numbers shall appear on the drawings with arrows to the corresponding part.

5. Category 5 - Wiring Diagrams
   a. Diagrams: Category 5 shall include complete internal and connection wiring diagrams for electrical equipment items.
6. Category 6 - Shop Drawings
   a. Drawings: This category includes approved shop or fabrication drawings with Designer comments and corrections incorporated, complete with dimensions.
7. Category 7 - Safety
   a. Procedures: This category describes the safety precautions to be taken when operating and maintaining the equipment or working near it.
8. Category 8 - Documentation:
   a. Equipment warranties, affidavits, certifications, calibrations, laboratory test results, etc. required by the technical specifications shall be placed in this category.

C. Format

1. Each hard copy O&M Manual shall be bound in standard size 3-ring hardcover binders labeled on the spine and cover with project name, Owner's project number, specification section number, equipment name, and equipment identification number.
2. Each binder shall contain its own detailed table of contents at the front, plus a summary level table of contents information for the other binders in a MultiFinder set.
3. Documents in binders shall be 3-hole punched, no text shall be punched out, and pages larger than 8-1/2” by 11” shall be folded to 8-1/2” by 11”.
4. Each final set of O&M Manuals shall include a CD with electronic files:
   a. Project specific files created in Adobe Acrobat portable document format.
   b. Manufacturer literature in Adobe Acrobat portable document format.

D. Review Process

1. Contractor shall furnish 2 hard copies and one electronic copy of the draft O&M Manuals for each Specification Section that requires a Manual. Contractor will forward one hard copy each to Owner and Designer, and will refer other reviewers to the electronic version. Owner will return both copies to Contractor with review comments.
2. Contractor shall incorporate comments into the draft and submit 2 hard copy and 5 electronic copies on CD of the final Manual for acceptance.

E. Schedule

1. Except where indicated otherwise, manuals shall be submitted in final form to the Owner not later than the 75 percent of construction completion date. Discrepancies found by the Owner shall be corrected within 30 days from the date of written notification by the Owner.
2. Work under this Contract involves commissioning of equipment in multiple areas. Manuals shall be complete for each piece of equipment' prior to placing equipment into service. Final acceptance of the equipment by the Owner will be dependent on operational training of the Owner’s personnel. Except where indicated otherwise, manuals shall be submitted for review in final form a minimum of 30 days prior to pre-commissioning and commissioning the start of performance testing for each piece of equipment. Discrepancies found by the Owner shall be corrected within 30 days from the date of written notification by the Owner.

1.12 SPARE PARTS LIST

A. Furnish to Owner five identical sets of spare parts information for mechanical, electrical, and instrumentation equipment. The spare parts list shall include those spare parts that each manufacturer recommends be maintained by the Owner in inventory.

1. Sources and Pricing: The spare parts list shall include a current list price of each spare part. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to assist the Owner in ordering.

B. Format: The spare parts lists shall be bound in standard size, 3-ring, loose-leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2-1/2". Each copy of the spare parts lists shall be accompanied by a CD containing the lists in files created under Adobe Acrobat.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TESTING

A. Concrete testing (slump, air content, and compressive strength) shall be completed for every 50 cubic yards of concrete place, per mix, per day, with a minimum of one set per concrete placement. Concrete testing shall be completed according to ASTM C143 and ASTM C31 and C39.

B. Soils compaction testing shall be completed at a minimum of every 1,000 cubic yards of backfill places, or twice per day when backfill is placed, to determine modified Proctor density. Compaction testing shall be completed according to ASTM D1557.

3.02 REQUIRED WRITTEN NOTIFICATION

C. Must be provided to the Engineer **one to two weeks** prior to commencement of the following construction activities:

1. Partial or full closure of North 61st Street

D. Must be provided to the Engineer **at a minimum of 2 business days** prior to the commencement of the following construction activities:

1. Location of existing RCP pipeline
2. Excavation for access manholes
3. Sliplining existing RCP pipeline with HDPE pipeline
4. Subgrade preparation
5. Access Manholes installation
6. Access Manholes interior piping and fittings installation
7. Backfilling structures
8. Steel concrete reinforcement installation
9. Concrete installation
10. Setting Parshall Flume
11. Placing concrete backfill around Parshall Flume
12. Seeding and mulching
13. Demolition of existing measurement structure and RCP

3.03 REQUIRED SUBMITTALS

A. Must be provided to the Engineer **at a minimum of 2** weeks to the commencement of pertinent construction activities:

1. Schedule
2. List of Subcontractors
3. Permits obtained
4. Testing schedule
5. Test results
   a. Concrete and grout strengths
   b. Backfill compaction
   c. Pipeline leakage
6. Imported Fill and Soils on Site used for structural backfill
   a. Gradation and material properties
   b. Proctor curves
   c. Particle size analysis, including hydrometer analysis, liquid limit and plastic limit
7. HDPE pipe product information and manufacturer's installation guidance
8. DIP pipe shop drawings, product information and manufacturer's installation guidance
9. Combination air valves product information and manufacturer's installation guidance
10. Bolted flexible couplings product information and manufacturer's installation guidance
11. Misc. valves and pipe fittings product information and manufacturer's installation guidance
12. Pipe stand, pipe support and stem guide shop drawings
13. FRP Parshall Flume product information and manufacturer's installation guidance
14. Concrete mix design
15. Grout mix designs
16. Concrete reinforcement shop drawings
17. Water stops product information and manufacturer's installation guidance
18. Pre-cast concrete manhole shop drawings
19. Manhole frame and cover shop drawings
20. Manhole gasket product information and manufacturer's installation guidance
21. Epoxy anchor product information and manufacturer's installation guidance
22. Shear gate product information and manufacturer's installation guidance
23. Metal gratings shop drawings
24. Butterfly valve product information and manufacturer's installation guidance
25. Seed mix

B. Must be provided to the Engineer **upon completion**:

1. Concrete and grout strengths
2. Backfill compaction
3. Pipeline leakage tests
4. Pipeline interior video inspection
5. Pipeline location surveying information

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 33 51

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall keep and maintain, at the job site, a copy of contract documents, marked up to indicate all changes made during the course of a project, as specified herein.

1.02 RELATED REQUIREMENTS

A. Contract Close-out submittals are included in Section 01 77 00.
B. Record shop drawings are included in Section 01 33 00 (Contractor Submittals).

1.03 REQUIREMENTS INLCUDED

A. Contractor shall maintain a record copy of the following documents, marked up to indicate all changes made during the course of a project:
   1. Contract Drawings
   2. Specifications
B. Contractor shall assemble copies of the following documents for turnover to the Engineer at the end of the project, as specified.
   1. Field Orders, Change Orders, Work Change Directives, and RFIs
   2. Field Test records
   3. Permits and permit close-outs (final approvals)
   4. Certificate of Occupancy or Certificate of Completion, as applicable
   5. Certificates of Compliance for materials and equipment
   6. Record Shop Drawings
   7. Samples.
C. Record Drawings
   1. Contractor shall annotate (mark-up) the Contract Drawings to indicate all project conditions, locations, configurations, and any other changes or deviations that vary from the original Contract Drawings. This requirement includes, but is not limited to, buried or concealed construction, and utility features that are revealed during the course of construction. Special attention shall be given to recording the locations (horizontal and vertical) and material of all buried utilities that are encountered during construction - whether or not they were indicated on the Contract Drawings. The record information added to the drawings may be supplemented by detailed sketches, if necessary, clearly indicating, the WORK, as constructed.
   2. These annotated Contract Drawings constitute The Contractor's Record Drawings and are actual representations of as-built conditions, including all revisions made necessary by change orders, design modifications, requests for information and field orders.
   3. Record drawings shall be accessible to the Owner and Engineer at all times during the construction period.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.
   1. Provide files and racks for storage of the record documents.
   2. Provide locked cabinet(s) or secure storage space for storage of samples.
B. File documents and samples in accordance with Construction Specifications Institute (CSI) format.
C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.
D. Make documents and sample available for inspection by the Engineer or Owner at all times.
E. Up-to-date Record Drawings may be a pre-requisite of processing periodic monthly pay

applications, if so specified under the section for progress payment.

3.02 MARKING METHOD

A. Use the color *Red* (indelible ink) to record information on the Drawings and Specifications.
B. Label each document "PROJECT RECORD" in neat large printed letters.
C. Unless otherwise specified elsewhere, notations shall be affixed to hardcopies of documents.
D. Record Information contemporaneously with construction progress.
E. Legibly mark drawings with as-built information:
   1. Elevations and dimensions of structures and structural elements.
   2. All underground utilities (piping and electrical), structures, and appurtenances.
   3. Changes to existing structure, piping and appurtenance locations.
   4. Record horizontal and vertical locations of underground structures, piping, utilities and appurtenances, referenced to permanent surface improvements.
   5. Record actual installed pipe material, class, size, joint type, etc.

3.03 RECORD INFORMATION COMPILATION

A. Do not conceal any work until the required information is acquired.
B. Items to be recorded include, but are not limited to:
   1. Location of internal utilities and appurtenances concealed in the construction - referenced to visible and accessible features.
   2. Field changes of dimensions and/or details.
   3. Interior equipment and piping relocations.
   4. Architectural and structural changes, including relocation of doors, windows, etc.
   5. Architectural schedule changes.
C. Changes made by Field Order, Change Order, design modification, and RFI.
D. Details not indicated on the original Contract Drawings.
E. Specifications – legibly mark each Section to record:
   1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.
   2. Changes made by Field Order, Change Order, RFI, and approved shop drawings.

3.04 SUBMITTAL

A. If specified under the Section for progress payments, monthly applications for payment will be contingent upon up-to-date Record Drawings. If requested by the Engineer or Owner, Contractor shall provide a copy of the Record Drawings, or present them for review prior to processing monthly applications for payment.
B. Upon Substantial Completion of the Work and prior to Construction Acceptance, the Contractor shall finalize and deliver a complete set of Record Drawings to the Engineer conforming to the construction records of the Contractor. The set of drawings shall consist of corrected and annotated drawings showing the recorded location(s) of the Work. Unless specified otherwise elsewhere, Record Drawings shall be in the form of a set of prints with annotations carefully and neatly superimposed on the drawings in red.
C. Upon Substantial Completion of the Work and prior to Construction Acceptance, the Contractor shall finalize and deliver a complete set of Record Documents to the Engineer conforming to the construction records of the Contractor. The set of documents shall consist of corrected and annotated documents showing the as-installed equipment and all other as-built conditions not indicated on the Record Drawings.
D. The information submitted by the Contractor into the Record Drawings and Record Documents will be assumed to be correct, and the Contractor shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data.
E. Delivery of Record Drawings and Record Documents to the Engineer will be a prerequisite to Final payment.
F. The Contractor shall maintain a copy of all books, records, and documents pertinent to the performance under this Agreement for a period of 5 years following completion of the contract.

END OF SECTION

SECTION 01 41 26
PERMITS AND AGREEMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall obtain required permits for the execution of the Work in accordance with the Contract Documents. Furnish copies of all permits obtained by Contractor to the Owner. Materials submitted to the Owner includes, but is not limited to, completed application materials, the permit, written correspondence between the Contractor and the regulatory agency issuing the permit and any information required to be submitted to demonstrate compliance with permit terms and conditions (i.e., inspection reports).

B. Comply with all conditions of the permits.

C. Any fees listed in this Section are estimates and for Contractor's information only. Contractor shall verify and pay actual fees.

D. Completeness of the permit list is not guaranteed by Owner. The absence of information does not relieve Contractor of responsibility for determining and verifying the extent of permits required and of obtaining all permits.

E. Certain permit applications have been obtained during design and are provided herein for Contractor's convenience. Owner does not guarantee the accuracy or completeness of the permit applications, requirements, and/or fees. Contractor shall be responsible for verification of all permit application forms, fees and requirements.

F. Contractor is responsible for confirming lead and review time frames associated with permit submittal and approval. Contractor shall be responsible for incorporating all permit requirements, permit lead times, submittal review periods and re-submittals into the Contractor's CPM Schedule.

G. The Contractor's attention is directed to Section 01 50 00 - Protection of Existing Facilities for information related to permits and constraints associated with utility crossings.

1.02 SUMMARY OF PERMITS TO BE OBTAINED BY CONTRACTOR

A. The following permits shall be obtained by Contractor. Contractor shall coordinate permit applications and submittals directly with the Owner. For those Contractor permits where standard permit application forms are available and the Owner has initiated the application, such application forms have been included in Section 00 31 00 – Available Project Information. Contractor shall complete permit application process in person at each jurisdiction's permit center for those required permits for which courtesy copies of applications are not provided.

B. Completed application materials, fully executed and agency approved permits, written correspondence between the Contractor and the regulatory agency issuing the permit and any information required to be submitted to demonstrate compliance with permit terms and conditions (i.e., inspection reports) shall be submitted to the Owner in accordance with Section 01 33 00 - Contractor Submittals.

C. Contractor shall be responsible for incorporating all permit requirements, permit lead times, submittal review periods, and re-submittals into the Contractor's CPM Schedule.

D. Local permits obtained shall be for use within applicable local jurisdictions as indicated and as regulated by agencies having jurisdiction. State-issued permits shall be for use within the entire Site unless the location is otherwise specifically indicated.

E. The Owner shall furnish Contractor with drawings prepared for final approval; final approval of Drawings will be contingent on Contractor obtaining permits and providing necessary submittal information. Contractor shall utilize furnished drawings and contractor submittals with a favorable disposition to obtain permits. Contractor shall submit all applicable Shop Drawing Submittals necessary for final approval of permits prior to fabrication in accordance with permit requirements and the Contract Documents.

F. Contractor will be responsible for payment of permit fees at the time of permit approval.

G. Permits to be obtained by Contractor include:

Permitting Authority	Permit Name	Permittee
CDPHE	Construction Dewatering (COG070000)	Contractor
CDPHE	Stormwater Discharge Associated with Construction Activities (COR030000)	Contractor
Boulder County Transportation	Access Permit	Contractor
Boulder County Land Use	Grading Permit	Contractor

1.03 SUMMARY OF PERMITS AND AGREEMENTS OBTAINED BY OWNER

A. The following permits and agreements have been or will be obtained by Owner. Copies of permits and agreements obtained by the Owner are provided in Section 00 31 00 – Available Project Information. Contractor shall satisfy the conditions of said permits and agreements.

B. Contractor shall be responsible for incorporating all permit and agreement requirements, lead times, submittal review periods, and re-submittals into the Contractor's schedule.

C. No additional compensation or additional Contract Times will be granted to Contractor because of delays by Owner in obtaining any permit unless Contractor is unable to proceed and complete Work and such delays are clearly demonstrated by the Contractor's schedule.

D. Contractor is required to adhere to the following permits and agreements obtained by the Owner:

E. Known Permits and Agreements Obtained or to be Obtained by Owner are indicated as follows:

Permitting Authority or Grantor	Permit Name	Permittee or Grantee
USA Corps of Engineers	Section 404	Boulder County Parks and Open Space
Boulder County	Special Use Permit	Boulder County Parks and Open Space
Oligarchy Irrigation Company	Agreement for and Grant of Access Easement dated __/__/2018	Boulder County Parks and Open Space and St. Vrain & Left Hand Water Conservancy District
Matthew Condon	Agreement for and Grant of Access Easement dated __/__/2018	Boulder County Parks and Open Space and St. Vrain & Left Hand Water Conservancy District

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 ABBREVIATIONS AND ACRONYMS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used. Additional abbreviations and acronyms are defined in the Contract Drawings.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AASHTO	American Association of State Highway and Transportation Officials
4.	ABMA	American Bearing Manufacturer's Association
5.	ACGIH	American Conference of Governmental Industrial Hygienists
6.	ACI	American Concrete Institute
7.	AF&PA	American Forest and Paper Association
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AIA	American Institute of Architects
12.	AIHA	American Industrial Hygiene Association
13.	AIIM	Association for Information and Image Management
14.	AISC	American Iron and Steel Construction
15.	AISI	American Iron and Steel Institute
16.	AMCA	Air Movement and Control Association
17.	ANSI	American National Standards Institute
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	ASAE	American Society of Agricultural Engineers
21.	ASCE	American Society of Civil Engineers
22.	ASME	American Society of Mechanical Engineers
23.	ASNT	American Society for Nondestructive Testing
24.	ASQ	American Society for Quality
25.	ASTM	ASTM International
26.	ATSSA	American Traffic Safety Services Association
27.	AWCI	American Wire Cloth Institute
28.	AWS	American Welding Society
29.	AWWA	American Water Works Association
30.	BBC	Basic Building Code, Building Officials and Code Administrators International
31.	BHMA	Builders Hardware Manufacturers' Association
32.	CABO	Council of American Building Officials
33.	CBM	Certified Ballast Manufacturer
34.	CDA	Copper Development Association
35.	CDOT	Colorado Department of Transportation
36.	CEMA	Conveyors Equipment Manufacturer's Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CLFMI	Chain Link Fence Manufacturer's Institute
40.	CMAA	Crane Manufacturers' Association of America
41.	CRSI	Concrete Reinforcing Steel Institute
42.	CS	Commercial Standard
43.	CSA	Canadian Standards Association
44.	CSI	Construction Specifications Institute
45.	DCDMA	Diamond Core Drilling Manufacturer's Association

46. DIN Deutsches Institut fur Normung e.V.
47. DIRPA Ductile Iron Pipe Research Association
48. EI Energy Institute
49. EIA Electronic Industries Alliance
50. EJCDC Engineers Joint Contract Documents Committee
51. FA Federal Aviation Administration
52. FCC Federal Communications Commission
53. FCI Fluids Controls Institute
54. FDA Food and Drug Administration
55. FEMA Federal Emergency Management Agency
56. FHWA Federal Highway Administration
57. FIPS Federal Information Processing Standards
58. Fed. Spec. Federal Specifications (FAA Specifications)
59. FS Federal Specifications and Standards (Technical Specifications)
60. GESC Grading, Erosion, and Sediment Control (Arapahoe County)
61. HI Hydraulic Institute
62. HMI Hoist Manufacturers' Institute
63. HSWA Federal Hazardous and Solid Waste Amendments
64. IAPMO International Association of Plumbing and Mechanical Officials
65. IBC International Building Code
66. ICBO International Conference of Building Officials
67. ICC International Code Council
68. ICEA Insulated Cable Engineers' Association
69. IFC International Fire Code
70. IEEE Institute of Electrical and Electronic Engineers, Inc.
71. IFI Industrial Fasteners Institute
72. IMC International Mechanical Code
73. INDA Association of the Nonwoven Fabrics Industry
74. IPC International Plumbing Code
75. ISA Instrumentation, Systems, and Automation Society
76. ISO International Organization for Standardization
77. ITL Independent Testing Laboratory
78. JIC Joint Industry Conferences of Hydraulic Manufacturers
79. MIL Military Specifications
80. MUTCD Manual of Uniform Traffic Control Devices
81. NACE NACE International
82. NEBB National Environmental Balancing Bureau
83. NEC National Electrical Code
84. NECA National Electrical Contractors Association
85. NEMA National Electrical Manufacturers' Association
86. NESC National Electrical Safety Code
87. NETA InterNationalElectrical Testing Association
88. NFPA National Fire Protection Association
89. NICET National Institute for Certification in Engineering Technologies
90. NIST National Institute of Standards and Technology
91. NRCA National Roofing Contractors Association
92. NRTL Nationally Recognized Testing Laboratories
93. NSF NSF International
94. NSPE National Society of Professional Engineers
95. OSHA Occupational Safety and Health Act (both Federal and State)
96. PCI Precast/Prestressed Concrete Institute
97. PEI Porcelain Enamel Institute
98. PPI Plastic Pipe Institute
99. PS Product Standards Section-U.S. Department of Commerce
100. RMA Rubber Manufacturers' Association
101. RUS Rural Utilities Service

102.	SAE	Society of Automotive Engineers
103.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
104.	SPI	Society of the Plastics Industry
105.	SSPC	The Society for Protective Coatings
106.	TEMA	Tubular Exchanger Manufacturers' Association
107.	TIA	Telecommunications Industry Association
108.	UBC	Uniform Building Code
109.	UFC	Uniform Fire Code
110.	UL	Underwriters Laboratories Inc.
111.	UMC	Uniform Mechanical Code
112.	UNCC	Utility Notification Center of Colorado
113.	USACE	United States Army Corps of Engineers
114.	USSR	U.S. Bureau of Reclamation

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Paragraph 3.02 of the General Conditions, and as may otherwise be required herein and in the individual Specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product, and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of most applicable referenced standards have not been bound in these Contract Documents.

G. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor's personnel, Subcontractors, Owner, and Owner’s Representative.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.01 GENERAL

The Contractor shall have a certified and qualified field and laboratory testing firm to complete the required Quality Control testing including but not limited to nuclear density testing, soil laboratory testing, concrete field testing, and concrete laboratory testing.

1.02 SUBMITTALS

A. Qualifications of the Contractor's Quality Control (QC) Representative must include all qualifying registrations and show that the candidate has had experience on projects of similar type and size.

B. Contractor's QC Plan: No payments will be made to Contractor until the Plan is accepted by the Owner.

C. Contractor's Daily QC Report: Submit to Engineer within 2 days of completion of each inspection.

D. Daily Inspection Report: Submit to Engineer at the end of each working day or no later than prior to the beginning of the next working day.

1.02 CONTRACTOR'S INSPECTION OF THE WORK

A. Work performed by Contractor shall be inspected by the Contractor's QC Representative. Non-conforming Work and any safety hazards in the Work area shall be noted and promptly corrected.

B. No materials or equipment shall be used in the Work without inspection and acceptance by Contractor's QC Representative.

C. Materials and equipment furnished to Contractor by Owner shall be inspected by Contractor's QC Representative upon receipt of such materials and equipment, with the results of the inspection included in the Contractor's Daily Inspection Report. In the event Contractor believes any material or equipment provided by Owner to be of insufficient quality for use in the Work, Contractor shall immediately notify the Engineer.

1.03 OWNER'S INSPECTION AND TESTING

A. The Work will be conducted under the general observation of the Engineer and is subject to inspection by representatives of the Owner to ensure strict compliance with the requirements of the Contract Documents.

B. Engineer may perform independent QA audits to verify that actions specified in the Contractor's QC Plan have been implemented. No Engineer audit finding or report shall in any way relieve Contractor from any requirements of this Contract.

C. Testing services provided by the Owner are for the sole benefit of the Owner; however, one copy of the results of each field and laboratory test made will be made available to the Contractor and any nonconforming results shall be corrected by the Contractor at no additional cost to the Owner. All cost for retesting required shall be reimbursed to the Owner.

D. Testing necessary to satisfy the Contractor's internal QC procedures shall be the sole responsibility of the Contractor.

1.04 QUALIFICATIONS

A. Contractor's QC Representative: Demonstrate having performed similar QC functions on similar type projects. Submit records of personnel experience, training, and qualifications.

1.05 COVERING WORK

A. Whenever Contractor intends to backfill, bury, cast in concrete, or otherwise cover any Work, notify Engineer not less than 3 days in advance to request Inspection before beginning any such Work of covering. Failure of Contractor to notify Engineer in accordance with this requirement shall be resolved according to Article 13 of the General Conditions.

1.06 REJECTED WORK

A. Failure to promptly remove and replace rejected Work will be considered a breach of this Contract, and Owner may proceed under provisions of the General Conditions.

1.07 CONTRACTOR'S QC PROGRAM

A. General:

1. Establish and execute a QC program for Work. The program shall establish adequate measures for verification and conformance to defined requirements by Contractor personnel and lower-tier Subcontractors (including fabricators, suppliers, and sub-subcontractors). This program shall be described in a Plan responsive to this Section.

B. QC Personnel

1. The Contractor's on-site Representative who has immediate charge, shall act as the Contractor QC Representative and be onsite as often as necessary, but not less than the daily working hours specified in the Contract Documents to remedy and demonstrate that Work is being performed properly and to make multiple observations of Work in progress.
2. The Contractor is to furnish personnel with assigned QC functions reporting to the QC Representative. Persons performing QC functions shall have sufficient qualifications, authority, and organizational freedom to identify quality problems and to initiate and recommend solutions.

C. QC Plan:

1. Contractor's QC Plan shall include a statement by the Contractor designating the QC Representative and specifying the authority delegated to the QC Representative to direct cessation or removal and replacement of defective Work.
2. Describe the QC program and include procedures, work instructions, and records. Describe methods relating to areas that require special testing and procedures as required by the specifications.
3. Include specific instructions defining procedures for observing Work in process and comparing this Work with the Contract requirements (organized by specification Section).
4. Describe procedures to ensure that equipment or materials that have been accepted at the Site are properly stored, identified, installed, and tested.
5. Include procedures to verify that procured products and services conform to the requirements of the specifications. Requirements of these procedures shall be applied, as appropriate, to lower-tier Suppliers and/or Subcontractors.
6. Testing QC: Include procedures to verify that the testing requirements of the Contract Documents are integrated into the Contractor's QC Plan and conform to the requirements of the specifications. Requirements of these procedures shall be applied, as appropriate, to the Contractor and lower-tier suppliers and/or subcontractors.
7. Include instructions for recording observations and requirements for demonstrating through the Daily Inspection Reports that Work observed was in compliance or a deficiency was noted and action to be taken.
8. Procedures to preclude the covering of deficient or rejected Work.
9. Procedures for halting or rejecting Work.
10. Procedures for resolution of differences between the QC Representative and the production personnel.
11. Identify contractual hold/inspection points, as well as any Contractor-imposed hold/inspections points.

D. Daily Inspection Report: Include, at a minimum:

1. Items inspected
2. Quality characteristics in compliance

3. Quality characteristics not in compliance
4. Corrective/remedial actions taken
5. Statement of certification
6. QC Manager's signature

E. Deficient and Non-Conforming Work and Corrective Action: Include procedures for handling deficiencies and non-conforming Work. Deficiencies and non-conforming Work are defined as documentation, drawings, material, equipment, or Work not conforming to the indicated requirements or procedures. The procedure shall prevent non-conformances by identification, documentation, evaluation, separation, disposition, and corrective action to prevent recurrence. Conditions having adverse effects on quality shall be promptly identified and reported to the senior level management. The cause of conditions adverse to quality shall be determined and documented and measures implemented to prevent recurrence. In addition, at a minimum, this procedure shall address:

1. Personnel responsible for identifying deficient and non-complying items within Work.
2. How and by whom deficient and non-compliant items are documented "in the field."
3. The personnel and process utilized for logging deficient and non-compliant Work at the end of each day onto a deficiency log.
4. Tracking processes and tracking documentation for deficient and non-conforming Work.
5. Personnel responsible for achieving resolution of outstanding deficiencies.
6. Include detailed procedures for the performance and control of special process (e.g., welding, soldering, heat treating, cleaning, plating, nondestructive examination, etc.).

F. Audits: The QC program shall provide for regularly scheduled documented audits to verify that QC procedures are being fully implemented by Contractor and its Subcontractors. Audit records shall be made available to Engineer upon request.

G. Documented Control/Quality Records:

1. Establish methods for control of Contract Documents that describe how Drawings and specifications are received and distributed to assure the correct issue of the document being used. Describe how as-built data are documented and furnished to Engineer.
2. Maintain evidence of activities affecting quality, including operating logs, records of inspections, audit reports, personnel qualification and certification records, procedures, and document review records.
3. Maintain quality records in a manner that provides for timely retrieval and traceability. Protect quality records from deterioration, damage and destruction.
4. Develop a list of specific records as required by the Contract Documents that will be furnished to Project Manager at the completion of activities.

H. Acceptance of QC Plan: Engineer's acceptance of the QC Plan shall not relieve Contractor from any of its obligations for performance of Work. Contractor's QC staffing is subject to Engineer's review and continued acceptance. Owner, at its sole option, and without cause, may direct Contractor to remove and replace the QC Representative.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 50 00
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 GENERAL

A. Protect all existing utilities and improvements not designated for removal and restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation.

1.02 DEFINITIONS

A. Excavation: Any digging, trenching, auguring, backfilling, ditching, grading, plowing-in, pulling-in, ripping, scraping or tunneling.

1.03 RIGHTS-OF-WAY

A. The Contractor shall not do any Work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter upon the rights-of-way involved until notified that the Owner has secured authority from the proper party.
B. Copies of encroachment agreements and encroachment requirement for work in existing rights of way are included in the Supplement section of this specification. Implement actions required by those agreements and guidelines.
C. Requirements for work near high voltage overhead power transmission lines are the responsibility of the contractor. Contractor shall be responsible for taking all necessary precautions and complying with these clearance requirements.
D. After authority has been obtained, Contractor shall give said party due notice of Contractor's intention to begin work, if required by said party, and remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROTECTION OF STREET OR ROADWAY MARKERS

A. Do not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization.
B. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. Survey markers or points disturbed shall be accurately restored after street or roadway resurfacing has been completed.
C. Contractor is responsible for the cleanliness and safety of all roadways adjacent to the construction site. If at any time, these roadways are found to be dangerous or not passable due to debris or mud, local jurisdictions may shut down the project until necessary clean-up is carried out by the contractor at his expense. If clean-up is deemed to be unsatisfactory or If the local jurisdiction chooses, the local jurisdiction may carry out required clean-up and bill the Owner or Contractor. The Contractor is required to incur the cost of all such clean-up.

3.02 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements which are subject to partial removal shall be neatly saw-cut in straight lines.
B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: Contractor shall comply with any agency requirements associated with permanent resurfacing in the jurisdiction that resurfacing is completed. In order to obtain a satisfactory junction with adjacent surfaces, saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along Excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.
D. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions. If no such period of time is so fixed, maintain said temporary sidewalks or roadways until the final restoration thereof has been made.

3.03 EXISTING UTILITIES AND IMPROVEMENTS

A. Protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the utilities are indicated on the Drawings. Take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
B. Maintaining in Service: Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said utilities.
C. Except where the Drawings indicate utilities have been field located during design or certain utility locations will be exposed as part of the Work, make exploratory Excavations as deemed necessary to determine the exact locations and depths of utilities which may interfere with the Work. All such exploratory excavations shall be performed within a sufficient time in advance of construction to avoid possible delays. Notify the Owner if such exploratory Excavations show the noted utility locations to be in error.
D. Utilities to be Relocated: If necessary to relocate the property of any utility owner, coordinate with the utility owner to relocate such property.
E. Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage and, if damaged, shall be immediately repaired or replaced, unless otherwise repaired by the owner of the damaged utility. If the owner of the damaged facility performs its own repairs, reimburse said owner for the costs of repair.
F. Underground Utilities Not Indicated: In the event of damages to existing utility lines that are not indicated or the locations of which are not made known to the Contractor prior to excavation, immediately report the damage to the owner of the damaged utility. Also provide an immediate verbal report of such damage to the Owner, to be followed by a prompt written report to both the Owner and the utility owner.
G. Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other Work.

3.04 UTILITY COORDINATION

A. Contact and coordinate with utility companies regarding protection of existing utilities and special requirements at utility crossing locations and other conditions where the Work is nearby existing utilities. Contractor shall be responsible for all costs of coordination with utilities including but not limited to outages, protection or support and any fees for costs from the utility. Furnish copies of all written agreements obtained by Contractor to the Owner.

3.05 TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAYS AND PROTECTED LIMITS

A. General: Except where trees or shrubs are indicated to be removed, exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits. Do not trim or remove trees unless so approved by the owner of the tree or shrub and as directed by the Engineer.

B. Trimming: Symmetry of the tree shall be preserved; no stubs or split or tom branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosene, coal tar, creosote, or other material injurious to the life of the tree.

C. Replacement: Immediately notify the Engineer if any tree or shrub is damaged by the Contractor's operations so that the Engineer may notify the tree or shrub's owner. Replace the tree or shrub if, in the opinion of said owner, the damage is such that replacement is necessary. The replacement tree or shrub shall be of a like size and variety as the one damaged.

3.06 LAWN, LANDSCAPED, PASTURE AREAS

A. Lawn, landscaped, or pasture areas damaged during construction shall be repaired to match the pre-construction condition to the satisfaction of the land owner.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 55 00
SITE ACCESS AND STORAGE

PART 1 GENERAL

1.01 CONTRACTOR'S WORK AND STORAGE AREA

A. Staging areas are shown on the Drawings. Staging areas are for the exclusive use by the Contractor during the term of the Contract as a storage and shop area for its construction operations on the Work. At completion of the Work, return these areas to their original condition, including grading and landscaping, unless otherwise shown.

B. Maintain a separate area within the staging area for hazardous materials used in constructing the Work.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, 2-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.
2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.
3. Obtain and submit to the Owner a single EPA number for wastes generated at the Site.
4. The separate storage area shall meet the requirements of authorities having jurisdiction over the storage of hazardous materials.
5. The separate storage area shall be inspected by the Owner prior to construction of the area, upon completion of construction of the area, and upon cleanup and removal of the area.
6. Hazardous materials that are delivered in containers shall be stored in the original containers until use. Hazardous materials delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

1.02 PARKING

A. The Contractor shall direct its employees to park in areas requested by the Owner.

B. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. The Contractor shall repair breaks, potholes, low areas which collect standing water, and other deficiencies.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01 60 00
PRODUCTS, MATERIALS, AND EQUIPMENT

PART 1 GENERAL

1.01 DEFINITIONS

A. The word "Products," as used in the Contract Documents is defined to include purchased items for incorporation into Work, regardless of whether specifically purchased for the project or taken from Contractor's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to Work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying, and installation of Work.

1.02 SELECTION

A. Source Limitations: To the greatest extent possible for each unit of Work, provide products, materials, and equipment of a single kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product, material, or equipment, select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material, and equipment selections.

1.03 TRANSPORTATION AND DELIVERY

A. Transport products by methods designed to avoid damage and deliver in undamaged condition in manufacturer's unopened containers and packaging.

B. Provide equipment and personnel to handle products, materials, and equipment, including those furnished by Owner, if any, by methods designed to prevent soiling and damage.

C. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

D. Control delivery schedules to minimize long-term storage of products at the Site and overcrowding of construction spaces. In particular, Contractor shall coordinate to minimize holding or storage times for flammable, hazardous, easily damaged, or materials sensitive to deterioration, theft, and other sources of loss.

1.04 STORAGE AND PROTECTION

A. Store Work by methods and means that will prevent damage, deterioration, and loss including theft. Store products in accordance with manufacturer's written Instructions and with seals and labels intact and legible. Store sensitive products in weather-tight climate-controlled enclosures; maintain temperature and humidity ranges within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, store products on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.

C. Store loose granular materials on solid flat surfaces in a well-drained area; prevent mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection.

1.05 MAINTENANCE OF PRODUCTS IN STORAGE

A. Periodically inspect stored products on a scheduled basis to assure products are undamaged and are maintained under required conditions. Maintain a log of inspections and make the log available to the Owner on request.

B. Surfaces of products exposed to the elements shall not be adversely affected and weathering of finishes shall not occur.
C. For mechanical and electrical equipment, furnish a copy of the manufacturer's service instructions with each item.
D. Service products on a regularly scheduled basis. Maintain and submit a log of services as a record document prior to final acceptance in accordance with the Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 77 00
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 FINAL CLEANUP

A. Remove from the vicinity of the completed Work and adjacent areas affected by the Work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Acceptance of the Work is conditional upon satisfactory final cleanup, which shall include, as a minimum:
   1. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
   2. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
   3. Broom clean exterior paved driveways and parking areas.
   4. Hose clean sidewalks, loading areas, and others contiguous with the Site.
   5. Remove snow and ice from access to appurtenance structures.
   6. Leave water courses, gutters, and ditches open and clean.

1.02 COMPLETION CRITERIA

A. Before requesting that the Owner issue a Notice of Substantial Completion, Contractor must have:
   1. Completed all requirements necessary for the safe, proper, and complete operation of the Work as intended.
   2. Prepared a punch list of incomplete Work for submission with the request for issuance of a certificate of Substantial Completion.
   3. Submitted and received acceptance of accurate record drawings for all Work completed to date.
   4. Submitted and received acceptance of warranties, bonds, guarantees, and O&M Manuals.
   5. Completed all required services for testing and, where required, commissioning.
   6. Delivered all spare parts, maintenance stock items, and special tools.

B. Upon receipt of the request for Substantial Completion, the Owner ad Engineer shall make an inspection of the Project to determine the status of completion. If the Owner and Engineer consider the Project substantially complete, the Owner will issue a Notice of Substantial Completion and attach a tentative list of items to be completed or corrected before Construction Acceptance in accordance with the General Conditions.

C. Before notifying Owner and Engineer that Construction Acceptance has been achieved, Contractor must have:
   1. Completed all punch list items and satisfied Engineer and Owner that all deficiencies are corrected.
   2. Submitted releases from agreements as specified herein.
   3. Submitted Contractor’s Certificate and Release as required in the General Conditions.
   4. Demobilized and cleaned the Site.
   5. Furnished new permanent cylinders and key blanks for all locks.
   6. Submitted maintenance stock items; spare parts; special tools.
   7. Submitted certificates of inspection and acceptance by local governing agencies having jurisdiction.
   8. Submitted Final Application for Payment.

D. Upon receipt of the request for Construction Acceptance, the Owner and Engineer shall make the final inspection. If Owner and Engineer find that the Project has been completed according to the Contract, the Owner shall issue a Notice of Construction Acceptance in accordance with the General Conditions.

1.03 RELEASE AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.

B. In the event Contractor is unable to secure written releases:
   1. Inform Owner of the reasons.
   2. Owner or its representatives will examine the Site and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
   3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
   4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement special easement, right is reserved to waive requirement for written release if:
      a. Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or
      b. Contractor is unable to contact or has had undue hardship in contacting grantor.

1.04 CORRECTION OF DEFECTS

A. Earth fill or backfill that settles below the required finish elevations will be considered defective Work and shall be repaired under the General Conditions Article 13.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 02 – SITE WORK

SECTION 02 00 00

EXISTING CONDITIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Prepare the site for construction.

B. Move in personnel and equipment.

C. Set up temporary facilities and utilities.

D. Procure all necessary permits.

1.2 RELATED WORK

A. General Conditions

B. Special Conditions

C. 01 41 26 Permits and Agreements

1.3 SITE CONDITIONS

A. The Owner has provided the right-of-way, easement or project site for all permanent access or permanent construction for the project. Any additional access, access right-of-way, construction areas, or additional needed land which may be involved in the construction of this project shall be the responsibility of the Contractor.

B. Only the area within the construction limits shown in the Drawings, may be used as site headquarters, storage yard, or base of operations provided that the use of said land meets with all of the requirements and restrictions imposed by the Owner at the time of usage. Any waste materials, including petroleum products, shall be removed from the area and disposed of in an approved location. Any areas outside the construction limits used by the Contractor shall be restored to its original condition on completion of the construction.

C. No access shall be allowed through nor shall any materials be stored in designated wetlands.

D. Access to other parts of the site shall be limited to the work to be performed at that location.

E. Construction entrance to site access road is off North 61st Street west of Hygiene, Colorado.

1.4 SITE PREPARATION FOR CONTRACTOR OCCUPANCY

A. The Contractor shall provide all temporary facilities as required for performing the work.

B. The Contractor shall secure and maintain proper storage areas for equipment and materials in locations he may deem necessary for the proper execution of the job as approved by the Owner.

C. No storage yard or project headquarters site may be utilized in conflict with objections from the adjacent property owners unless the Contractor obtains from the Owner specific written permission for such objectionable use.

D. No objectionable material will be allowed to blow from, wash off or drain off of any storage yard on to adjacent property or the designated wetlands. The Contractor shall maintain all storage yards in as neat and orderly manner as possible, allowing no accumulation of waste materials or disposal piles.

E. The Contractor may construct a temporary security fence for the protection of materials, tools, and equipment. The fence shall be maintained during the construction period. Upon completion of work, the security fence shall be removed from the site.

F. The Contractor shall provide adequate parking facilities within the designated area for personnel working on the project.

G. The Contractor shall obtain the necessary permits for connection to necessary services provided by utility companies serving the project area.

H. Materials, equipment, and work required for temporary storm water management during the construction period shall be provided by the Contractor as required to ensure public safety, protect the environment, protect work in progress, and protect materials stored onsite.

I. Prior to commencing work, Contractor shall install reinforced silt fencing and other structures as needed to insure that designated wetlands and other areas to be protected are not accessed and that no material washes into them.

1.5 DAMAGE OR USE-FEE CLAIMS

A. Any damage or use-fee claims filed against the Contractor may become a part of the final settlement of this project and may be cause for delay of final acceptance or delay of final payment.

part 2 PRODUCTS (NOT USED)

part 3 EXECUTION

3.1 CONSTRUCTION STAKING

A. Prior to the commencement of construction surveying, the Contractor shall verify the location and elevation of the project benchmarks and verify that they are consistent with the benchmarks shown on the Construction Plans. The Contractor shall report any inconsistencies to the Engineer.

B. The Contractor shall stake out the construction limits, establish temporary benchmarks, lines, levels, batterboards, reference points, centerlines, and verify all dimensions in relation to connection with existing facilities. The Contractor shall be solely responsible for all errors in connection with this work.

C. Prior to commencement of the work, the Contractor shall report to the Engineer any inconsistencies in the proposed lines, levels, grades, dimensions, or locations shown on the Drawings.

3.2 OBSTRUCTIONS

A. The location of some utilities and obstructions may not be shown. The Contractor is advised to carefully inspect the existing facilities before preparing his proposal. The removal and replacement of minor obstructions such as electrical conduits, air, water and water piping, and similar items shall be anticipated and accomplished, even though not shown or specifically mentioned. Major obstructions encountered that are not shown on the Contract Drawings or could not have been foreseen by visual inspection of the site prior to bidding should immediately be brought to the attention of the Owner. The Engineer will make a determination for proceeding with the work. If the Owner finds that the obstruction adversely affects the Contractor's costs or schedule for completion, a proper adjustment to the Contract will be made in accordance with the General Conditions or revised plan provided at the discretion of the Owner.

3.3 DEMOLITION

A. Any existing structures encountered during construction shall be preserved until accepted for removal by the Owner. The Contractor shall be required to repair pipes or structures in use that are damaged during construction at no cost to the Owner. The removal of abandoned pipes shall be subject to approval by the Engineer and may require Contractor coordination with the original utility owner.

3.4 REMOVAL AND SALVAGE OF MATERIALS

A. The Contractor shall carefully remove materials specified to be reused or salvaged so as not to damage the material.

B. Reuse by the Contractor of salvaged material will not be permitted, except as specifically shown or specified herein.

C. Existing materials to be removed or replaced and not specifically designated for salvage shall become the property of the Contractor.

3.5 CLEARING THE SITE

A. All areas underlying new structures and embankment shall be cleared of stumps, shrubs, brush, and other vegetative growth. The top 6-in to 12-in of soil will be removed and stockpiled for future use as topsoil. Soil shall be removed to such a depth that no black, organic soil is visible.

B. Upon completion of the project, completion of a particular phase of the project, or termination of the use of any particular area, site, storage yard, right-of-way, or easement, the Contractor shall promptly and neatly clean up the area and re-establish the ground to the contours required by the project or conditions prior to project commencement.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 03 - CONCRETE

SECTION 03 15 16

JOINTS IN CONCRETE

PART 1 GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall construct all joints in concrete at the locations shown. Joints required in concrete structures are of various types and will be permitted only where shown, unless specifically accepted by the Engineer.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All codes, as referenced herein are specified in Section 01 42 19 – Reference Standards.

B. Federal Specifications:

TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures.

C. U.S. Army Corps of Engineers Specifications:

CRD-C572	PVC Waterstop.

D. Commercial Standards:

ASTM C920	Specification for Elastomeric Joint Sealants.
ASTM D412	Test Methods for Rubber Properties in Tension.
ASTM D624	Test Method for Rubber Property -- Tear Resistance.
ASTM D638	Test Method for Tensile Properties of Plastics.
ASTM D746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
ASTM D775	Standard Specification for Epoxy-coated Steel Reinforcing Bars.
ASTM D1056	Specification for Flexible Cellular Materials -- Sponge or Expanded Rubber.
ASTM D1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM D2240	Test Method for Rubber Property -- Durometer Hardness.
ASTM D2241	Standard specification for PVC Pressure Rated Pipe.

1.3 TYPES OF JOINTS

A. **Construction Joints**: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape specified and shown. The surface of the first pour may also be required to receive a coating of bond breaker as shown.

B. **Contraction Joints:** Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.

C. **Expansion Joints:** To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop as shown.

D. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

E. The space so formed shall be filled with a joint sealant material as specified in the Paragraph in Part 2.3, "Joint Sealant". In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.

F. **Control Joints:** The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant".

1.4 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

B. **Waterstops**: Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the Engineer has reviewed the qualification samples.

C. **Joint Sealant:** Prior to ordering the sealant material, the Contractor shall submit to the Engineer for the Engineer's review, sufficient data to show general compliance with the requirements of the Contract Documents.

D. Certified test reports from the sealant Manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished to the Engineer before the sealant is used on the job.

E. **Shipping Certification:** The Contractor shall provide written certification from the Manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

F. **Joint Location:** The Contractor shall submit placement shop drawings showing the location and type of all joints for each structure.

1.5 QUALITY ASSURANCE

A. **Waterstop Inspection:** It is required that all waterstop field joints shall be subject to rigid inspection, and no such Work shall be scheduled or started without having made prior arrangements with the Engineer to provide for the required inspections. Not less than 24 hours' notice shall be provided to the Engineer for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor at its own expense.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:
   1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.
   2. Exterior crack at joint, due to incomplete bond, which is deeper than 1 /16-inch or 15 percent of material thickness, at any point, whichever is less.
   3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.
   4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.
   5. Porosity in the welded joint as evidenced by visual inspection.
   6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

D. **Waterstop Samples:** Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be

submitted to the Engineer for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the Engineer for testing by a laboratory at the Owner's expense. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

E. **Construction Joint Sealant:** The Contractor shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.

F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
   1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.
   2. Sealant shall be cast and cured according to Manufacturer's recommendations except that curing period shall not exceed 24 hours.
   3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.6 GUARANTEE

A. The Contractor shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the Owner, at no additional cost to the Owner, any such defective areas which become evident within said 5-year guarantee period.

PART 2 PRODUCTS

2.1 GUARANTEE

A. All joint materials specified herein shall be classified as acceptable for potable water use, by the Environmental Protection Agency, within 30 days of application.

2.2 PVC WATERSTOPS

B. **General**: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The Contractor shall obtain from the waterstop Manufacturer and shall furnish to the Engineer for review, current test reports and a written certification of the Manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein. Flatstrip and Center-Bulb Waterstops: Flatstrip and center-bulb waterstops shall be as detailed and as manufactured by: **Water Seals, Inc., Chicago, Illinois; Greenstreak Plastic Products Co., St. Louis, Missouri;** or equal; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.

C. **Multi-Rib Waterstops:** Multi-rib waterstops, where required, shall be as detailed and as manufactured by **Water Seals, Inc., Chicago, Illinois; Greenstreak Plastic Products Co., St. Louis, Missouri;** or equal. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.

D. **Other Types of Waterstops:** When other types of waterstops, not listed above are required and shown, they shall be subjected to the same requirements as those listed herein.

E. **Waterstop Testing Requirements:** When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (psi)	1750	D638, Type IV
Ultimate Elongation-min (percent)	350	D638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D746
Stiffness in Flexure-min (psi)	400	D747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min (psi)	1500	D638, Type IV
Ultimate Elongation-min (percent)	300	D638, Type IV

Effect of Alkalies (CRD-C572)		
Change in Weight (percent)	+0.25/-0.10	D2240
Change in Durometer, Shore A	+5	
Finish Waterstop		
Tensile Strength-min (psi)	1400	D638, Type IV
Ultimate Elongation-min (percent)	280	D638, Type IV

2.3 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 50 percent R.H.):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D412)	200 psi, minimum
Ultimate Elongation (ASTM D412)	400 percent, minimum
Tear Resistance (Die C ASTM D624)	75 pounds per inch of thickness, minimum
Color	Light Gray

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2 part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C920 Type M or Federal Specification TT-S-00227 E(3) for 2 part material, as applicable.
2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C920 Class 25, Grade NS, or Federal Specification TT-S-0027 E(3), Type II, Class A.
3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C920 Class 25, Grade P, or Federal Specification TT-S-0027 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.
4. Primer materials, if recommended by the sealant Manufacturer, shall conform to the printed recommendations of the sealant Manufacturer.

2.4 WATERSTOP JOINT MATERIALS

A. **Bearing Pad**: Bearing pad to be neoprene conforming to ASTM D1752 Type I, 40 durometer hardness unless otherwise noted.

B. **Neoprene Sponge:** Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D1056, type RE-45-E1, with a compression deflection, 25 percent deflection (limits), 119 to 168 kPa (17 to 24 psi) minimum.

C. **Preformed Joint Filler:** Preformed joint filler material shall be of the preformed nonextruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1752 for Type I, except as otherwise specified herein.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall be Super Bond Breaker as manufactured by **Edoco Company, Sure-Lift J-6WB by DS Construction Chemicals**, or equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.7 SLIP DOWELS

A. Slip dowels in expansion joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A775.

2.8 PVC TUBING

A. PVC tubing in expansion joints shall be Sch. SDR 13.5, conforming to ASTM D2241.

PART 3 EXECUTION

3.1 GENERAL

A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. Waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of Manufacturer of the waterstops. The Contractor shall take suitable precautions and means to support and protect the waterstops during the progress of the Work and shall repair or replace at its own expense any waterstops damaged during the progress of the Work. Waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the Manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.
2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of two (2) identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the Contractor prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. **Setting Waterstops:** In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the Work and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.

B. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with

their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.

D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

E. **Joint Location**: Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. Where joints are shown spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the Engineer.

F. **Joint Preparation:** Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03 30 00 - Cast-in-Place Concrete. Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.

G. **Construction Joint Sealant:** Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer used shall be supplied by the same Manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

H. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the Manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least seven (7) days before the structure is filled with water.

I. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations. Before Work is commenced, the crew doing the Work shall be instructed as to the proper method of application by a representative of the sealant Manufacturer.

J. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the Contractor shall arrange to have the crew doing the Work carefully instructed as to the proper method of mixing and application by a representative of the sealant Manufacturer.

K. Any joint sealant which, after the Manufacturer's recommended curing time for the job conditions of the Work hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant Work shall be at the expense of the Contractor.

END OF SECTION

SECTION 03 20 00

REINFORCING STEEL

PART 1 GENERAL

1.1 WORK INCLUDED

A. This work shall consist of furnishing and placing reinforcing steel in accordance with these specifications and in conformity with the Contract Documents.

1.2 RELATED WORK

A. Section 03 30 00 – Cast-In-Place Concrete

PART 2 MATERIALS

2.1 GENERAL

A. Materials used in the work shall meet the requirements for the class of material named. Unless otherwise provided on the plans, in the specifications or in the contract, all bar steel reinforcement shall be of the deformed type. Reinforcing steel shall conform to the requirements of the following specifications:
   1. Deformed Billet-Steel Bars for Concrete
   2. Reinforcement--AASHTO M31, ASTM A615 (Grade 60)
   3. Deformed Steel Wire for Concrete Reinforcement--AASHTO M225 (ASTM A496)
   4. Cold-Drawn Steel Wire for Concrete Reinforcement--AASHTO M32 (ASTM A82)

PART 3 EXECUTION

3.1 BAR LIST

A. Copies of a list of all reinforcing steel and bending diagrams shall be furnished to the Engineer at the site of the work at least 2 weeks before the placing of reinforcing steel is begun. The Contractor shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the plans.

B. Bar lists and bending diagrams for structures, which are included in the plans, do not have to be furnished by the Contractor. When bar lists and bending diagrams are included in the plans, they are intended for estimating approximate quantities. The Contractor shall verify the quantity, size and shape of the bar reinforcement against those shown on the plans and make any necessary corrections before ordering.

3.2 STORING AND SURFACE CONDITION OF REINFORCEMENT

A. Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, detrimental rust, loose scale, paint, grease, oil, or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross section area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel specified.

3.3 FABRICATION

A. Fabrication tolerances for straight and bent bars shall be in accordance with the requirements of Subsection 4.3, Tolerance, of the American Concrete Institute Standard 315.

3.4 PLACING AND FASTENING

A. The placing, fastening, splicing and supporting of reinforcing steel and bar mat reinforcement shall be in accordance with the plans and the latest edition of "CRSI Recommended Practice for Placing Reinforcing Bars". In case of discrepancy between the plans and the CRSI publication stated above, the plans shall govern.

B. Steel reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete by means of spacer strips, stays, metal chairs or other approved devices or supports. When metal chairs are used, the part of the chair in contact with the form and at least 1 inch from the form shall be hot dip galvanized or plastic coated. Other coatings or treatments will be acceptable when specifically accepted by the Engineer. Precast concrete bricks or other accepted bricks or blocking may be used in structures to support reinforcement in footings or slabs placed on grade; however, the bricks or blocking shall not contact the reinforcement over a distance greater than the depth of a standard concrete brick. Reinforcing shall be embedded with 3” of concrete where cast

against earth and 2” of concrete elsewhere unless otherwise noted on the Plans.

C. Bars shall be securely tied at all intersections except where spacing is less than 1’ in each direction, when alternate intersections shall be tied. Tying of steel by spot welding will not be permitted unless specifically authorized by the Engineer. The placing and securing of the reinforcement in any unit or section shall be accepted by the Engineer before any concrete is placed in any such unit or section. At the time the concrete is placed, the reinforcing steel required shall be free from flaky rust, mud, oil or other coatings that will destroy or reduce the bond.

3.5 SPLICING

A. Bar Steel reinforcement shall be furnished in the full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the written acceptance of the engineer. All splicing shall strictly follow and adhere to all ACI codes and requirements. Splices shall preferably be staggered. In cases where permission is granted to splice bars, other than those shown on the plans, the additional material required for the lap shall be furnished by the contractor at his own expense.

MINIMUM LAP LENGTHS

Bar No.	Splice Lap Length (in.)
4	25
5	31
6	37
7	54
8	62
9	70

3.6 BENDING

A. All bars shall be bent cold. No bars partially embedded in concrete shall be field-bent.

B. Bends on all bars shall have a radius on the inside of the bar not less than the value of the following:

Bar Size	Minimum Radii
#3, #4, #5	2 1/2 bar diameters
#6, #7, #8	3 bar diameters
#9, #10, #11	4 bar diameters

3.7 TIES, CHAIRS, SPACERS

A. Reinforcement shall be accurately placed and adequately supported by concrete, metal or other approved spacers or ties and secured against displacement within the tolerance permitted.

3.8 PLACEMENT

A. Unless otherwise specified by the Engineer, reinforcement shall be placed in specified positions within the following tolerances:
   1. In walls and floors, all reinforcement shall be placed within, plus or minus, one-quarter inch of specified location.
   2. Longitudinal location of bends and ends of bars, plus or minus, two inches except where specified concrete cover at ends of members shall not be reduced.

B. The final length of the vertical bars will need to be adjusted per the Contractor’s field survey elevations.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall provide cast-in-place concrete, joints in concrete, reinforcement and appurtenant Work, formwork, bracing, shoring, supports, and shall design and construct falsework, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All codes, as referenced herein are specified in Section 01 42 19 – Reference Standards.

B. Federal Specifications:

TT-S-227E	Joint Sealer
TT-S-230C	Joint Sealer

C. Commercial Standards:

ACI 117	Standard Specifications for Tolerances for Concrete Construction Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concrete
ACI 306	Cold Weather Concrete
ACI 315	Details of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 347	Recommended Practice for Concrete Formwork
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM C31	Standard Practice for Making and Curing Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Standard Specification for portland Cement
ASTM C156	Standard Test Method for Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete
ASTM C157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C192	Method For Making and Curing Test Specimens

ASTM C260	Standard Specification of Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C920	Standard Specification for Elastomeric Joint Sealants
ASTM C1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete raw Materials
AASHTO T 303	Standard Method of Test for Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction
IBC 1704	Special Inspections

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Shop Drawings:

1. Mix Designs: Prior to beginning the Work, submit preliminary concrete mix designs which shall show the proportions and gradations of materials proposed for each class and type of concrete. The mix designs shall be checked by an independent testing laboratory acceptable to the Engineer. Costs related to such checking shall be the Contractor's responsibility. When a water reducing admixture is to be used, the Contractor shall furnish mix designs for concrete both with and without the admixture.
2. Provide the following Submittals in Accordance with ACI 301:
    a. Mill tests for cement
    b. Admixture Certification (Chloride ion content shall be included.)
    c. Aggregate gradation and certification
    d. Materials and methods for curing
3. Reinforcement fabrication, erection and placement drawings:
    a. Shop bending diagrams, placing lists, and drawings of reinforcing steel prior to fabrication. Details of the concrete reinforcing steel and concrete inserts shall be submitted at the earliest possible date after receipt by the Contractor of the Notice to Proceed. Include bar placement diagrams.
    b. Shop drawings shall conform to ACI 315.
    c. Placement drawings shall include location of reinforcement, water stops, anchor bolts and other items embedded in concrete that influences placement of reinforcement.
4. Manufacturer's information demonstrating compliance with requirements of the following:
    a. Preformed joint filler
    b. Backing rod
    c. Bond breaker

d. Form ties and related accessories

e. Form gaskets

f. Form release agent

g. List of form materials and locations of use

h. Material for water stop

i. Floor covering and joint filler materials

5. Placement drawings showing the location and type of joints for each structure.

6. Samples of working floor surface coatings.

C. **Delivery Tickets:** Where ready-mix concrete is used, the Contractor shall furnish certified delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring, and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, the amounts of water in the aggregate, added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each certificate shall state the mix number, total yield in cubic yards, the amount of water that can be added to the concrete mix at the site which maintains the required water cement ratio, and the time of day to the nearest minute, corresponding to the time when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.

1.4 QUALITY CONTROL

A. Testing of Materials:

1. The contractor shall hire a qualified concrete field and laboratory testers. The laboratory shall meet or exceed the requirements of ASTM C1077.

2. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as indicated herein. Tests for determining slump will be in accordance with the requirements of ASTM C143.

3. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness in accordance with ASTM C33 and AASHTO T260.

4. If required by the Owner, concrete for Quality Assurance testing shall be furnished by the Contractor at no cost to the Owner, and the Contractor shall assist the Engineer in obtaining samples and disposal and cleanup of excess material.

B. Field and Laboratory Testing:

1. Field testing of concrete samples shall include slump, percent air entrained, density, temperature, and as required cylinders specimens for compression testing. The first two readymix trucks shall be tested and every third truck tested thereafter. If a test fails, the interval of testing shall reset and the next two trucks will be tested and every third truck tested thereafter.

2. Compression test specimens shall be taken during construction from the first placement of each class of concrete and at intervals selected by the Engineer to insure continued compliance with these Specifications. Each set of test specimens will be a minimum of 4 cylinders. A set of compression cylinders shall be taken for each concrete placement or one for every 25 cubic yards.

3. Compression test specimens for concrete will be made in accordance with ASTM C31. 4-inches diameter by 8-inches high cylinders is acceptable.

4. Compression tests will be performed in accordance with ASTM C39. One (1) test cylinder will be tested at seven (7) days and two (2) at 28 days. The remaining cylinder will be held to verify test results, if needed.

5. If the Contractor intends to remove forms or otherwise work near the placed concrete prior to 7 days, additional cylinders shall be taken to verify the concrete compression strength.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 318.
2. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for subsequent batches of the type of concrete affected.
3. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement as part of the Work.

D. **Construction Tolerances:** The Contractor shall set and maintain concrete forms and perform finishing operations so that the concrete is within the tolerances herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated. Where tolerances are not indicated, permissible deviations will be in accordance with ACI 117.

1. The variation from required lines or grades shall not exceed 1/4-inch in 10-feet and there shall be no offsets or visible waviness in the finished surface.

PART 2 -- PRODUCTS

2.1 FORM AND FALSEWORK MATERIALS

A. Except as otherwise expressly accepted by the Engineer, lumber brought on the Site for use as forms, shoring, or bracing shall be new material.

B. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.
2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork and shall conform US Product Standard PS 1 - Construction and Industrial Plywood for Concrete Forms, Class 1, and shall be edge sealed.
3. Form materials shall be metal, wood, plywood, or other material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade required. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

C. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.

D. Forms and falsework to support roof and floor slabs shall be designed for a minimum form dead load of 10 psf plus a 50 psf minimum live load. Live load shall be increased when motorized carts are used to a minimum of 75 psf. These loads shall be in addition to concrete dead load.

2.2 FORM TIES

A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties or other removable form-tie fasteners having a circular cross-section shall not exceed 1-1/2 inches; and such fasteners shall be such as to leave holes of regular shape for reaming. Form ties shall be **Penta Tie System** by **MeadowBurke, Snap Ties** by **Dayton Superior**, or equal.

B. Removable taper ties may be used when approved by the Engineer. Taper ties shall be **Taper Ties** by **MeadowBurke, Taper Ties** by **Dayton Superior**, or equal.

2.3 REINFORCING STEEL

A. **General:** Reinforcing steel for cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A615 for Grade 60 Billet Steel Reinforcement, unless otherwise indicated.
2. Welded wire fabric (WWF) shall conform to ASTM A185 and the details indicated. WWF with longitudinal wire of W4 size wire and smaller shall be in flat sheets or in rolls with a core diameter of not less than 10 inches. WWF with longitudinal wires larger than W4 size shall be in flat sheets only.

B. Accessories:

1. Include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position and secure reinforcement during concrete placement. Bar supports shall conform to CRSI Manual of Standard Practice. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
2. Concrete blocks (dobies) used to support and position reinforcing steel shall have the same or higher compressive strength as required for the concrete in which they are located. Wire ties shall be embedded in concrete block bar supports.
3. Accessories in contact with epoxy coated bars shall conform to CRSI Manual of Standard Practice and ASTM A934.

2.4 CONCRETE MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the order that it is received.

B. Materials for the Work shall conform to ACI 301.

C. Storage of materials shall conform to ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand portland cement conforming to ASTM C150 - portland cement for Type I, Type II, or Type I/II.
2. Water shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used.
3. Aggregates shall be obtained from pits acceptable to the Engineer, shall be non-reactive, and shall conform to ASTM C33. Items (d) and (e) below are required to achieve well-graded aggregates for a 1-1/2” maximum aggregate size, with corresponding testing of these criteria required. “Gap-graded” aggregates will not be permitted. Aggregates shall be non-reactive with alkalis in cement.
4. Well graded crushed stone or washed gravel with limits of deleterious substances and physical property requirements (per weathering region).

    a. Coarse Aggregates: Maximum size of coarse aggregates shall be 1-1/2”.

    b. Fine aggregate: Lightweight sand for fine aggregate will not be permitted. Sand shall be washed, natural and clean conforming to ASTM C33.

    c. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using

the cement proposed for the project. If aggregates proposed for use do not meet this requirement, then satisfy either 1) or 2) below.

1) Total equivalent alkali content of the cement used shall not exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C150.

2) The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.10 percent in 16 days when tested in accordance with ASTM C1260 and using the cement and fly ash proposed for the project. The proportions of the cement-fly ash mix shall be the same as those proposed for the project.

d. The aggregate shall conform to ACI 302.1R-04, with particular attention paid to the grading criteria. The range of percentage retained per sieve size by weight shall be as discussed in section 5.4 of ACI 302.1R-04 pertaining to 1-1/2" minimum aggregate size.

e. The following aggregate gradation range is the intended range and represents an approximate mix of 60% No. 57 coarse aggregate and 40% ASTM concrete sand fine aggregate.

Sieve Size	Percent Passing
1-1/2"	100
1"	90-100
½"	50-75
No. 4	30-65
No. 8	20-50
No. 16	10-40
No. 30	5-30
No. 50	5-25
No. 100	1-4
No. 200	0-3

This aggregate gradation is intended to minimize aggregate gap gradations, as well as shrinkage potential of the concrete once placed. Other similar aggregate gradations may be considered and submitted for Engineer approval if it can be shown that it meets the design intent.

5. Ready-mix concrete shall conform to the requirements of ASTM C94.
6. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the Contractor shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
   a. Air-entraining agent meeting the requirements of ASTM C260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 5 to 7 percent. The Owner reserves the right, at any time, to sample and test the air-entraining agent received on the job by the Contractor. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a

mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement. Air entraining agent shall be **Daravair 1000 by Grace Construction Products; Sika AEA-15 by Sika Corporation**; or equal.

b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Engineer. Concrete containing an admixture shall be first placed at a location determined by the Engineer. Admixtures specified herein shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the Engineer.

2) Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture such as **Plastocrete 161 MR by Sika Corporation; Daratard 17 by Grace Construction Products**; or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a non-corrosive set accelerating admixture such as **Plastocrete 161 FL by Sika Corporation; Daraset 200 by Grace Construction Products**; or equal shall be used.

3) Normal range water reducer shall conform to ASTM C494, Type A. **WRDA 82 by Grace Construction Products; Plastocrete 161 by Sika Corporation**; or equal. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

4) High range water reducer shall conform to ASTM C494, Type F or G. **Plastol 5000 by Euclid Chemical Company, Sikament FF by Sika Corporation**; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.

5) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

6) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

7. Calcium Chloride: Calcium chloride will not be permitted in concrete.

2.5 CURING MATERIALS

A. Materials for curing concrete shall conform to the following requirements and ASTM C309:

1. Curing compounds shall be white-pigmented and resin-based. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be **Kurez VOX White Pigmented** by **Euclid Chemical Company, Cure R-2** by **L&M Construction Chemicals, 1200-White** by **W.R. Meadows,** or equal. When curing compound must be removed for finishes or grouting, curing compounds shall be **Kurez DR VOX** by **Euclid Chemical Company, L&M Cure R** by **L&M Construction Chemicals, 1100-Clear** by **WR Meadows,** or equal. Curing compounds shall meet local VOC requirements.

2. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6-mils. The loss of moisture when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.

3. Evaporation retardant shall be a material such as **Confilm** by **BASF, Eucobar** by **Euclid Chemical Company, E-CON** by **L&M Construction Chemicals, Inc.,** or equal.

2.6 JOINT MATERIALS

A. Materials for joints in concrete shall conform to the following requirements:

1. Sponge rubber joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. Non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1752; for Type I, except as otherwise indicated.

2. Elastomeric joint sealers:

   a. Two-component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-227E, Class A, Type 1 and ASTM C920, Type M, Class 25, Grade P.

      1) **SikaFlex 2cNs** by **Sika Corporation**

      2) **Chem-Calk 500** by **Bostic,** or equal.

   b. One-component, self-leveling, polyurethane or polysulfide sealant conforming to Federal Specification TT-S-230C, Class A, Type 1, and ASTM C920, Type S, Class 25, Grade P.

      1) **SikaFlex-15LM** by **Sika Corporation**

      2) **Vulkem 45** by **Tremco,** or equal.

   c. One-component, gun grade polyurethane based, non sag, vertical and horizontal sealant.

      1) **Vulkem 116** by **Tremco**

      2) **Vulkem 921** by **Tremco**

      3) **SikaFlex-15LM** by **Sika Corporation**

      4) **SikaFlex 1A** by **Sika Corporation,** or equal.

3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the Engineer.

4. Preformed joint filler (PJF) shall be a non-extruding resilient, bituminous type conforming to the requirements of ASTM D1751.

2.7 MISCELLANEOUS MATERIALS

A. Floor sealer/hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate or of sodium silicate, and shall be as manufactured by **Grace Construction Products, Sika Corporation**; or equal. The solution shall be delivered ready for use in the manufacturer's original sealed containers. Each gallon of the fluosilicate solution shall contain not less than 2 pounds of crystals.

B. Dampproofing agent shall be an asphalt emulsion such as **Hydrocide 600** by **Sonneborn, Dehydratine 75, 85, 95** by **Euclid Chemical Company, Sealmastic** by **W. R. Meadows Inc.**, or equal.

C. Epoxy adhesives shall be the following products:

1. For bonding freshly-mixed, plastic concrete to hardened concrete, **Sikadur 32 Hi-Mod Epoxy Adhesive** by **Sika Corporation, Concresive Liquid (LPL)** by **BASF**; **BurkEpoxy MV** by **Edoco,** or equal.
2. For bonding hardened concrete or masonry to steel, **Sikadur 31 Hi-Mod Gel** by **Sika Corporation, BurkEpoxy NS** by **Edoco, Concresive Paste (LPL)** by **BASF**; or equal.

D. Epoxy adhesive for reinforcing bars and anchors shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Adhesive shall have an ICC/ES Evaluation Report that shows acceptability of the product for use in the conditions used.

E. Working Floor Surface Coatings:

1. **Epoxy WP-70 by Wooster Products Safety Coatings Systems,** or equal.

2.8 CONCRETE DESIGN REQUIREMENTS

A. General:

1. Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. Mix changes shall be subject to review by the Engineer.
2. The Contractor is cautioned that the limiting parameters below are **NOT** a mix design. Admixtures may be required to achieve workability required by the Contractor's construction methods and aggregates. The Contractor is responsible for providing concrete with the required workability.

B. **Water-Cement Ratio and Compressive Strength:** The minimum compressive strength and cement content of concrete shall be not less than the following tabulation.

Type of Work	Class of Concrete Min 28-Day Compressive Strength, psi	Max Size Aggregate in	Cement Content Per cu yd, lbs	Max W/C Ratio (by weight)
Structural concrete	4,000	1	564 to 600	0.45
Mass concrete	2,000	1	376 (min)	0.60

2.9 CONSISTENCY

A. Consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143. The slumps shall be 3-inches plus or minus 1-inch

2.10 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the Engineer; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement and the cement is delivered at the mixer in the

original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.11 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device that is acceptable to the Engineer and capable of measuring the water in variable amounts within a tolerance of one percent.

2.12 READY-MIXED CONCRETE

A. At the Contractor’s option, ready-mixed concrete shall be used. Materials, batching, mixing, transporting, placing, shall conform to ASTM C94 and this specification.

B. Ready-mixed concrete shall be delivered to the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever comes first. In hot weather, under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counter shall be actuated at the time of starting the mixer at mixing speed.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. Materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

E. Each batch of ready-mixed concrete delivered to the Work shall be accompanied by a delivery ticket furnished to the Engineer in accordance with the requirements above.

F. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

PART 3 -- EXECUTION

3.1 EVALUATION OF CONCRETE, GROUT OR MORTAR TEST RESULTS

A. Tests.

1. Test results for standard molded and cured test cylinders to be evaluated separately for each mix design. Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards. For evaluation of potential strength and uniformity, each mix design shall be represented by at least three strength tests. A strength test shall be the average of two cylinders from the same sample tested at 28 days.
2. Drying shrinkage tests shall be made in advance of submission at the time of the first placement of each class of concrete, and during construction to insure continued compliance with these Specifications.
3. Drying shrinkage specimens shall be 4 in by 4 in by 11 in prisms with an effective gage length of 10 IN, fabricated, cured, dried, and measured in accordance with ASTM C157 modified as follows:
    a. Specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70 degrees F ± 3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F ± 3 degrees F.

b. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations (“0” days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F ± 3 degrees F and 50 percent ± 4 percent relative humidity for the remainder of the test.

c. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

4. The drying shrinking deformation of each specimen shall be computed as the difference between the base length (at “0” days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 IN at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 IN, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project.

B. Acceptance:

1. Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:

a. Average of all sets of three consecutive strength tests equal or exceed the required specified 28-day compressive strength.

b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.

2. Shrinkage Limitation

a. The maximum concrete shrinkage, as measured at 21-day drying age or at 28 day drying age, shall be 0.036 percent or 0.042 percent, respectively. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements.

b. The maximum concrete shrinkage for specimens cast in the field shall not exceed average maximum shrinkage requirement by more than 25 percent.

c. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement, and/or admixtures; reducing water content; washing of aggregate to reduce fines; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

3. Alkili-Silica Reactivity limitations:

a. The maximum percentage in specimen length at 14 days shall not exceed 0.1 percent per AASHTO T-303.

b. Mix design shall be modified to show proportions of ASR inhibitor.

c. If the ASR limitation is not met during construction, the Contractor shall take any or all of the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement, and/or admixtures; or other actions designed to minimize reactivity without deleterious effect on concrete properties.

3.2 GENERAL FORMWORK REQUIREMENTS

A. Forms to confine and shape the concrete to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of forms, and any forms that are unsafe or inadequate in any respect shall promptly be removed from the Work and

replaced. A sufficient number of forms of each kind shall be available to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and federal regulations. Design, construction, maintenance, preparation, and removal of forms shall be in accordance with ACI 347.

B. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

3.3 CONSTRUCTION

A. **Vertical Surfaces:** Vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is indicated. Not less than 1-inch of concrete shall be added to the indicated thickness of a concrete member where concrete is permitted to be placed against trimmed ground in lieu of forms. Permission to do this on other concrete members will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. **Construction Joints:** Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties:

1. Embedded Ties: Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, after the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink or regular cement grout. Exposed faces of walls shall have at least the outer 2-inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.4 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view.

3.5 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. Members which must support their own weight shall not have their forms removed until they have attained at least 75 percent of the 28-Day strength of the concrete. Forms for vertical walls and columns shall remain in place at least 48 hours after the concrete has been placed. Forms for parts of the Work not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.6 GENERAL REINFORCEMENT REQUIREMENTS

A. Reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements indicated herein.

3.7 FABRICATION

A. General:

1. Reinforcement steel shall be accurately formed to the dimensions and shapes indicated, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.
2. The Contractor shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the Contractor.
3. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. **Bending or Straightening:** Reinforcement shall not be straightened or rebent in a manner that will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the Engineer.

3.8 PLACING

A. Reinforcement shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. Reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, the Contractor shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. The portions of accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.

D. Bars additional to those indicated which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor as part of the Work.

E. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

F. The minimum spacing requirements of ACI 318 shall be followed for reinforcing steel.

3.9 SPLICING

A. **General:** Reinforcement splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where indicated, the character of the splice shall be reviewed and accepted by the Engineer.

B. Splices of Reinforcement

1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318, for a Class B splice.
2. Welded splices shall be performed in accordance with AWS D1.4.

3. Laps of WWF shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

3.10 CLEANING AND PROTECTION

A. Reinforcement steel shall always be protected from conditions conductive to corrosion until concrete is placed around it.

B. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and, if necessary recleaned.

3.11 PROPORTIONING AND MIXING

A. **Proportioning:** Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.

B. **Mixing:** Mixing of concrete shall conform to the requirements of Chapter 7 ACI 301.

C. **Slump:** Slumps shall be as indicated herein.

D. **Retempering:** Retempering of concrete or mortar which has partially hardened shall not be permitted.

3.12 PREPARATION OF SURFACES FOR CONCRETING

A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. **Joints in Concrete:** Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of laitance, loose or defective concrete, and foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting. Pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent Work; provided that construction joints shall be made only where acceptable to the Engineer.

D. Embedded Items

1. No concrete shall be placed until formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. Surfaces of forms and embedded items that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.

2. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated or by Shop Drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.

E. **Casting New Concrete Against Old:** Where concrete is to be cast against old concrete (defined as any concrete which is greater than 60 Days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydroblasting (exposing aggregate) prior to the application

of an epoxy bonding agent. Application shall be according to the bonding agent manufacturer's instructions and recommendations.

F. No concrete shall be placed in any structure until water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. No concrete shall be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of the Engineer.

G. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

H. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided for during the placing of concrete.

I. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

3.13 HANDLING, TRANSPORTING, AND PLACING

A. **General:** Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. **Non-Conforming Work or Materials:** Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications or which is of inferior quality shall be removed and replaced at the expense of the Contractor.

C. **Unauthorized Placement:** No concrete shall be placed except in the presence of a duly authorized representative of the Engineer. The Contractor shall notify the Engineer in writing at least 24 hours in advance of placement of any concrete.

D. Placement in Wall and Column Forms:

1. Concrete shall not be dropped through reinforcement steel or into any deep form nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4-feet in walls and 8-feet in columns below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6-feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2-feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5-feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of forms so that the concrete at the places of deposit is visible from the deck or runway.

2. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel, and laitance shall be removed.

E. **Conveyor Belts and Chutes:** Ends of chutes, hopper gates, and other points of concrete discharge throughout the Contractor's conveying, hoisting, and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the Engineer. Chutes longer than 50-feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the required consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. Conveyor belts and chutes shall be covered.

F. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the required minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water, using ice, or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.

G. Cold Weather Placement:

1. Placement of concrete shall conform to ACI - 306, and the following:
    a. Earth foundations shall be free from frost or ice when concrete is placed upon or against them.
    b. Maintain the concrete temperature above 50 degrees F for at least 72-hours after placement.

3.14 PUMPING OF CONCRETE

A. **General:** If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment:

1. The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the Site during pumping.
2. The minimum diameter of the hose conduits shall be in accordance with ACI 304.
3. Pumping equipment and hose conduits that are not functioning properly shall be replaced.
4. Aluminum conduits for conveying the concrete shall not be permitted.

3.15 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required.

B. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.16 FINISHING CONCRETE SURFACES

A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects.

1. Surface holes larger than 1/2-inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.

C. **Unformed Surfaces:** After proper and adequate vibration and tamping, unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Whenever the air temperature exceeds 85 degrees F or the wind speed exceeds 25 mph at the time of placement, the concrete shall be treated as follows. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each Work operation as necessary to prevent drying shrinkage cracks. The classes of finish for unformed concrete surfaces are designated and defined as follows:

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by the Engineer.
3. Finish U3 - After the Finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of irregularities. Place Working Floor Surface Coating.
4. Finish U4 - Trowel the Finish U3 surface to remove local depressions or high points. In addition, the surface shall be given a light broom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

D. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE	
Area	**Finish**
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Slabs	U4
Top surface of walls	U3

3.17 CURING AND DAMPPROOFING

A. **General:** Concrete shall be cured for not less than seven (7) days after placing, in accordance with the methods indicated below for the different parts of the Work.

B. **Concrete Curing Method:** The surface shall be sprayed with a liquid curing compound.

1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film that will seal thoroughly.
2. Unstripped forms that are removed within seven (7) days of placing the concrete shall be sprayed with liquid curing compound immediately after stripping forms.
3. Liquid curing compound shall not be sprayed in construction joints between footings and walls and between floor slabs and columns. The surface of the construction joint shall be free of bond breakers.
4. Concrete that shall be buried will need to be cured for seven (7) days and have 75% concrete compression strength prior to backfilling.
5. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the seven (7) day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
6. Wherever curing compound has been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting or approved method just prior to the placing of new concrete.
7. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within two (2) hours after removal of forms. Repairs required to be made to formed surfaces shall be made within the said two (2) hour period; provided, however, that any such repairs which cannot be made within the said two (2) hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted or approved method to remove the curing compound.
8. During the curing period, no traffic of any nature and no depositing of any materials, temporary or otherwise, shall be permitted on surfaces coated with curing compound. Foot traffic and the depositing of materials may be allowed after three (3) days if the surface is covered with 5/8-inch plywood placed over polyethylene sheets.

C. The Contractor may submit alternate methods of curing which maintain the concrete in a continuously wet condition for acceptance by the Engineer.

3.18 PROTECTION

A. The Contractor shall protect concrete against injury until final acceptance.

B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The Contractor shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.19 CURING IN COLD WEATHER

A. Cold weather concrete shall conform to ACI 306 for cold weather concrete placement.

B. Water curing of concrete may be reduced to six (6) days during periods when the mean daily temperature in the vicinity of the Site is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

C. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50 degrees F.

D. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than three (3) days, 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

E. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.20 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, exposed concrete surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. Repairs and replacements shall be performed promptly.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of laitance or soft material, plus not less than 1/32-inch depth of the surface film from hard portions by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. Repairs shall be built up and shaped in such a manner that the completed Work will conform to the requirements of this Section as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

3.21 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, which becomes

defective at any time prior to the final acceptance of the completed Work, which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

END OF SECTION

SECTION 03 60 00

GROUT

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall provide all materials for grout and appurtenant Work, complete and in place, in accordance with the Contract Documents.

B. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.

2. Cement Grout

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All codes, as referenced herein are specified in Section 01 42 19 – Reference Standards.

B. Specifications, codes, and standards shall be as specified in Section 03 30 00 - Cast-in-Place Concrete, and as referred to herein.

C. Commercial Standards:

CRD-C621	Corps of. Engineers Specification for Non-Shrink Grout
ASTM A706	Standard Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in or 50-mm cube specimens).
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings
ASTM C579	Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
ASTM C827	Test Method for Early Volume Change of Cementitious Mixtures
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink),
ASTM D696	Test Method for Coefficient of Linear Thermal Expansion of Plastics

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. **Shop Drawings:** Include certified test results verifying compliance with the compressive strength, shrinkage, expansion requirements and Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each proposed type of non-shrink grout.

C. Provide Manufacturer’s independent certification of ASTM C1107 compliance without modification of the standard methods certifying that the Class B or C grout post hardening non-shrink properties are not based on gas expansion, grouts have strengths of 3500 psi at one (1) day, 6500 psi at three (3) days and 7500 psi at 28 days when cured at 72 degrees F as well as meeting the 3, 7, and 28 day strengths when tested and cured at the 45 degree and 95 degree limits and all other requirements of ASTM C1107.

D. The Contractor shall engage an independent testing laboratory to run a 24-hour grout evaluation in accordance with ASTM C1107 of each grout submitted for approval showing compliance to all aspects of the evaluation and submit results to the Engineer for review.

E. The Contractor shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements specified herein; and Manufacturer's literature containing

instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink used in the Work.

1.4 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to insure continued compliance with these specifications. The specimens will be made by the Engineer or its representative.
2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three (3) specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the Contractor.
4. The cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. However, the Contractor shall be charged for the cost of any additional tests and investigation on Work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.
5. The Contractor shall assist the Engineer in obtaining specimens for testing and shall furnish all materials necessary for fabricating the test specimens.

B. **Construction Tolerances:** Construction tolerances shall be as specified in the Section 03 30 00 - Cast-in-Place Concrete, except as modified herein and in the Contract Documents.

PART 2 -- PRODUCTS

2.1 CEMENT GROUT

A. **Cement Grout:** Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement grout materials shall be as specified in Section 03 30 00 - Cast-in-Place Concrete.

2.2 PREPACKAGED GROUTS

A. Non-Shrink Grout:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the Manufacturer for the particular application.
2. Class A non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C621.
3. Class B non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi and shall meet the requirements of CRD C621.
4. Application:
    a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout

specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

2.3 CURING MATERIALS

A. Curing materials shall be as specified in Section 03 30 00 - Cast-in-Place Concrete for cement grout and as recommended by the Manufacturer of prepackaged grouts.

2.4 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

2.5 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers.

B. Shovel measurement shall not be allowed.

C. Prepackaged grouts shall have ingredients measured by means recommended by the Manufacturer.

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03 30 00 - Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete.

B. The Manufacturer of Class A non-shrink grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

3.2 GROUTING PROCEDURES

A. **Prepackage Grouts:** All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the Manufacturer.

B. All structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.

1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a one-inch thickness of grout or a thickness as indicated on the Drawings.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and be tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the Engineer, alternate grouting methods shall be submitted for acceptance.

3. Modify consistency only by altering the aggregate per Manufacturer.

3.3 GROUTING OF BASES FOR EQUIPMENT AND STRUCTURES

A. All equipment and structural base plates shall be firmly and solidly grouted in place, utilizing non-shrink grout by methods that will ensure complete, uniform, and permanent filling of all space beneath the base without disturbing or displacing the alignment or level of the base in its correct position.

B. Should the installation of any equipment be done under the supervision and direction of a Manufacturer's erection superintendent, or other accredited supervisor provided by the Manufacturer of the equipment, then the grouting procedure shall follow his direction. Otherwise, these specifications shall govern.

C. Surface Preparation:

1. The surfaces of hardened concrete upon which grout will be placed shall be chipped to remove laitance and surface mortar and to expose the aggregate.
2. The surface of the hardened concrete shall be cleaned of all oil, grease, laitance, curing compound, and other foreign loose materials and shall be saturated with water for not less than 24 hours immediately before the grout is placed.
3. All excess water shall be removed.

D. **Alignment and Leveling:**

1. Each base shall be set in place over its anchor bolts and shall be carefully aligned in proper position and then brought to accurate level.
2. Small structural bases may be leveled by means of an extra nut below the base on each anchor bolt.

E. **Mixing:**

1. Non-shrinking grout shall be furnished factory premixed so only water is added at the job site.
2. Grout shall be mixed in a mechanical mixer for a minimum of three (3) minutes.
3. No more water shall be used than is recommended by the Manufacturer.

F. **Placement:**

1. Non-shrinking grout shall be placed immediately after mixing and before stiffening sets in.
2. Grout shall be placed in strict accordance with the directions of the Manufacturer so that all grout space is completely filled without voids.
3. Non-shrinking grout shall be finished smooth in all locations where the grout will be exposed to view after it has reached its initial set.

G. **Finishing of Edges:**

1. When the placing of the grout has been completed, it shall be allowed to stand undisturbed until set stiff.
2. Then immediately the form or dam, if any, shall be taken off, and the portions of the grout which extend beyond the edges of the base shall be cut off flush and removed, except where a sloping surface is indicated on the drawings.
3. Sloping surfaces shall be finished to a one-to-one slope.
4. All grouting shall be completed in a proper and workmanlike manner with the exposed edges of the foundation and the surfaces adjacent thereto left clean and free from cement and grout.

3.4 DOWELS

A. Dowels shall be provided in those places as shown on the drawings.

B. Dowels shall be ASTM A706 grade 60 bar.

C. Grout shall be placed to the full depth of hole.

3.5 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 5 – METALS

SECTION 05 50 00

MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish, fabricate, and install miscellaneous metalwork and appurtenances, complete, in accordance with the requirements of the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All codes, as referenced herein are specified in Section 01 42 19 – Reference Standards.

B. Federal Specifications:

QQ-F-461 C (1)	Floor Plate, Steel, Rolled.
MIL-6-18015	(Ships) Aluminum Planks. (6063-T6)

C. Commercial Standards:

Aluminum Assn. AA-M32	C22A41.
AASHTO HS-20	Truck Loading.
AISC	Specifications and Commentary.
AISI	Specifications and Commentary.
ASTM A36	Specification for Structural Steel.
ASTM A48	Specification for Gray Iron Castings.
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A125	Specification for Steel Springs, Helical, Heal Treated.
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
ASTM A563	Specification for Carbon and Alloy Steel Nuts.
ASTM A575	Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades.
ASTM B98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
ASTM B438	Specification for Sintered Bronze Bearings (Oil-Impregnated).
ANSI/AWS 01.1	Structural Welding Code - Steel.
NFPA 101	Life Safety Code.
NAAMM	Metal Stairs Manual.

1.3 CONTRACTOR SUBMITTALS

A. **Shop Drawings:** Shop drawings of all miscellaneous metalwork shall be submitted to the Engineer for review in accordance with Section 01 33 00 - Contractor Submittals.

B. **Anchors:** Wherever power-driven pins will be utilized for anchorage or support, complete information describing pin capacity, connections, and proposed use locations shall be furnished to the Engineer.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. **Standard**: All structural steel shall conform to the requirements of:

1. W-shapes and DWT-shapes: ASTM A992, Grade 50.
2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
3. Hollow Structural Sections: ASTM A500, Grade B (yield 46ksi).
4. Other shapes and plates: ASTM A36.

B. **Corrosion Protection:** Unless otherwise shown, miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09 90 00 - Protective Coating and shall not be galvanized prior to coating. All other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein.

C. **Stainless Steel:** Unless otherwise shown, stainless steel metalwork and bolts shall be of Type 316 stainless steel and shall not be galvanized. Where anaerobic conditions are anticipated, Type 304 stainless steel shall be used.

2.2 STEEL PIPE HANDRAILS

A. Steel pipe handrails, including brackets and related hardware, which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type 316 stainless steel. All other steel pipe handrails shall be standard 1-1 /2-inch carbon steel pipe made up by welding and hot-dip galvanized after fabrication.

2.3 LADDERS

A. Ladders which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type 316 stainless steel. All other ladders shall be of carbon steel, hot-dip galvanized after fabrication.

2.4 METAL GRATING AND FLOOR HATCHES

A. **General**: Metal grating and floor hatches shall be of the design, sizes and types shown. Aluminum in contact with other metal or concrete shall be shop-painted in accordance with System 208 of Section 09 90 00 - Protective Coating.

B. **Metal Grating:** Metal grating shall be of hot dipped galvanized as shown. No single piece of grating shall weigh more than 80 lb unless otherwise specified or shown.

C. **Floor Hatches:** Floor hatches shall be of steel or aluminum as shown in the construction drawings. Hatches shall be double-swing, and shall be furnished with 2 stay bars designed to hold the cover in an open position and provide a railing around the opening, stay bar brackets designed to provide storage for the bars when the hatch is closed, 4 flush handles, joint gutter, and a moat-type edge drain complete with drain connection. Steel hatches shall be hot-dip galvanized after fabrication. Floor hatches shall be double leaf aluminum hatch Bilco floor model JD-4AL or approved equal.

2.5 SEAT ANGLES, SUPPORTS, AND GUIDES

A. Seat angles for grating shall be aluminum or steel as shown and of a size as shown. Guides for slide gates shall be steel, of a size shown, hot-dip galvanized after fabrication.

2.6 BOLTS AND ANCHORS

A. **Bolts:** Unless other corrosion-resistant bolts are shown, all bolts, anchor bolts and washers shall be of Type 316 stainless steel, with bronze nuts, or cap screws (where screwed into stainless steel), of copper-silicon alloy, conforming to ASTM B98, alloy C 65100, designation H04, or alloy C 65500, designation H04. Wherever stainless steel bolts and nuts are specified, it shall refer to the above material combination, unless specifically excluded.

B. Bolt Requirements:

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

C. **Adhesive Anchors:** Unless otherwise shown or specified, all anchors shall be adhesive anchors.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy systems shall be Sika/FI System with Sikadur Injection Gel Epoxy or Masterbuilders Concresive Epoxy Cartridge Dispensing System and Concresive Paste LPL. Threaded rod shall be stainless steel Type 316.

2. Unless otherwise shown, glass capsule, polyester resin adhesive anchors will be permitted in locations not specified above and shall be Hilti HV or Molly Parabond. Threaded rod shall be galvanized steel.

D. **Expanding-Type Anchors:** Expanding-type anchors are not permitted.

2.7 LADDER EXTENSION

A. A telescoping high strength steel safety post shall be installed on the fixed ladders. The device shall be **"Ladder Up" by Bilco**, or approved equal.

2.8 PIPE STANDS, SUPPORTS and GUIDES

A. Pipe stands, supports and guides shall be fabricated from ASTM A36 steel and hot-dip galvanized.

2.9 STAFF GAGE

A. **Style:** Type C or approved equal.

B. **Width:** 2.5 inches.

C. **Length:** As shown on construction drawings.

D. **Graduation Markings:** Graduation marks every 1/100 foot and numerical markings every 1/10 foot and 1 foot.

E. **Materials:** Porcelain-enameled, iron core, resistant to rust and discoloration.

F. **Mounting:** Brass grommets with 0.188 inch opening for #8 stainless steel screws. Style C Staff Gage should be mounted to composite decking or other approved back plate material before being attached to any hard structure such as concrete.

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. **Fabrication and Erection:** Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. **Steel Railings:** Field welding of steel pipe handrail joints will be permitted only if approved by the Engineer, and then only in accordance with its instructions.

C. **Floor Hatches:** Unless otherwise shown, the Contractor shall furnish and install a 1/2-inch drain line to the nearest floor drain for all floor hatches.

3.2 WELDING

Material Penetrated by Pin	Material's Minimum Thickness	Pins Shank Penetration in Supporting Material	Minimum Space from Pins CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	160	60 minimum	140	200
Steel	1/4-inch	Steel thickness	40	70

A. **Method**: All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

B. **Quality**: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.3 GALVANIZING

A. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153. Field repairs to galvanizing shall be made using **"Galvinox," "Galvo-Weld,"** or equal.

3.4 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its specified strength in accordance with the Manufacturer's instructions.

END OF SECTION

DIVISION 31 - EARTHWORK

SECTION 31 11 00
SITE PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General: In its initial move onto the Site, the Contractor shall protect existing fences and associated improvements, streets, and utilities within and downslope of construction areas from damage due to boulders, trees, or other objects dislodged during the construction process and clear, grub, strip, and re-grade certain areas in preparation with commencing work, in accordance with the Contract Documents. The Contractor shall stay within the limits of construction as identified on the drawings. Construction fencing shall be used to delineate areas that shall not be disturbed by the Work.

B. Clearing and Grubbing

C. Tree Removal

D. Over Excavation, Re-grading and Backfill

1.02 RELATED SECTIONS

A. Section 32 92 19: Seeding

1.03 SITE INSPECTION

A. Prior to moving onto the Site, the Contractor shall inspect the Site conditions and review maps of the on-Site pipelines, utilities, and existing facilities along with property and right-of-way lines.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRIMARY ACCESS

A. The Contractor shall utilize existing, and improve as directed in the Contract Documents, access to the Site as shown, including access barriers to prohibit entry of unauthorized persons.

B. Utility Interference: Where existing utilities interfere with the Work, notify the utility owner and the Construction Manager before proceeding in accordance with the General Conditions.

3.02 CLEARING, GRUBBING, AND STRIPPING

A. Construction areas shall be cleared of grass and weeds to at least a depth of 2-in and cleared of structures, pavement, sidewalks, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the subsequent usefulness of the Work, or obstruct its operation. Loose stones and boulders within 10-ft of the top of cut lines shall be removed from the Site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction.

B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove stumps, roots, and buried logs larger than 1-in diameter and other objectionable material. Underground structures, debris or waste shall be removed if found on the Site. Objectionable material from the clearing and grubbing process shall be removed from the Site and wasted in approved off Site locations.

C. Areas on the drawings that are not identified for clearing and grubbing shall be left untouched by the Contractor.

D. Unless otherwise indicated, native vegetation larger than 3-in in diameter at the base shall not be removed without the Engineer’s approval. The removal of any trees, shrubs, fences, or other improvements outside of the construction limits, if necessary for the Contractor's choice

of means and methods, shall be first discussed with the Engineer before being arranged with the owner of the property, and shall be removed and replaced, as part of the Work.

E. Debris from clearing and grubbing shall be stockpiled and removed from the Site by conventional construction techniques and disposed of off Site. Burning or burying of debris is not permitted on Site.

F. Existing riprap on the dam and any around the existing gate valve vault embankment shall be salvaged and temporarily stockpiled for reuse on the completed dam embankment.

3.03 TREE REMOVAL

A. Remove trees

1. Trees to be removed as shown on Drawings or as directed by the Engineer.

2. Trees that are not directed for removal by the Engineer or as indicated for removal on the Drawings shall be protected.

B. Demolition of trees will be administered using conventional construction techniques and carried out by a licensed tree company.

C. Trees shall be stockpiled and removed from the site by conventional construction techniques, and disposed of offsite. Burning or burying debris on Site shall not be permitted.

D. Any limbs to be trimmed to facilitate the work shall be carried out by a licensed tree company.

3.04 OVER EXCAVATION, RE-GRADING, AND BACKFILL

A. After the Work area has been cleared, grubbed and excavated, the areas to receive concrete structures will require over excavation, re-grading, and backfill, consisting of the removal and/or stockpiling of undesirable soils. The ground surface shall be re-contoured for keying the fill and removing severe or abrupt changes in the topography of the Site. The over excavated volumes are to be included to a level in the Work and not as a separate line item.

B. Under each concrete structure, the Engineer may require a 1-ft or deeper over-excavation which is to be backfilled with compacted structural fill.

END OF SECTION

SECTION 31 23 16
EXCAVATION

part 1 GENERAL

1.01 section includes

A. This Section covers furnishing of all labor, materials, tools, equipment, and performing all Work and services for excavating, over excavating, borrowing, removing undesired or excess materials as shown on the Construction Drawings, in accordance with the Contract Documents.

B. Although such work is not specifically indicated, perform all supplementary work incidental to the services outlined above.

C. Foundations include footings, floor slabs, walls, mat foundations, aprons, piers, pits, or any other support placed on or in the soil.

1.02 RELATED SECTIONS

A. Section 31 23 19: Dewatering
B. Section 31 23 23.15: Trenching and Backfilling

1.03 SUBMITTALS

A. Informational Submittals:

1. Bedrock Protection, needed to prevent weathering and desiccation of exposed bedrock:
    a. Methods to employ
    b. Water controls
    c. Sequencing

1.04 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized over excavation. The Contractor shall verify adequate survey control designating an individual to perform by spot checking elevations for the Owner. The Engineer shall approve or reject the results.

1.05 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after the material drains and dries sufficiently for proper compaction.

C. All exposed bedrock beside or beneath structures or when backfill is to be placed will be kept covered to prevent weathering and desiccation.

1.06 SEQUENCING AND SCHEDULING

A. Clearing, Grubbing, and Stripping: Complete applicable Work specified in Section 31 11 00, Site Preparation, prior to excavating.

B. Dewatering: Conform to applicable requirements of Section 31 23 19, Dewatering, prior to initiating excavation.

1.07 SUBSURFACE AND GEOLOGICAL INVESTIGATIONS

A. An investigation has not been made to obtain relative data concerning the character of material being made available to prospective bidders and the Contractor. The Contractor shall satisfy himself as to the kind and type of soil to be encountered and any water or subsurface conditions which might affect the construction of the project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Excavations shall conform to all applicable OSHA Standards.

B. The Contractor shall notify the Engineer at least 48 hours in advance of the commencement of any phase of the work, as well as any delays or stoppage.

C. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of +/- 0.1-ft, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, over excavation, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

D. Do not excavate below specified over excavation limits without written authorization of the Engineer.

E. The Contractor will perform all excavation of every description and substance encountered, to the depths indicated in the Drawings or as otherwise specified. During excavation, materials suitable for backfilling will be piled in an orderly manner, a sufficient distance from the banks to avoid overloading and to prevent slides or cave-ins. Topsoil will be removed and piled separately for use in finish grading the grounds. Grading will be done as may be necessary to prevent surface water from flowing into trenches or other excavations. Any water accumulating therein will be removed by pumping or by other approved methods. Sheeting and shoring will be done as may be necessary for the protection of the work and the safety of the personnel. All trenches left open shall be protected by fencing or other approved methods at the end of each workday.

3.02 TOPSOIL

A. Topsoil in areas to be excavated shall be removed and stockpiled as described in Section 31 11 00, Site Preparation.

3.03 EXCAVATION

A. Complete all excavation regardless of the type, nature, or condition of the materials encountered to the limits defined or described by the Contract Documents.

B. The Contractor shall excavate to elevations shown on the Contract Drawings, allowing additional space as required for construction operations and review of foundation construction. All excavation and side slopes shall conform to all applicable regulations. Where engineered cut slopes are required by OSHA regulations, the Contractor shall retain a professional to provide the necessary engineering designs for review by the Engineer. The Contractor shall remove obstructions including but not limited to old foundations, pipe, unsuitable subgrade soils, and any other materials which may be concealed beneath the present grade, as required to construct an acceptable grade for the foundations.

3.04 OVER EXCAVATION

A. The Contractor shall over-excavate subgrade soils, as shown on the Drawings, or in areas with undesirable or unsuitable soils for foundation support as determined by the Engineer. No over-excavation shall be performed without the written approval of the Engineer.

3.05 PREPARATION OF FOUNDATIONS

A. Where foundations are to rest on rock, the rock shall be fully exposed and the surface of the rock shall be leveled off to approximate horizontal and vertical steps. The bedrock shall be protected from desiccation and weathering caused by wetting of the bedrock. The bedrock, once exposed at the proper grade, shall be covered with a “mud slab” coat of concrete.

B. Where foundations are to rest on subgrade material other than rock, care should be taken to avoid disturbance of the bottom of the excavation. Soils loosened during excavation shall be removed from the excavation, and the excavation restored to a condition at least equal to the undisturbed subgrade.

C. The Contractor is responsible for notifying the Engineer as soon as excavations are completed in order that subgrade may be reviewed.

D. Completed excavations shall be protected from becoming unacceptable including but not limited to becoming wet, frozen, overly dry, or soft due to weather, and or construction operations. Grading around excavations for structures shall be performed to prevent water from running into the excavation or from damaging completed foundations. Should any free water, groundwater, or

springs be encountered, the Contractor shall be required to keep excavations free from water during construction of the foundations by the use of trenches, well points, or other means as reviewed and accepted by the Engineer.

E. The Contractor shall shore, sheet pile, slope, and/or brace excavations as required to maintain a safe site and to conform to all local, state, or federal agency regulations having jurisdiction over the work. The Contractor is fully and solely responsible for maintaining safe working conditions during construction.

F. The Contractor is responsible for protecting all monuments, benchmarks, and other reference points to be used to construct the foundations. Reference points disturbed that require restaking will be restaked at the Contractor's expense.

3.06 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, as shown on the drawings.

B. Remove stones and rock that exceed 3-in diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-ft radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.07 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Confine stockpiles to within the construction limits and approved work areas. Do not obstruct roads, streets, or utility easements.

C. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

D. Do not stockpile excavated materials near or over or under existing utilities and facilities, adjacent property, or completed Work, if weight and height of stockpiled material could induce excessive settlement.

3.08 DISPOSAL OF SPOIL

A. Dispose of excavated materials, as approved by the Engineer, which are unsuitable or exceed quantity needed for fill or backfill, within the Construction Area unless otherwise directed in the Drawings.

B. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 11 00, Site Preparation, for clearing and grubbing debris. Do not bury onsite.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 23 19
DEWATERING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and perform all installation, maintenance, removal, and area cleanup related to dewatering.

1.02 RELATED WORK

A. Site Preparation is included in Section 31 11 00.

B. Sedimentation and Erosion Control is included in Section 31 25 00.

C. Excavation is included in Section 31 23 16.

D. Dewatering Permit information is included in Section 01 41 26

1.03 SUBMITTALS

A. Informational Submittals

1. Water control plan
2. Discharge permits

1.04 WATER CONTROL PLAN

A. At a minimum, include:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment; methods; standby equipment and power supply, pollution control facilities, discharge locations to be utilized, sediment control, and provisions for immediate temporary water supply as required by this section.
2. Drawings showing locations, dimensions, and relationships of elements of each system.
3. Design calculations demonstrating adequacy of proposed dewatering systems and components.

B. If system is modified during installation or operation revise or amend and resubmit Water Control Plan.

C. Include in plan any monitoring and how it will be completed to meet discharge permits or water accounting.

PART 2 MATERIALS

A. Generators and engines shall be reasonably quiet and meet all local noise ordinance.

PART 3 EXECUTION

3.01 GENERAL

A. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

3.02 SURFACE WATER CONTROL

A. Control of surface water shall conform to the requirements of grading, erosion, and sediment control plans included in the Drawings, as well as the Stormwater Management Plan.

B. Dewatering Sediment Control (reference the permit application coverage under Permit No. 070000 “Colorado Department of Public Health and Environment (CDPHE) General Permit for Construction Dewatering Operations”): Sediment shall be contained within the construction site and shall not be discharged into drainages and/ or jurisdictional waters. Contained sediment should be disposed of at a designated location away from the Site or as approved by the Owner and Engineer.

C. Water from dewatering shall conform to the requirements within the construction dewatering permit and shall be filtered so that sediment plumes are not deposited into drainage ways or wetlands.

1. Contractor shall develop a dewatering plan and obtain approval by the Engineer prior to the start of any Work onsite. The plan shall indicate the methodology and equipment that will filter water and indicate where stored sediment will be disposed of offsite. The plan shall designate a person or persons who will monitor the sediment control program and order decreased dewatering, as necessary, to prevent transport of sediment offsite. The plan shall be submitted to the CDPHE to obtain a construction dewatering permit.
2. If any sediment is deposited into jurisdictional water or wetland the Engineer shall be contacted immediately, and Work shall stop until the sediment leak is repaired and discharge ceases.

D. Remove surface runoff controls when no longer needed.

3.03 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in the dry and to lower and maintain groundwater level a minimum of 2-ft below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source and until backfilled to final grade.

B. Design and Operate Dewatering Systems:

1. To prevent loss of ground as water is removed.
2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
3. To relieve artesian pressures and resultant uplift of excavation bottom.

C. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

D. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

3.04 MONITORING FLOWS

A. The Contractor shall also perform monitoring as required in the CDPHE Dewatering Permit.

3.05 DISPOSAL OF WATER

A. Obtain discharge permit for water disposal from authorities having jurisdiction.

B. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge. Also, assure that the effluent limits set forth by the CDPHE Discharge Permit are met.

C. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

D. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

3.06 PROTECTION OF PROPERTY

A. Make assessment of potential for dewatering induced settlement. Provide and operate devices or systems, including but not limited to reinjection wells, infiltration trenches and cutoff walls, necessary to prevent damage to existing facilities, completed Work, and adjacent property.

B. Securely support existing facilities, completed Work, and adjacent property vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.

3.07 PROTECTION OF CLAYSTONE SUBGRADES

A. Exercise additional care when dewatering claystone subgrades as this material has a strong tendency to desiccate with exposure to water and air.

B. Take all appropriate precautions to prevent wetting and subsequent disturbance of claystone/sandstone subgrades within the foundation foot print of the structure.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 23 23
TRENCHING, BACKFILLING, AND COMPACTION (PIPELINES)

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and perform all trenching for pipelines and appurtenances, including drainage, filling, backfilling, disposal of surplus material and restoration of trench surfaces and easements.

B. Excavation shall extend to the width and depth shown on the Drawings or as specified herein and shall provide suitable room for installing pipe, structures, and appurtenances.

C. Furnish and place all sheeting, bracing, shoring, boxes, and supports and remove from the excavation all materials which the Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects, acceptable. If conditions warrant, deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.

D. All pipelines installed by open cut trench method shall be bedded with granular pipe bedding or flowable fill as required on the Drawings and per Section 31 23 24.

E. All excavation, trenching and related sheeting, bracing, etc., shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P).

F. Wherever the requirement for 95 percent compaction is referred to herein it shall mean “at least 95 percent of maximum density as determined by ASTM D698", standard proctor.

G. Wherever the requirement for 70 percent relative density is referred to herein it shall mean “at least 70 percent of relative density as determined by ASTM D4254".

H. Prior to the start of work submit the proposed method of backfilling and compaction to the Engineer for review.

I. The Contractor will not use private property outside construction easements without first obtaining written permission. A copy of this document shall be provided to the engineer prior to the Contractor using said property.

1.2 RELATED WORK

A. Section 31 23 19 – Dewatering.

B. Section 31 23 24 Fill Materials (Pipelines).

C. Section 31 23 16 – Excavation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TRENCH EXCAVATION

A. Trench excavation shall include material of every description and of whatever substance encountered, except rock and boulders. Pavement shall be saw-cut along straight lines before excavating.

B. Strip and stockpile topsoil from grassed areas crossed by trenches. At the Contractor's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.

C. While excavating and backfilling is in progress all utilities and other property shall be protected as provided in the General Conditions and Contract Documents.

D. Trenches shall be excavated to the depth indicated on the Drawings and in widths sufficient for laying the pipe, bracing and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Trench width shall be practical minimum.

E. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, "quick," or otherwise unsatisfactory as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced by screened gravel fill as required by the Engineer at the Contractor's expense.

F. Where pipe is to be laid in screened gravel or granular bedding, the trench may be excavated by machinery to the normal depth of the trench provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

3.2 JACKING/RECEIVING PITS

A. Jacking and receiving pits shall be no larger than required for reasonable installation of tunneling equipment and personnel to work.

B. Jacking and receiving pits shall be adequately braced to maintain all sidewalks and floor in a safe manner and that meets all OSHA requirements. Bracing shall generally include steel sheet piles, trench boxes, steel plating, etc.

C. The floor of the pits shall be free of mud and water and have at a minimum crushed rock of adequate thickness for a working floor surface and a sump for dewatering.

D. All pits shall have steel or concrete barriers (CDOT, precast type or approved equal) placed around them. All pits shall be adequately fenced to prevent access by unauthorized individuals both during construction and when no construction is taking place.

3.3 DISPOSAL OF MATERIALS

A. Excavated material shall be stacked without excessive surcharge on the trench bank or obstructing free access to hydrants and gate valves. Excavated material shall be segregated for use in backfilling as specified below.

B. It is expressly understood that no excavated material shall be removed from the site of the work or disposed of, except as directed by the Engineer. When removal of surplus materials has

been approved by the Engineer, dispose of such surplus material in approved designated areas.

C. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stockpiled at an area approved by the Engineer. When required, it shall be re-handled and used in backfilling the trench.

D. Excess soil remaining from the trench excavation shall be placed as shown on the Construction Drawings.

3.4 TEST PITS

A. Excavation of test pits will be required for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.

B. Test pits shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as specified.

3.5 EXCAVATION BELOW GRADE AND REFILL

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.

B. If the Contractor excavates below grade through error or for the Contractor's own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his own expense.

C. If the material at the level of trench bottom consists of fine sand, sand and silt, or soft earth that may work into the screened gravel notwithstanding effective drainage, the subgrade material shall be removed to the extent directed and the excavation refilled with a 6-inch layer of coarse sand, or a mixture graded from coarse sand to the fine squeegee, as approved by the Engineer, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Engineer prior to placement. Screened gravel shall then be placed in 6-in layers thoroughly compacted up to the normal grade of the pipe. If directed by the Engineer, bank run gravel shall be used for refill of excavation below grade.

D. Geotextlle filter fabric may be substituted for filter layer if approved by the Engineer. Filter fabric shall be Mirafi 140N; Supac equivalent, or equal.

3.6 BACKFILLING

A. The trench shall not be backfilled until the pipe installation is reviewed by the Engineer. After the pipe has been laid and jointed and reviewed by the Engineer, backfilling shall begin and thereafter be prosecuted expeditiously. Bedding material, as specified for the type of pipe installed, shall be placed up to 1-foot over the pipe.

B. Prior to placement in the trench, all pipe, fittings, and appurtenances shall be cleaned and examined for defects by the Contractor. If found defective, the Contractor shall reject the defective pipe, fitting, or appurtenance. The Contractor shall advise the Engineer of all defective materials.

C. The length of open trench shall not exceed 100-feet. No trench shall be left open overnight without proper protection and adequate safety fencing.

D. Where the pipes are laid cross-country, the remainder of the trench shall be backfilled with common fill material in loose layers not to exceed 6 to 12-inches thickness. In some areas, it may be necessary to remove excess material during the cleanup process, so that the ground may be restored to its original level and condition.

E. To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material or screened gravel has been placed and compacted to a level 1-foot over the pipe.

F. Bedding material in the pipe zone and subsequent backfill shall be brought up evenly on all sides. Each layer of backfill material shall be thoroughly compacted by rolling or tamping with a vibrating mechanical compacting equipment or hand tamping, to 95 percent standard proctor compaction, 70 percent relative density, or as a performance specification as agreed upon with the Engineer. Bedding and backfill soils will have a minimum compaction of 95 percent of the maximum dry density determined by ASTM D698 for cohesive soils and will have a minimum compaction of 70 percent relative density determined by ASTM D4254 for granular soils. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to compact the fill throughout the full width of the trench. Where flowable fill is used as pipeline bedding, contractor shall take all measures necessary to prevent flotation of the pipe. Pipe measured to be off grade will be directed for removal and reinstallation at the sole discretion of the Engineer at the Contractor's expense.

G. Where other methods are not practicable, compaction shall be by use of hand or pneumatic ramming with tools weighing at least 20-lb. The material being spread and compacted in layers not over 6-inches in loose measured thickness. Layer thickness may be increased to 12-inches when sufficient compaction tests are provided to the Engineer that verifies that a piece of equipment can compact to a depth of 12-inches. If necessary, sprinkling shall be employed in conjunction with rolling or ramming. Only hand tamping equipment or vibratory hand units will be allowed within the first 36-inches above the top of the pipe and around the pipe.

H. Subject to the approval of the Engineer, fragments of ledge and boulders smaller than 6-inches may be used in trench backfill providing that the quantity in the opinion of the Engineer is not excessive. Rock fragments shall not be placed until the pipe has at least 2-feet of earth cover. Small stones and rocks shall be placed in thin layers alternating with earth to ensure that all voids are completely filled. Fill shall not be dropped into the trench in a manner to endanger the pipe.

1. Bituminous paving shall not be placed in backfill. Frozen material shall not be used under any circumstances. Concrete rubble shall not be placed in the backfill.

I. All road surfaces shall be boomed and hose cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.7 PIPE BEDDING

A. Place pipe bedding over the full width of the prepared trench bottom in horizontal lifts not exceeding 8-inches loose thickness.

B. Hand grade and compact each lift using a vibratory plate compactor to provide a firm, unyielding surface.

C. Minimum Thickness: 6-inches, except where shown otherwise.

D. Check grade and correct irregularities in bedding material. Loosen top 1-inch to 2-inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe.

E. Install to form continuous and uniform support except at bell holes, if applicable, or minor

disturbances resulting from removal of lifting tackle.

F. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.8 PIPE BACKFILL ZONE

A. Place pipe zone material to the minimum height above the pipe crown as shown on the Drawings.

B. Restrain pipe as necessary to prevent their movement during backfill operations.

C. Place material simultaneously in maximum 8-inches horizontal lifts on both sides of pipe.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

E. After the full depth of the pipe zone material has been placed as specified, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls.

F. Do not use power-driven impact compactors to compact pipe zone material.

3.9 TESTING REQUIREMENTS FOR BACKFILL AND PIPE BEDDING

Construction Zone	Soil Material Type Requirements	Minimum Placement Compaction Requirements	Testing Requirements	Minimum Testing Interval
Trench Backfill	Excavated Native Soils	95% of ASTM D698	Density by nuclear gage, ASTM D698	Each 250 yds3 or 1 per day when soil is being placed, whichever is more frequent
Pipe Bedding and Cover	Approved Pipe Bedding Material from Fill Spec Section 31 23 24	70% +/- 5% of relative density, ASTM D4253 and D4354	Density by nuclear gage, ASTM D698	Each 100 yds3 or 1 per day when soil is placed, whichever is more frequent

3.10 RESTORING TRENCH SURFACE

A. Where the trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross country areas, thoroughly consolidate the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.

B. In an adjacent to streets, the 12-inch layer (20-inch in State Highways) of trench backfill below the specified initial pavement shall consist of compacted COOT Class 6 base course. Should the Contractor wish to use material excavated from the trench as gravel subbase for pavement replacement, the Contractor, at his/her own expense, have samples of the material tested by an independent testing laboratory at intervals not to exceed 500-feet, in order to establish its compliance with the specifications. Only material which has been tested and approved by the Engineer shall be allowed to be incorporated into the work.

C. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved road shall be restored to a condition at least equal to that existing before work began.

D. In sections where the pipeline passes through grassed areas, and at the Contractor's own expense, remove and replace the sod, or loam and seed the surface to the satisfaction of the Engineer.

END OF SECTION

SECTION 31 23 23.13
STRUCTURE EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section covers furnishing of all labor, materials, tools, equipment, and performing all work and services for excavating, over excavating, borrowing, removing undesired or excess materials, filling and backfilling of the soils for the structures shown on the Drawings, in accordance with the Contract Documents.

B. Although such work is not specifically indicated, perform all supplementary work incidental to the services outlined above.

C. Foundations include footings, floor slabs, walls, mat foundations, aprons, or any other support placed on or in the soil.

1.02 QUALITY STANDARDS

ASTM D-698 (Standard Proctor)

1.03 SUBMITTALS

See Section 01 33 00

PART 2 - MATERIALS

2.01 FILLS

Materials for use in the construction of fills shall conform with the fill designation indicated on the plans and specified in the appropriate section of the specifications. Materials excavated on-site may be acceptable for use with prior review and acceptance by the Owner/Engineer.

2.02 STRUCTURAL BACKFILL - CDOT CLASS I

Materials used for structural backfill shall be of a quality acceptable to the engineer and shall be free from frozen lumps, wood, or other organic, extraneous or perishable material. Imported fill material shall meet the following gradation:

Sieve Size	% Passing by Weight
2”	100
No. 4	50 - 100
No. 50	35 - 50
No. 200	25 - 40

In addition, a plasticity index of 15 or less when determined in conformity by AASHTO T90, and shall be non-swelling soils. Soils with claystone bedrock are not allowed.

PART 3 - EXECUTION

3.01 GENERAL

The Contractor shall notify the Owner/Engineer at least 48 hours in advance of the commencement of any phase of the work, as well as any delays or stoppage.

3.02 TOPSOIL

Topsoil shall be removed and stockpiled for use during finish grading. Topsoil which is to be used shall be free from brush, weeds, debris, and stones larger than 1.5” in diameter. Excess topsoil shall be disposed offsite.

3.03 EXCAVATION

The Contractor shall excavate to elevations shown on the Contract Drawings, allowing additional space as required for construction operations and review of foundation construction. All excavation and side slopes shall conform to all applicable regulations. Where engineered cut slopes are required by OSHA regulations, the Contractor shall retain a Professional Engineer to provide the necessary engineering designs for review by the Owner/Engineer. The Contractor shall remove obstructions including but not limited to old foundations, pipe, unsuitable subgrade soils, and any other materials which may be concealed beneath the present grade, as required to construct an acceptable grade for the foundations.

The Contractor shall protect existing structures from displacement, settlement, or damage caused by excavation work. Protection may include shoring, bracing, and hand excavations or other techniques as approved by the Owner/Engineer.

3.04 OVER-EXCAVATION

The Contractor shall over-excavate subgrade soils, as required or as shown on the Drawings, which in the opinion of the Owner/Engineer, are undesirable or unsuitable for foundation support.

3.05 PREPARATION OF STRUCTURE FOUNDATIONS

A. Where foundations are to rest on subgrade material, care should be taken to avoid disturbance of the bottom of the excavation. Soils loosened during excavation shall be removed from the excavation, and the excavation restored to a condition at least equal to the undisturbed subgrade. The subgrade shall be moisture conditioned and compacted prior to placement of the structure’s foundation components or structural fill.

B. The Contractor is responsible for notifying the Owner/Engineer as soon as excavations are completed in order that subgrade may be reviewed.

C. Completed excavations and subgrades shall be protected from becoming unacceptable including but not limited to becoming wet, frozen, or soft due to weather, and or construction operations. Grading around excavations for structures shall be performed to prevent water from running into the excavation or from damaging completed foundations. Should any free water, ground water, or springs be encountered, the Contractor shall be required to keep excavations free from water during construction of the foundations by the use of trenches, well points, or other means as reviewed and accepted by the Owner/Engineer. The subgrades shall be protected from freezing by blankets, a removable “loose lift” of soil, or other means as approved by the Owner/Engineer. Any frozen soil will be required to be removed and the subgrade will be required to be reworked.

D. The Contractor shall shore, sheet pile, slope, and/or brace excavations as required to maintain a safe site and to conform to all local, State, or Federal agency regulations having jurisdiction over the work. The Contractor is fully and solely responsible for maintaining safe working conditions during construction.

E. The Contractor is responsible for protecting all monuments, benchmarks, and other reference

points to be used to construct the foundations. Reference points disturbed that require restaking, will be restaked at the Contractor's expense.

3.06 STRUCTURE BACKFILL

A. Structure backfill shall not be placed until the foundations or other portions of the structure have been reviewed by the Owner/Engineer and accepted for backfilling. The foundation soils shall be tested by density gauge and/or proof rolled, as approved by the Owner/Engineer, before any backfill material and structures are placed. No backfill materials shall be deposited against foundation walls, abutments, and retaining walls until the structure has reached the strength necessary to sustain backfill and other anticipated loads.

B. When permitted by the Owner/Engineer, footings may be backfilled to a level equal to the top of the footings or berm elevation where appropriate, upon removal of the forms.

C. Foundations for rigid frame structures or walls or abutments which are not designed as self-sustaining against soil and backfill loads shall not be backfilled unless the superstructure has been placed and has reached a strength necessary to sustain the anticipated loads.

D. Foundations shall not be backfilled until the area involved has been cleared of all falsework, sheet piling, cribbing, shoring, bracing, forms, and debris.

E. Structure backfill shall be performed as to prevent wedging action against the structure. Existing slopes shall be stepped, terraced, or otherwise treated as necessary to prevent slippage and wedging of the backfill.

F. Unless otherwise provided, backfill shall be placed in continuous horizontal layers not exceeding 10” in loose thickness. Where hand operated compaction equipment is used, the layers shall not exceed 6” thick. Hand operated compaction equipment will be required within 3’ of existing or new structures. Each layer shall be brought up uniformly on all sides of the foundation and shall be compacted before the next layer is placed, by means of rollers, tampers or vibrators. No fill shall be placed when the bank soils are frozen, contains snow or ice, or the surface on which the fill is to be placed is snow covered, or is frozen and contains ice lenses. Any frozen soil within the backfill soils shall immediately be removed.

G. Backfilling operations shall be performed to minimize live load and compaction effort surcharges to the foundation. Backfill operations shall be performed in such a manner that no portion of the foundation or structure is damaged or deflected out of alignment. All backfill shall be compacted in accordance with the densities shown on the plans, but not less than 95% Standard Proctor at +/- 2% optimum moisture. Soil that does not meet these specifications shall immediately be reworked until the compaction and moisture specifications are met, or removed.

H. The foundation shall be free of any standing water. If water is present, it shall be removed and the foundation reworked, repaired, and retested before any backfill material or structures are placed. Water shall not be used to expedite settlement of backfill. Compaction by jetting is unacceptable.

I. Backfill materials transported in trucks or other vehicles shall be placed so that the contents of each vehicle are carefully and gradually deposited. All clams, dippers, or containers of backfill shall be lowered to within 5’ of the surface of the previously deposited backfill before they are dumped.

J. The Contractor is responsible for legally disposing of excess excavated materials, rock, organic materials, and soils from the site. The Owner/Engineer may request written confirmation from the Owner of the property where excess and waste materials are deposited.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 23 24
FILL MATERIALS (PIPELINE)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Fill materials are specified in this Section, but their use for bedding pipe, replacement of unsuitable material, pavement base, foundation support, and similar uses are shown and/or specified in detail elsewhere. The Engineer may order the use of fill materials for purposes other than those specified in other Sections, or if not otherwise indicated, if, in the Engineer's opinion, such use is advisable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching, Backfilling, and Compaction are included in Section 31 23 23.

B. Individual fill materials may be specified elsewhere in Division 31.

1.3 SUBMITTALS

A. Submit certified sieve analysis (per ASTM C1361) and source information for each material used, performed by a laboratory meeting CDOT Standards.

B. Submit Relative Density Curve (ASTM D4253 and D4254).

C. For CLSM or flowable fill submit certified mix design and test results. Submit performance related certified test results 24 hours after completion of the required testing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All bedding materials shall be unfrozen, free of snow, ice, and deleterious materials, in addition to requirements shown below.

B. Granular pipe backfill and bedding: Bedding shall consist of hard, durable particles of clean gravel and sand of proper size and gradation, and it shall be free from loam, clay, excess fines, coal and coal byproduct materials, and deleterious materials. The size of the particles shall be uniformly graded as follows:

Sieve No. or Size	Percent Passing (by weight)
3/4-in	100
1/2-in	95 - 100
3/8-in	80 - 95
No. 4	10 - 30
No. 200	0 - 5

C. Trench stabilization material: Material shall consist of crushed stone or gravel having hard, strong, durable pieces free from adherent coatings, clay balls or other organic materials or debris, well graded, and conforming to the following requirements:

Sieve No. or Size	Percent Passing (by weight)
3-in	100
1-1/2-in	95 - 100
3/4-in	35 - 70
3/8-in	10 - 30
No. 4	0 - 5

D. (CLSM) or Flowable Fill Backfill (Flow Fill) - Flowable fill concrete backfill shall consist of the following materials and mix proportions. The weights below are based upon aggregates in a saturated, surface dry condition. Batch plant corrections must be made for moisture in aggregates. Design physical properties shall be such that a 6-inch to 8-inch slump will be achieved with a minimum 28-day compressive strength of 200 psi. Flowable fill concrete may be approved for use as pipe bedding at selected locations other than where required by specific jurisdictions or as shown on the drawings. Specific measures and construction procedures will be required and submitted for approval to prevent pipe flotation. The maximum layer thickness for flow fill shall be 3 feet. Additional layers shall not be placed until the flow fill has lost sufficient moisture to be walked on without indenting more than 2 inches. Damage resulting from placing flow fill in layers that are too thick or from not allowing sufficient time between placement of layers shall be repaired at the Contractor's expense.

Material	Standard	Per Cubic Yard of Concrete
Cement	ASTM C150	50-lb
Sand	ASTM C33	1,845-lb
Size #57 Aggregate	ASTM C33	1,700-lb
*AEA	ASTM C260	5.0-oz
Water	ASTM C94	39.0-gal

* Note: Air entraining agent may be used to increase flowability.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See other parts of the specifications and Drawings for where these materials should be used. See also paragraph 1.1.A.

B. Unless otherwise noted, materials shall be placed on unfrozen, firm, solid, undisturbed earth or rock, or well-compacted foundation and shall be placed to the depths specified or shown.

C. Gravel shall be placed in not greater than 8-inch layers and thoroughly compacted by tamping, hand operated vibrators, or otherwise as acceptable by the Engineer.

D. In-place density and moisture testing for pipe bedding material and backfilling of the trench is specified in Section 31 23 23 Trenching, Backfilling, and Compaction (Pipeline).

END OF SECTION

SECTION 31 25 00
SEDIMENTATION AND EROSION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all installation, maintenance, removal, and area cleanup related to erosion and sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, stone filter boxes, stone filter berms, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, excelsior matting installation and final cleanup.

1.02 RELATED WORK

A. Site Preparation is included in Section 31 11 00.

B. Fill materials are included in Section 31 23 23.

C. Seeding is included in Section 32 92 19.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01 33 00, within 10 days after award of Contract, technical product literature for all commercial products, including seed mix, fertilizer, erosion control blankets, sediment control logs, and straw mulch tackifier, to be used for erosion and sedimentation control.

1.04 QUALITY ASSURANCE

A. Be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the Work site to offsite areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment offsite shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the Owner will be considered. The Contractor shall obtain a General Storm Water Discharge Permit as required by the Colorado Department of Health and Environment for Stormwater Discharges Associated with Construction Activity.

B. Sedimentation and erosion control measures shall conform to the requirements of the Colorado Department of Public Health and Environment, and City of Longmont standard specifications. If conflict between standards occurs, Contractor is to use most strict description.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed stone for sediment filtration devices, access ways and staging areas shall conform to Section 32 11 23 (Aggregate Base Course).

B. Riprap

1. Riprap shall meet the requirements of Section 31 37 00 Riprap.

C. Silt Fence

1. Sediment fence shall be a prefabricated commercial product made of a woven, polypropylene, ultraviolet resistant material such as “Envirofence” by Mirafi Inc., Charlotte, NC or approved equal.

D. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air dry condition and suitable for placement with blower equipment.

E. Latex acrylic copolymer or organic tackifier shall be a commercial product specifically manufactured for use as straw mulch tackifier.

F. An asphalt tackifier shall only be used when temperatures are too low to allow the use of a latex acrylic copolymer and only with prior written approval from the Engineer.

G. Erosion control blanket shall be installed in all seeded drainage swales and ditches as shown on the Drawings or as directed by the Engineer. Erosion control blanket shall be 100 percent agricultural straw matrix stitch bonded with degradable thread between two photodegradable polypropylene nettings, such as Model S150 Double Net Short-Term Blanket (10 months) by North American Green, Evansville, IN or equal.

H. Sediment control log shall be installed as depicted in the Design Drawings and as per manufacturer instructions. Logs shall be staked using wooden stakes. The logs shall be made from straw, compost, excelsior, coconut fiber, or combination thereof.

PART 3 EXECUTION

3.01 INSTALLATION

A. Silt Fence: Install all materials per Design Details provided and guidance by material manufacturer.

B. Locate features as per Design Drawings or as required by construction activities.

C. Any relocation of features is to be redlined on SWMP Plan and implemented only after Engineer approval.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Make a visual inspection of all erosion and sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to off site areas, promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Silt Fences
    a. Remove accumulated sediment once it builds up to 1/2 of the height of the fabric.
    b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
    c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.
2. Sediment Logs
    a. Repair logs and remove sediments when 1/2 of log is buried.
3. Vehicle Tracking Pad and Concrete Washout
    a. Muck out trapped debris and dewatering pit trench when it has built up to within 6-in of the top of the berm.
    b. Replace crushed stone filter when saturated with silt and pore space is less than 1/4 of original installation.
4. Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mud holes.

3.03 TEMPORARY MULCHING

A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 days of the completion of rough grading.

B. Straw mulch shall be applied at rate of 100-lb/1,000-sq-ft and tackified with latex acrylic copolymer at a rate and diluted in a ratio per manufacturer’s instructions.

3.04 EROSION CONTROL BLANKETS

A. Erosion control blankets shall be installed in all seeded drainage swales and ditches as shown on the Drawings and as directed by the Engineer in accordance with manufacturer's instructions. The area to be covered shall be properly prepared, fertilized and seeded with permanent vegetation before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water

flow and stapled. Blankets shall be placed a minimum of three rows (of 4-ft) wide (total approx. 12-ft width) within the drainage swale/ditch and stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-in minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1 1/2-in crown. Commercial biodegradable stakes may also be used with prior approval by the Engineer. The staples shall be driven vertically into the ground, spaced approximately 2-li-ft apart, on each side, and one row in the center alternately spaced between each size. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. Erosion stops shall be created every 25-ft by making a fold in the fabric and carrying the fold into a silt trench across the full width of the blanket. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required in the swale, turn down upper end of downstream roll into a slit trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.

1. To ensure full contact with soil surface, roll matting with a roller weighing 100-lb/ft of width perpendicular to flow direction after seeding, placing matting and stapling. Thoroughly inspect channel after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.05 REMOVAL AND FINAL CLEANUP

A. Once the Site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 32 91 13
SOIL PREPARATION

PART 1 GENERAL

1.01 DESCRIPTION

A. All work related to the shaping and preparation of the subgrade for final grading and surface treatment including but not limited to ripping, amending, fertilizing and fine grading.

1.02 RELATED WORK

A. Section 32 92 19 SEEDING.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General

1. Herbicide: Deliver herbicide to Site in original unopened containers bearing manufacturer's name, trade name, and trademark.
2. Material will be inspected upon arrival at Project Site. Immediately remove unacceptable material from Project Site.

PART 2 PRODUCTS

2.01 ORGANIC AMENDMENT

A. The Contractor shall use one of the organic amendments listed below:

1. Well aged, ground, dairy cattle manure; thoroughly composted consisting of not less than 60 percent organic matter, pH value not greater than 7.5 and soluble salts not greater than 5-mmhos/cm tested on a saturated paste. Obtain independent soils test of manure to verify content.
2. Premium Compost: Finely shredded and free of plants, roots, sticks, stones, lumps, and noxious weeds.

B. The Contractor shall submit a sample to the Engineer for approval 10 days before delivery to the Site.

C. The Contractor shall have soils used in the fine grading of seeded areas analyzed by a qualified lab to determine the appropriate quantity of amendment and fertilizer.

2.02 FERTILIZER

A. Before seeding operations, areas shall be fertilized with a commercial brand granular non-burning fertilizer composed of not less than 50 percent slow release organic material of high quality with a compound equivalent to 10-10-10 (NPK).

B. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis, and name of manufacturer.

C. Each batch of fertilizer shall be delivered with the manufacturer's statement of analysis. The statement of analysis shall be submitted to and approved by the Engineer prior to application.

D. The Contractor shall have soils used in the fine grading of seeded areas analyzed by a qualified lab to determine the appropriate quantity of fertilizer and amendment.

PART 3 EXECUTION

3.01 INSPECTION

A. Unsatisfactory Conditions: Report in writing to the Engineer.

B. Acceptance: Beginning of installation means acceptance of existing conditions by the Contractor.

3.02 SOIL PREPARATION

A. Existing Utilities: Protect from damage any sewer, water, gas, electric, irrigation or other pipelines or conduits during work.

B. General: Do not perform work when existing Site conditions will not provide satisfactory results. Obtain subgrade inspection and approval from Engineer prior to commencing with this section of work.

C. Unsuitable Material: Grub and remove unsuitable woody and rock materials present in surface grade.

D. Runoff: Take measures and furnish equipment and labor necessary to control flow, drainage, and accumulation of water to run off grounds as is intended by grades.

3.03 INSTALLATION

A. Ripping/Weed Control

1. Spot treat with herbicide such as Roundup or approved equal where noxious weed beds have been established except in wetland or near wetland areas where Rodeo or approved equal shall be used. Herbicide to be applied by qualified contractors at the rate recommended by the manufacturer. Precautions shall be taken to avoid drifting of spray onto other properties, wetland areas or open bodies of water and shall not be done in breezy conditions. Harmed plant material not designated for herbicide application shall be replaced by the contractor at no expense to the Owner. A low pressure should be used to spray herbicide as to create large droplets and prevent drifting. Spot treating with herbicides will also likely be required during grass establishment.
2. Rip or scarify subgrade to minimum 6" depth with agricultural subsoiler in areas to receive seed.

B. Fine Grading

1. Perform fine grading for areas prior to seeding.
2. For ground surface areas surrounding fences and structures, maintain positive drainage away from structures.
3. Live noxious weeds or parts thereof shall not be present in the surface grade prior to plant or seed installation.
4. Compaction of Surface Grade prior to Landscaping Installation: Firm, but not hard (80% of standard Proctor density within 2% of optimum moisture).
5. Obtain Engineer’s acceptance of prepared areas prior to proceeding.
6. Apply fertilizer at a rate of 1/4 ton per acre or as directed by the Engineer based on soil test recommendations. Disc or harrow fertilizer 3” into soil prior to seeding.

3.04 CLEANING

A. Remove debris and excess materials from Site.

3.05 PROTECTION

A. Protect prepared areas from erosion, traffic, and disrepair. Reestablish grades and reapply topsoil to settled, eroded and disturbed areas to specified tolerances and requirements until final acceptance. Maintenance shall begin immediately after Site preparation of each area.

END OF SECTION

SECTION 32 92 13
HYDRAULIC MULCHING

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work covered by this section consists of furnishing all labor, materials, equipment, supplies, supervision, and tools and performing all work necessary to apply Hydraulic Mulch to the areas to be seeded.

1.02 RELATED WORK

A. Section 32 92 19: Hydraulic Seeding

PART 2 PRODUCTS

2.01 MULCH

A. Hydraulic mulch shall be EcoFlex High Performance Flexible Growth Medium meeting the following requirements or approved equal:

Properties	Requirement	Test Method
Organic Fibers	71% Min.	ASTM D 2974
Cross Linked Tackifiers	10%±-2% Min	
Reinforced interlocking Fibers	10%±-1% Min	
Biodegradability	100%	ASTM D 5338
Ground Cover @ Application Rate	90% Min	
Functional Longevity	12 Months Min	
Cure Time	< 8 Hours	
Application		
Application Rate	2800 lbs./ Acre	

1. Virgin wood cellulose fiber: May not contain any substance or fiber that may inhibit germination or growth of grass seed.
2. Dye to appropriate color to allow proper metering of application.
3. Fibers must have ability to become evenly dispersed and suspended when agitated in water.
4. When sprayed uniformly on surface of soil, fibers shall form blotter-like ground cover that readily absorbs water, and allows infiltration to underlying soil.
5. Weight specifications shall refer only to air dry weight of fibers with a standard moisture content of 10 percent.
6. Mulch material shall be supplied in containing not weighing over 100 pounds and showing air dry weight of fibers.
7. Organic tackifier may be supplied with Hydraulic Mulch fibers or be added at a later time.

PART 3 EXECUTION

3.01 GENERAL

A. All seeded areas to be hydro-mulched. Mulch placement shall not extend beyond seeded area by more than 5 feet.
B. Verify that grades are as indicated and specified.
C. Report any unsatisfactory conditions to the Owner in writing.
D. Beginning of installation means acceptance of existing conditions by this Contractor.

3.02 PREPARATION

A. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil, and accumulation of wind deposited materials at the site throughout the duration of work.

3.03 HYDRAULIC MULCHING

A. Timing: Mulch designated area immediately following seed placement. Mulch shall be placed within 48 hours following seeding. If seeding is completed in phases, mulch shall be placed following each phase.
B. Hydraulic Mulching

1. Mixing: Add cellulose fiber mulch after proportionate quantities of water and other accepted materials have been placed in slurry tank. Mix ingredients to form homogenous slurry. Water shall be free from oil, acid, alkali, salt, and other substances harmful to the growth of grass. The water source shall be subject to approval, prior to use.
2. Spray mulch blanket shall strictly comply with the manufacturers mixing recommendations and installation instructions.
3. Apply spay on mulch blanket in a uniform application using a 50-degree fan tip nozzle.
4. Apply mulch in 2 directions (from top of slope down and from toe of the slope up, as well as, be applied at a minimum of two layers)
5. Apply spray on mulch blanket to achieve 100% soil surface coverage at an average and uniform depth of 3 mm.
6. Dilution rate of 100 gallons of water/50-pound bale. Flexterra HP flex growth medium (FGM) or EcoFlex HP FGM at dilution rate of 125 gallons/50-pound bale may be substituted with prior approval.
7. Spraying: Apply slurry mulch uniformly over designated seed areas using control of mulch as metering agent. Apply hydraulic mulch at rate of 2,800 pounds per acre plus organic tackifier at a rate of 150 pounds per acre. Upon completion of the application, soil shall not be visible through the hydraulic mulch.
8. Do not apply in presence of free surface water resulting from rain, melting snow or irrigation.

C. Hydraulic Mulching Equipment
1. Pump shall be capable of operation at 100 gallons per minute at 100 psi, unless otherwise directed.
2. Nozzle shall be adaptable to hydraulic mulching requirements.
3. Storage tanks shall have means of calculating volume used or remaining in tank.

D. Quality Control
1. The Contractor shall obtain approval of hydraulic mulch area preparation from the Owner prior to application. Operators of hydraulic mulching equipment shall be thoroughly experienced in this type of application. Apply the specific slurry mix in a motion to form a uniform mat at the specified rate. Operators shall keep the hydraulic mulch within the areas designated and keep from contact with other plant material. Immediately after application, thoroughly wash off any plant material, planting areas or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations. If in the opinion of the Engineer, unplanted skips and areas are noted after hydraulic mulching, the Contractor shall be required to seed the unplanted areas with the grasses that were to have been planted at no additional cost to Owner.
2. Repair or re-mulch areas improperly mulched or damaged during construction.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work in this Section includes but is not limited to the following items to furnish and install in the areas as indicated on the plans:

1. Mulch and Seed
2. Maintenance during the warranty period

1.02 RELATED WORK

A. Section 32 91 13 – Soil Preparation

B. Section 32 92 13 – Hydraulic Mulching

1.03 QUALITY ASSURANCE

A. Source Quality Control:

1. Seed Materials: Subject to inspection and acceptance. Engineer reserves right to reject at any time or place prior to acceptance, any work and seed which in their opinion failed to meet these specification requirements.
2. Inspection: Primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance. Seed may be inspected where produced, but inspection at growth site shall not preclude right of rejection.
3. Inspection will be made periodically during seeding, at completion, and at end of warranty period, by Engineer.

C. Testing Requirements: Seed and seed label shall conform to current State and Federal regulations and will be subject to testing provisions of Association of Official Seed Analysis.

D. Coordination: Begin work only upon completion of soil preparation.

1.04 REFERENCES

A. Reference Standards: Comply with U.S. Department of Agriculture Rules and Regulations under Federal Seed Act and equal in quality to standard for Certified Seed.

1.05 SUBMITTALS

A. Certificates: State, Federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Engineer prior to acceptance of material.

B. Seed Tags: Submit to Engineer prior to seeding.

C. Seeding Schedule: Seeding shall occur when weather and soil conditions are favorable or as authorized by Engineer. The Contractor shall supply the Engineer with a seeding schedule establishing the dates for the commencement and completion of each type of work.

1.06 DELIVER, STORAGE AND HANDLING

A. Delivery and Storage of Products

1. Seed: Deliver in sealed standard containers, stating correct name and composition on outside of container.
   a. Seed damaged in transit or storage will not be accepted.
   b. Protect seed containers from water and exposure prior to use.
2. Material will be inspected upon arrival at project site.
3. Immediately remove unacceptable material from project site.

PART 2 MATERIALS

2.01 MATERIALS

A. Seed: The seed shall have a minimum germination and a maximum purity of 85%. Seed shall not exceed 1% weed content. All seed should be local genotypes where possible. If seed available on the market does not meet the minimum purity or germination percentages specified, the contractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of pure live seed in pounds. The formula used for determining the quantity of pure live seed (PLS) shall be:

1. Pounds of Seed x (Purity x Germination) = Pounds Pure Live Seed
2. Any seed substitutions shall be approved by the Engineer.

B. Use the following seed mixture of pure live seed at rate shown. Broadcast seeding is not allowed.

Common Name	% of mix	PLS/Acre
Western Wheatgrass	35	14
Side Oats Grama	20	8
Blue Grama - Northern Native	20	8
Covar Sheep Fescue	15	6
Little Bluestem – Native	10	4
Totals	**100**	**40**

Rates are for Hydraulic Seeding. If using a seed drill, reduce rates by half.

PLS = Pure Live Seed

VNS = Variety Not Stated

C. Hydro-mulch material per section 32 92 13.

PART 3 EXECUTION

3.01 INSPECTION

A. Layout of seeding areas: Any area disturbed by construction activity. Verify layout with Engineer prior to starting seeding operations.

B. Grades: Inspect to verify that fine grading provides positive drainage away from all structures.

C. Weather: No seeding shall take place when the site is wet. Any areas that have been prepared and approved for seeding are subject to re-inspection and acceptance by the Engineer. The contractor shall notify the Engineer of his intent to seed following delays because of weather, allowing the Engineer sufficient time to inspect and approve the prepared areas. Any areas that in the opinion of the Engineer require re-grading or additional soil preparation because of wind and water erosion, or require additional tillage because of compaction, shall be done at the Contractor's expense.

D. Seeding shall not be undertaken until adjacent site improvements are substantially complete. No trucking or moving of equipment or materials will be permitted upon completed seeded areas.

3.02 PREPARATION

A. Preparation

1. Seeded Areas: Free of debris and rocks which may hinder tilling, seeding, finish grading or subsequent operations. Dispose of accumulated debris.
2. Perform fine grading required to maintain drainage into swales, away from structures, etc. as required to provide smooth well-contoured surface prior to proceeding.

3. Prepare ground per Section 32 91 13 – Soil Preparation.
4. Seeding shall not occur during windy weather, or when ground is frozen or otherwise untillable, such as in extremely wet or dry soil conditions. Seeding shall occur within the appropriate time frame, from October 1st to March 30th. Seeding at any other time must be approved by the Engineer.

B. Drainage: Be responsible to assure finished areas of seed are such that positive drainage of storm and irrigation waters will occur and ponding of water will be prevented. Tolerance: ±2".

3.03 SEEDING

A. General: Hydroseeding will not be accepted. Seeding must be accomplished by drill or broadcast methods. Drill native grasses at the rate provided in the seed mix. If seeding by broadcast, double the seeding rate shall be required.

B. Drill mechanically (with engineering approval) with a Native Grass Drill with depth bands on slopes less than 3:1. Drill in manner that after surface is raked and rolled seed shall have 1/4" to 1/2" of cover. Seed shall be uniformly sown, one-half the seed in one direction and one half the seed at right angles to the first sowing, where possible. Where too narrow to accomplish two directional sowing, seed one half the seed in first sowing in one direction and one half the seed, in the same direction, with drill offset mid-row of first sowing. Seeding will not be permitted when wind velocity is such as to prevent uniform seed distribution. No application shall be undertaken during inclement or the forecast of inclement weather. No application shall take place in the presence of free surface water.

B. If seeding, raking in, and rolling operations are not performed in one mechanical operation, the raking and rolling operations shall be performed separately and immediately after seeding operations.

C. Broadcast seeding is not allowed

3.04 MULCHING

A. Mulching

1. Hydraulic mulch – Hydraulic mulch per 32 92 13 in separate operation after seeding.

3.05 MAINTENANCE

A. Mowing: Mow once the weeds grow above the desired seedlings at an average height of 8" (approximately 20 to 30 days after the seeding date). On the first mowing, cut the plants back to 5". Subsequent mowings should keep the plants to a height of 6" to 8" until mid-October. The height of the mower should be set at 2" to 8" above the desired seedlings. Leave the grass clippings for mulch. Weeds should not be allowed to set seed. Grass to be cut in dry condition and policed prior to mowing for trash and debris. Mow in alternate patterns where feasible.

1. Mowing of dryland grass areas shall occur at least 3 times in the first full growing season depending on conditions. Mowing shall occur at least twice the second full growing season if the second growing season is in the warranty period.

B. Reseeding: Reseed as needed and control weeds until a successful stand of grass is established under the warranty obligations.

3.06 PROTECTION

A. Provide and install barriers as directed by Owner to protect seeded areas from damage from pedestrian and vehicular traffic. Contractor shall not be held responsible for malicious destruction of seeding caused by others. No vehicular or pedestrian traffic shall be allowed on seed bed once mulched. Contractor to provide signage if needed.

3.07 CLEAN UP

A. After completion, remove objects or debris which may interfere with maintenance operation.

3.08 COMPLETION SERVICES

A. Operating and Maintenance Data: Include directions for irrigation, mowing, fertilizing and spraying as required for continuance and proper maintenance through the end of the construction

warranty period.

3.09 LANDSCAPE MAINTENANCE, INSPECTION, AND ACCEPTANCE

A. Seeding completed will be continuously maintained by the Contractor until Final Acceptance of the Project.

B. Seeding shall be inspected:

1. Upon completion of seedbed preparation.
2. Upon installation of Seeding and mulching.
3. At germination of Seeding.
4. At conditional acceptance of Seeding.
5. At Final Acceptance of Seeding.

C. Information inspection of the Work by Engineer or Owner may occur at any time during execution of the Work.

D. Prior to installation of Seeding, the Contractor is responsible for keeping the areas to be seeded areas completely free of weeds and debris. Weed control will be accomplished by a combination of mowing and chemical control. Mow the site at any point where weed specifies start to set flowers and before seed heads develop, or when weeds reach 12” in height. Mowing height shall be no lower than 4” above grade. Apply herbicides for spot control as needed once danger to seeded grass has past. Contractor will at all times possess a valid license applicable to the use of all chemicals used.

E. Prior to germination acceptance of Seed, the Contractor is responsible for keeping the seeded areas free of weeds and debris. Weed control will be accomplished by a combination of mowing and chemical application. Chemical control shall be utilized only once hazard to seeded areas has past. Mow the site at any point where weed species start to set flowers and before seed heads develop, or when weeds reach 12” in height. Mowing height shall be no lower than 4” above grade. Apply herbicides for spot control as needed once danger to seeded areas has past. Contractor will at all times possess a valid license applicable to the use of all chemicals used.

F. Germination acceptance of Seed shall occur when grass is clearly visible throughout the project area and shall be based on:

1. Clear visual evidence that all drill seed rows have germinated.
2. Dominant vegetation in the seeded area appears to be specified grass and there are no continuous bare spots greater than 6 square feet.
3. Noxious weeds are absent from the area.

G. Any areas of Seed deemed by the Engineer to have failed to germinate, be thin, weak or dead shall be reseeded according to these specifications and germinated prior to review for germination acceptance.

H. Conditional acceptance of Seed shall occur 60 days after germination acceptance and shall be based on:

1. Self-sustaining and healthy stand of grass which is evenly distributed throughout the seeded area.
2. Dominant vegetation in the seeded area are among the specified grasses.
3. Required coverage for all seed mixes shall be 6 acceptable/established seedlings per square foot with no continuous bare spots greater than 4 square feet.
4. A weed management program has been in-place and has been effective; no weeds are over 4” in height and no weed seed heads have been allowed to mature.
5. Noxious weeds are absent from the area.

I. Areas deemed by the Engineer to fail to meet the conditional acceptance shall be reseeded by the Contractor, at no cost to the Owner, according to these Specifications. Areas with rolling or gully development shall be repaired, reseeded with the seed specified herein. Apply mulch at 1-

ton per acre of straw overlay Jute netting installed as indicated.

J. Final acceptance of Seed shall occur when that area has completed a minimum of one complete growing season, defined as from May 1 through October 1 following germination acceptance.

K. Final acceptance for areas seeded prior to the final growing season during scheduled construction shall be based on:

   1. A uniform and even distribution of healthy plants of the specified grasses species with grass being the dominant plant in the area.
   2. Absence of noxious weeds.
   3. Required coverage for all seed mixes shall be 6 established grass plants (seedlings) per square foot with no continuous bare spots greater than 4 square feet.

L. Areas deemed by the Engineer to fail to meet the conditions for final acceptance shall be maintained and repaired of reseeded by the Contractor, at no cost to the Owner, according to these Specifications.

M. Maintenance of all seed areas is the responsibility of the Contractor. The conclusion of responsibility for installation and maintenance of seeded areas will occur when all areas that have been seeded for a full growing season have been finally accepted or when the warranty has expired, whichever comes last.

N. The Contractor shall notify the Engineer to review the work. If all seeding installation and maintenance to date is acceptable, the Engineer shall record that date and issue a “Final Acceptance” certificate and the Contractor’s responsibility will be concluded.

O. Temporary Irrigation System may be pumped from effluent tower to water seeded areas

   1. Supplemental irrigation will be required during the maintenance and warranty period.
   2. Submit plan for approval for irrigation equipment and rates that will be used during the germination period

P. Guarantee: All plant material and work accomplished under this section shall be guaranteed to provide a stand of vegetation acceptable to the Engineer at the end of the warranty period.

Q. In addition to the specified site restoration activities, the Contractor shall be responsible for general landscape management of the entire project footprint from mobilization to end of the one-year warranty period. For costing purposes, the Contractor shall, in addition to what is already specified, assume that he will need to mow all project surfaces (including cell slopes and bottoms) four times per year in an effort to manage noxious weeds. The intent of this requirement is to provide weed control by preventing annual weeds from producing seed. Mowing shall be scheduled to prevent weeds from setting seed and allow permanent grass to set seed. Mowing shall be coordinated with Owner.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 33 – UTILITIES

SECTION 33 05 13
PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to install precast concrete manholes, frames and covers, and appurtenances as shown on the Drawings, as specified herein. Engineer will be the sole judge as to compliance interpretation of the drawings and specifications.

1.02 RELATED WORK

A. Dam Embankment Soils Section 31 23 23.

1.03 SUBMITIALS

A. Submit to the Engineer, in accordance with Section 01 33 00, shop drawings, product data, materials and details of construction, reinforcing and joints. Submittals shall include at least the following:
   1. Base sections, riser sections, flat slab tops, grade rings with notarized certificate indicating compliance with ASTM C478.
   2. Pipe connections to manholes and catch basins.
   3. Manhole frame and cover and catch basin frame and grate with notarized certificate indicating compliance with the specified ASTM standard and Class designation.
   4. Method of repair for minor damage to precast concrete sections.

B. Design Data
   1. Precast concrete structures:
      a. Sectional plans and elevations showing dimensions and reinforcing steel placement.
      b. Structural calculations including assumptions.
      c. Concrete design mix.

C. Test Reports
   1. Precast concrete structures:
      a. Six copies of concrete test cylinder reports from an approved testing laboratory certifying conformance with this Section.
   2. Results of leakage tests.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)
   1. ASTM A48- Standard Specification for Gray Iron Castings.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.
   3. ASTM C150- Standard Specification for Portland Cement
   4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
   5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
   6. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures
   7. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealant.
   8. ASTM D4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials

B. American Concrete Institute (ACI)
   1. ACI318 - Building Code Requirements for Structural Concrete
   2. ACI350 - Code Requirements for Environmental Engineering Concrete Structures

C. American Association of State Highway and Transportation Officials (AASHTO)
   1. Standard Specifications for Highway Bridges

D. Occupational Safety and Health Administration (OSHA)

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All material shall be new and unused.
B. Materials' quality, manufacturing process and finished sections are subject to inspection and approval by Engineer or other Owner representative. Inspection may be made at place of manufacture, at work site following delivery, or both.
C. Materials will be examined for compliance with ASTM standards, this Section and approved manufacturer's drawings. Additional inspection criteria shall include: appearance, dimensions, blisters, cracks, and soundness.
D. Materials shall be rejected for failure to meet any requirements specified herein. Rejection may occur at place of manufacture, at work site, or following installation. Sewer manhole precast concrete sections will be manufactured using the "wet method" of fabrication. Mark for identification rejected materials and remove from work site immediately. Rejected materials shall be replaced at no cost to Owner.
E. Repair minor damage to precast concrete sections by approved method, if repair is authorized by Engineer. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Reference to a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
B. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and manufacturer's service.
C. Provide lifting lugs or holes in each precast section for proper handling.
D. Cement shall conform to ASTM C150, Type II cement or equal.
E. Precast concrete sections shall be properly cured prior to shipping. Precast concrete sections shall not be shipped before concrete has attained 3,000 psi compressive strength.
F. Mark date of manufacture, name, and trademark of manufacturer on the inside of each precast section.

2.02 PRECAST CONCRETE MANHOLE SECTIONS

A. Precast concrete base sections, riser sections, transition top sections, flat slab tops, and grade rings shall conform to ASTM C478 and meet the following requirements:
   1. Design precast concrete base and flat slab top for their own weight, weight of soil at 130 pcf, and a live load equal to AASHTO H-20 truck loading applied at finished grade.
   2. Bottom slab thickness shall be no less than the riser wall thickness.
   3. Construct precast concrete bases.
   4. Base, risers, and transition top sections shall have tongue and groove joints.

2.03 MANHOLE INVERTS

A. Drain manholes shall have cast-in-place concrete inverts and shelves conforming to one-half the diameter of the largest pipe.
B. At changes in direction, the cast-in-place concrete inverts shall be laid out in curves of the longest radius possible, tangent to the centerline of the drain pipes. Shelves shall slope towards the invert channels at 1/2-in per foot.

2.04 MANHOLE FRAME AND COVER

A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface to exclude surface water and so that the cover shall be level with the top of the ring.
B. Manhole rings and covers shall conform to Table 1 below. Covers will have no more than one lifting slot, which must extend beyond the lip of the ring.

TABLE 1

RING AND COVERS

SIZE OF RING AND COVER	SYSTEM	PIPE SIZE
24-in and 30-in	Raw Water	14-in and 18-in

2.05 MANHOLE STEPS

A. Manhole steps shall be aluminum cast into the manhole wall when the manhole section is cast. They may also be copolymer polypropylene plastic drilled and installed after the manhole section is in place. Block outs are not allowed.
B. Steps shall be by Alcoa No. 126538, as manufactured by the Aluminum Company of America, or PS2-PF as manufactured by M.A. Industries, Inc., or Owner approved equal.
C. Manhole steps shall be no more than 24-in and no less than 18-ln from the top of the manhole ring and 24-in from the bench of the manhole. Intermediate steps shall be a minimum of 12-in to a maximum of 16-in apart.
D. Aluminum steps shall have a bituminous coating on all areas in contact with concrete.
E. 20-in of clearance shall be maintained between the top step and the opposing wall of the manhole barrel section.

2.06 JOINTING PRECAST MANHOLE SECTIONS

A. Joints shall be sealed with O-Ring gaskets conforming to ASTM C443.
B. With approval of the engineer, precast manhole may be sealed with a flexible joint sealing compound. Preformed flexible joint sealant shall conform to Federal Specifications SS-S-210A. Sealing compounds will remain quite pliable to -20 degrees Fahrenheit and will not become excessively pliable at +120 degrees Fahrenheit.
C. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

2.07 PIPE CONNECTIONS TO MANHOLES

A. Connect pipe to manholes in the following ways:
   1. Grout around pipe in formed opening with non-shrink grout.

2.08 DAMPPROOFING (NOT REQUIRED)

A. Two coats of bituminous waterproofing material applied to the exterior surfaces of sanitary sewer manholes by brush or spray and in accordance with the manufacturer's recommendations.

2.09 PROTECTIVE COATING (NOT REQUIRED)

A. A protective coating system shall be applied to the interior surfaces of sanitary sewer manholes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manhole Installation.
   1. Manholes shall be constructed in conformity with ASTM C891 except as specified herein and to the dimensions shown on the Drawings. Protect all work against flooding and floatation.
   2. Place manhole and catch basin base on a bed of 12-in crushed stone as shown on the Drawings. Set manhole and catch basin base grade so that a maximum grade adjustment of 12-in is required to bring the manhole frame and cover to final grade.
   3. Manhole rings shall be held in place by being set on mortar. Mortar will be placed over the ring from the edge of the support structure to 1-in from the top edge of the ring for manholes that are not located within a pavement section. Concrete manhole rings will be used to adjust the final rim elevation to no further than 24-in to the first step.

4. Set precast concrete barrel sections plumb with a 1/4-in maximum out of plumb tolerance allowed. Seal joints of precast barrel sections with either a rubber 0- ring set in a recess or preformed flexible joint sealant in sufficient quantity to fill 75 percent of the joint cavity. Fill the outside and inside joint with non-shrink grout and finished flush with the adjoining surfaces. Caulk the inside of any leaking barrel section joint with lead wool or non-shrink grout to the satisfaction of the Engineer.
5. Allow joints to set for 14 hours before backfilling unless the Engineer specifically approves a shorter period.
6. Plug holes in the concrete barrel sections required for handling with a non-shrink grout or non-shrink grout in combination with concrete plugs. Finish flush on the inside.
7. Backfill carefully and evenly around manhole sections with native materials from excavation.

B. Manhole Pipe Connections
1. Construct manhole and catch basin pipe connections, including pipe stubs, as specified herein. Close or seal pipe stubs for future connections with a gasketed watertight plug.

C. Dampproofing (Not Required)
1. Paint outer surfaces of precast sanitary sewer manholes with two coats of bituminous dampproofing at the rate of 30- to 60-sq-ft/gallon, in accordance with manufacturer's instructions.

3.02 CLEANING

A. Thoroughly clean all new manholes of all silt, debris and foreign matter of any kind, prior to final inspections.

END OF SECTION

SECTION 33 11 00

PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

This section covers the furnishing and installation of ductile iron and PVC pipe and fittings.

1.02 RELATED WORK

A. 05 50 00 – Miscellaneous Metalwork

B. 31 23 23.15 – Trenching, Backfilling, and Compaction (Pipelines)

C. 33 12 00 – Pipe Leakage Testing

1.03 SUBMITTALS

See Section 01 33 00 – Contractor Submittals

PART 2 – MATERIALS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. Specifications

The pipe shall be designed, manufactured, tested, inspected and marked in accordance with the provisions of this Specification and AWWA Standard C-151, "American Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids", except as herein modified.

B. Dimensions

Nominal pipe lengths shall be 18’ or 20’, with shorter lengths provided as required by drawings, alignment and profile. Permissible variations in length, diameter, weight, wall thickness and straightness shall comply with the allowable tolerances specified in the applicable AWWA Standards. The minimum finished inside diameter of the pipe, after lining is placed, shall be as set forth in the applicable AWWA Standards.

C. Ductile Iron Pipe Diameter and Pressure Class

Pipe Size (inch)	Pressure Class
3 through 12	350
14 through 20	250
24	200
30 through 64	150

D. Joint Design and Fabrication

All joints shall be mechanically restrained using one of the following joint types: American Cast Iron Pipe Company's "LOKFAST" joint, U.S. Pipe and Foundry Company's "T.R. Flex" joint, Clow Corporation's "Super-Lock" joint, EBBA Iron's "Megalug," Griffin Pipe Products Company's "Snap-Lok" joint, or approved equal. The mechanical joint restraint shall be designed to resist thrusts resulting from internal pressure acting at bulkheads, bends, valves and extending over the distances as shown on the drawings. The joint restraint shall be designed for a minimum working pressure of 250 psi. Although thrust blocks are also required, joint restraint is to be designed without consideration given to any support derived from these blocks. Note: The manufacturer shall furnish all joint materials including rubber gasket and joint lubricant. Harness rods are to be utilized across closure assemblies in tied sections of the line. Rods are to be connected to the pipe by the use of mega lugs attached behind bell and spigot joints.

Following installation, the harness rods shall be wrapped with a layer of protective tape conforming to AWWA C-209. Design calculations for the harness rods, are to be submitted to the engineer for approval.

E. Specials and Fittings

Unless otherwise shown on the plans, all specials and fittings shall conform to the dimensions and requirements of AWWA Standard C-110. Fittings shall be designed for 150 psi working pressure and shall have the same lining and coating as the abutting pipe. Specials and fittings that cannot be mechanically lined and coated shall be lined and coated by hand, using the same materials as are used for the pipe and in accordance with the applicable AWWA Standards. Coatings and linings applied in this manner shall provide protection equal to that specified for the pipe. Areas of lining and coating that have been damaged shall be repaired by hand application in accordance with applicable AWWA Standards. Moderate deflections and long radius curves may be made by means of bends or fittings, by deflecting straight pipe, by using short lengths of pipe, or by a combination of any of these methods.

F. Flanges

All flanges shall conform to ANSI B16.5 for working pressure of 150 psi. Blind flanges shall be designed in accordance with ASME Unfired Pressure Vessel Code, Section VIII. The design pressure for the blind flanges shall be 150 psi. Flanges shall be designed on the basis of using 1/8-inch ring type compressed gaskets. Bolt holes in all flanges shall straddle field vertical centerline. Insulated flanges shall have bolt holes 3/16” diameter greater than the bolt diameter.

G. Gaskets for Flanges

Gaskets shall be 1/8” ring type Garlock No. 3200 compressed non-asbestos sheet packing or approved equal.

H. Cement-Mortar Lining

Interior surfaces of all pipe, fittings and specials shall be lined in the shop with cement-mortar in accordance with AWWA Standard C-104. The cement shall meet the requirements of “Standard Specifications for Type II Portland Cement,” ASTM Designation C150. The sand shall conform to that prescribed in AWWA C-104. The cement mortar shall contain not less than one part of cement to two parts of dry sand. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty, the unsatisfactory pipe shall be replaced.

I. Exterior Coating

The outside coating shall be a bituminous coating of either coal-tar or asphalt base approximately 1 (one) mil thick. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe.

J. Polyethylene Encasement

All ductile iron pipe and fittings shall be polyethylene encased with the following exceptions:

1. Concrete encased outlet pipe (return flow pipe casing & 24”)
2. Sand bedded outlet pipe (return flow pipe casing & 24”)

The polyethylene encasement material shall be manufactured in accordance with AWWA Standard C-105, “Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids” with the following additional requirements or exceptions.

1. Material - The raw material used to manufacture polyethylene film shall be Type I, Class A, Grade E-1 in accordance with ASTM Standard Designation D1248.

2. Physicals - The polyethylene film shall meet the following test requirements:

Tensile Strength	1200 psi minimum
Elongation	300% minimum
Dielectric Strength	800 V/mil thickness minimum
Thickness	0.008" (8 mils) minimum with minus tolerance not exceeding 10% of nominal Melt Index 0.4 max

L. Material Submittals

The following submittals shall be required for review and acceptance by the Engineer:

- Restrained Joint Detail
- Support/skid Detail for Carrier Pipe in Casing
- Pipe laying schedule
- Pipe support and restraint details before and during concrete encasement

2.02 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE – DRAIN PIPE

A. Specifications

The pipe shall be designed, manufactured, tested, inspected and marked in accordance with the provisions of this Specification and ASTM Standard D2241, "Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)," except as herein modified. Fittings shall be PVC conforming to the requirements of this specification, or shall be steel conforming to the requirements of Paragraphs 2.02 and 3.02 of this Section.

B. Dimensions

Nominal pipe lengths shall be 20', with shorter lengths provided as required by drawings, alignment and grade. Permissible variations in length, diameter, weight, wall thickness and straightness shall comply with the allowable tolerances specified in the applicable AWWA standards.

C. Thickness

The minimum wall thickness shall be Schedule 80.

D. Joint Type

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint. The joint shall comply with the requirements of AWWA C-905 when tested to 80 psi. Solvent-cement joints are strictly prohibited.

E. Materials Submittals

The following submittals will be required for review and acceptance by the Engineer:

- Standard joint detail
- Restrained joint detail
- Slot size and spacing
- Pipe laying schedule

F. Slotted Pipe

Slotted pipe for the drain shall have four rows of slots 0.025 inches wide, 1.2" in length spaced at 0.5" for 4" diameter pipe.

2.03 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE – OUTLET WORKS PIPE (NOT USED)

A. Specifications

C905 PVC pipe shall be designed, manufactured, tested, inspected and marked in accordance with the provisions of this Specification and ASTM Standard

D1784,"Standard Specification for Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVP) compounds" for water distribution pressure Class 150 psi DR18.

B. Dimensions

Nominal pipe lengths shall be 20', with shorter lengths provided as required by drawings, alignment and grade. Permissible variations in length, diameter, weight, wall thickness and straightness shall comply with the allowable tolerances specified in the applicable AWWA standards.

C. Thickness

The minimum wall thickness shall be DR18.

D. Joint Type

1. Restrained

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint. The joint shall comply with the requirements of AWWA C-900/950 when tested to 80 psi. All pipe joints shall be mechanically restrained with EBBA Irons "Megalug", Uni-Flange Corporation "Series 900, 1300, 1350" or approved equal meant for use with PVC pipe. Solvent-cement joints are strictly prohibited.

E. Where indicated on the Drawings a minimum 16 gage protected tracer wire shall be installed with the pipe and shall be electrically connected to each valve or valve box.

F. Specials and Fittings

All fittings shall be ductile iron conforming to Section 2.01.

PART 3 – EXECUTION

3.01 DUCTILE IRON PIPE INSTALLATION

A. Handling

Ductile iron pipe and fittings shall be handled at all times by lifting with padded cradles of canvas, leather or other suitable material so as to avoid shock or damage. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer. All pipe handling equipment is to be approved by the Engineer. The use of bare metal cables, chains, or hooks, etc. will not be permitted.

Stockpiled ductile iron pipe shall be supported on wood blocks and/or sand bags placed under the uncoated ends of the pipe. Bags shall be of sufficient size to prevent contact of the pipe coating with the ground or any obstruction. Rolling the pipe on coated surface will not be permitted. Adequate strutting shall be provided if necessary to prevent damage to pipe lining and coating.

B. Subgrade

No blocking of pipe will be permitted. Before the pipe is laid, the subgrade shall be prepared by backfilling with clean uniformly graded sand so as to provide a uniform and continuous bearing and support for the pipe at every point between bell holes, except that it will be permissible to disturb or otherwise damage the subgrade surface over a maximum length of 18" near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle.

C. Joining Mechanical Joint Pipe

Before joining mechanical joint ductile iron fittings to the ductile iron pipe, the outside of the spigot, the inside of the bell and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Normal practice is to lubricate the joint with a soap solution; however, in cold weather the joint may be assembled dry if approved by the Engineer. Extreme care shall be exercised in making the dry joint. The

ductile iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland. The pipe shall be pushed forward until the spigot end fully penetrates the bell. The gasket shall then be pressed into place in the bell evenly around the entire joint. The gland shall be moved along the pipe into position for bolting, the bolts inserted, and the nuts screwed finger tight, then tightened with a torque limiting wrench. The torque for the various sizes of bolts shall be as follows:

Pipe Size (inches)	Bolt Size (inches)	Range of Torque (ft-lbs)
2-3	5/8	60
4-24	3/4	90
30-36	1	120

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. Whenever it is desirable to deflect mechanical joint pipe in order to form a long radius curve, the deflection shall not exceed 80% of the pipe manufacturer's recommendations for maximum deflection.

D. Flanged Joint

Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessary stressing of the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence using torque wrenches at settings recommended by the manufacturer (75 lb. min.). Only compressed non-asbestos sheet gaskets with a rubber compound binder shall be used. Where steel flanges are connected to ductile iron flanges, an insulating connection shall be provided.

E. Polyethylene Wrap

Except for the outlet pipe, ductile iron pipe and fittings shall be polyethylene encased in accordance with AWWA Standard C-105, "Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids," and as detailed on the Contract Drawings.

F. Bonding Ductile Iron Pipe

When indicated on the Contract Drawings, ductile iron pipe joints shall be electrically bonded using 2 #2 Stranded Insulated CP Wires for 30” diameter pipe and 2 #4 Stranded Insulated CP Wires for 24” or less diameter pipe.

G. Cutting and Fitting

The Contractor shall make all pipe cuts required to conform to location, line and grade. All cuts on ductile iron pipe shall be made by the use of pipe cutters or pipe saws. All cuts shall be straight and true.

3.02 POLYVINYL CHLORIDE (PVC) GRAVITY PIPE INSTALLATION

A. General

All PVC pipe shall be installed in accordance with this specification. All pipe shall be handled and installed in accordance with AWWA C-600.

B. Handling

All pipe and fittings shall be handled at all times by lifting with padded cradles of canvas, leather or other suitable material so as to avoid shock or damage. Pipe shall be so handled that the exterior surface, coating and lining will not be damaged. If, however, any part of the exterior surface coating or lining is damaged, the repair or rejection of pipe shall be made by the Contractor at his expense in a manner satisfactory to the Engineer. All pipe handling equipment is to be approved by the Engineer. The use of bare metal

cables, chains, or hooks, etc. will not be permitted. Stockpiled pipe shall be supported on wood blocks and/or sand bags placed under the uncoated ends of the pipe. Bags shall be of sufficient size to prevent contact of the pipe coating with the ground or any obstruction. Rolling the pipe on coated surface will not be permitted. Adequate strutting shall be provided if necessary to prevent damage to pipe lining and coating. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care shall be used in handling PVC pipe during cold weather. Stockpiled PVC pipe stored outside which may be exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.

C. Joining Push-On Joints

Immediately before joining two lengths of pipe, the inside of the bell, and the outside of the spigot end and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The rubber gasket shall be flexed inward and properly inserted in the gasket recess of the bell socket. Caution shall be exercised to ensure the correct type of gasket is used. A thin film of gasket lubricant shall be applied to either the inside face of the gasket or the spigot end of the pipe or both. The spigot end of the pipe shall be placed in the socket with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to assure insertion to the full depth of the joint. The spigot end of field cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Whenever it is desirable to deflect push-on joint pipe in order to form a long radius curve, the deflection shall not exceed 80% of the pipe manufacturer's recommendations for maximum deflection.

D. Cutting and Fitting

The Contractor shall make all pipe cuts required to conform to location, line and grade. All cuts on pipe shall be made by the use of pipe cutters or pipe saws. All cuts shall be straight and true.

E. PVC toe drain pipe shall be inspected after a maximum of 3’ to 5’ of fill has been placed over the pipe and again after remaining fill has been placed.

3.03 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE INSTALLATION W/ DUCTILE IRON FITTINGS (NOT USED)

A. General

All PVC pipe shall be installed in accordance with this specification. All pipe shall be handled and installed in accordance with AWWA C-900.

B. Handling

All pipe and fittings shall be handled at all times by lifting with padded cradles of canvas, leather or other suitable material so as to avoid shock or damage. Pipe shall be so handled that the exterior surface, coating and lining will not be damaged. If, however, any part of the exterior surface coating or lining is damaged, the repair or rejection of pipe shall be made by the Contractor at his expense in a manner satisfactory to the Owner/Engineer. All pipe handling equipment is to be approved by the Owner/Engineer. The use of bare metal cables, chains, or hooks, etc. will not be permitted.

Stockpiled pipe shall be supported on wood blocks and/or sand bags placed under the uncoated ends of the pipe. Bags shall be of sufficient size to prevent contact of the pipe coating with the ground or any obstruction. Rolling the pipe on coated surface will not be permitted. Adequate strutting shall be provided if necessary to prevent damage to pipe lining and coating.

PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care shall be used in handling PVC pipe during cold weather.

Stockpiled PVC pipe stored outside which may be exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.

C. Bedding

No blocking of pipe will be permitted. Before the pipe is laid, the subgrade shall be prepared by backfilling with clean uniformly graded sand so as to provide a uniform and continuous bearing and support for the pipe at every point between bell holes, except that it will be permissible to disturb or otherwise damage the subgrade surface over a maximum length of 18" near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle.

E. Joining Mechanical Joint Pipe

1. Before joining mechanical joint ductile iron fittings to the pipe, the outside of the spigot, the inside of the bell, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter.

2. Normal practice is to lubricate the joint with a soap solution; however, in cold weather the joint may be assembled dry if approved by the Engineer. Extreme care shall be exercised in making the dry joint.

3. The ductile iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.

4. The pipe shall be pushed forward until the spigot end fully penetrates the bell. The gasket shall then be pressed into place in the bell evenly around the entire joint. The gland shall be moved along the pipe into position for bolting, the bolts inserted, and the nuts screwed finger tight, then tightened with a torque limiting wrench. The torque for the various sizes of bolts shall be as follows:

Pipe Size (inches)	Bolt Size (inches)	Range of Torque (ft/pounds)
2 - 3	5/8	60
4 - 24	3/4	90
30 - 36	1	120

5. Nuts spaces 180 degrees apart shall be tightened alternatively in order to produce an equal pressure on all parts of the gland.

6. Whenever it is desirable to deflect mechanical joint pipe in order to form a long radius curve, the deflection shall not exceed 80% of the pipe manufacturer's recommendations for maximum deflection.

F. Cutting and Fitting

The Contractor shall make all pipe cuts required to conform to location, line and grade. All cuts on pipe shall be made by the use of pipe cutters or pipe saws. All cuts shall be straight and true.

G. Concrete Encasement

Concrete encased pipe shall be supported with materials that do not create a cathodic desiccation potential with the concrete encased pipe. The pipe shall be supported as recommended by the manufacturer using concrete blocks, concrete grade beans, etc., or other supports as approved by the Engineer. Metal or steel supports will not be allowed.

The Contractor shall ensure that the pipe to be concrete encased is secure and does not "float" or move during the placement and curing of the concrete.

3.04 GALVANIZED VENT PIPE INSTALLATION (NOT USED)

A. A 6" hot dipped galvanized vent pipe shall be installed in accordance with this

specification and 05 50 00 Miscellaneous Metalwork. It shall be installed vertically encased in concrete as shown on the Drawings.

B. Handling and Storage

The pipe shall be handled by use of wide slings and padded cradles of canvas, nylon or other suitable material designed and constructed to prevent damage to the pipe coating. The use of bare metal cables, chains, hooks or other equipment which might injure the pipe coating will not be permitted. All other pipe handling equipment and methods must be approved by the Engineer. Stockpiled steel pipe shall be supported on sawdust and/or sand bags placed under the uncoated ends of the pipe. Bags shall be of sufficient size to prevent contact of the pipe coating with the ground or any obstruction. Rolling the pipe on coated surface will not be permitted.

C. Concrete Encasement – Outlet Vent Pipe

All welded joints shall be tested prior to concrete placement.

The steel pipe shall be adequately supported to prevent any deflections and provide room for the placement of steel reinforcement and concrete. The Contractor shall make provisions to prevent the pipe from floating or deflecting during placement of concrete. Steel reinforcement shall be kept clear of the pipe.

D. Field Welded Joints

Butt strap and lap joints shall be fillet welded on the exterior with a fully circumferential watertight fillet weld being at least equal in cross-section to the wall thickness of the steel pipe. The weld shall be accomplished by a certified welder having experience with joints of this type. The welder's qualifications shall be subject to the approval of the Engineer. All welds shall conform to AWWA C-206. All welds shall be tested using magnetic particle testing (ANSI/ASW D.1.1).

During welding the coating shall be protected by draping an 18” wide strip of heat resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld splatter. No welding ground shall be made on the coated part of the pipe.

E. Flanged Joint

Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessary stressing of the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence using torque wrenches at settings recommended by the manufacturer (75 lb. min.). Only compressed non-asbestos sheet gaskets with a rubber compound binder shall be used.

F. Field Joints - Lining and Coating

Upon completion of the installation of the welded joints exterior surfaces shall be prepared, primed and painted with liquid epoxy (Tnemec Pota-Pox) per specification Section 09900.

G. Steel Pipe Installation - General

The installation of all steel pipe and fittings shall conform to AWWA Manual M-11, “Steel Pipe - A Guide for Design and Installation.”

H. Pressure Testing

The steel pipe shall be pressure tested as described in these specifications.

3.06 PIPE INSTALLATION - GENERAL

A. Underground Interference

A reasonable attempt has been made to locate and identify the underground interferences to be encountered. However, it shall be the responsibility of the Contractor

to verify the locations shown on the Drawings. It shall also be the responsibility of the Contractor to locate any interference not shown on the Drawings. The Contractor shall exercise care when working in order to protect all underground interference and shall be fully responsible for any and all damage caused by his operations.

B. Pipe Alignment and Grade

In laying pipe, maximum tolerance is permitted to set line within +/-0.3' and grade within +/-0.1'. Fittings, valves and hydrants shall be installed at the specified locations and elevations, unless written permission to deviate is obtained from the Engineer. When laying pipe in curves, the intent is to lay to the alignment. The pipe shall be kept in alignment by deflecting joints, using short lengths or bends. Any changes in alignment and grade must be authorized by the Engineer and shall be accomplished by the installation of additional fittings, or "breaking" of joints.

C. Deviation from Alignment and Grade Occasioned by Other Structures

Whenever obstructions, not shown on the plans, interfere to such an extent that an alteration in the plans is required, the Engineer shall have the authority to determine the best method of correction. He may change the plans and order a deviation from line and grade, or he may instruct the Owner to arrange with the Contractor to arrange with the Owners of the structure for its removal, relocation or reconstruction, as best fits the economic and field conditions.

D. Temporary Bulkhead

Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be watertight and of such design as to prevent children, animals,

or debris from entering the pipe. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

E. Connection of Dissimilar Metals

Insulated couplings shall be used when joining pipes of dissimilar metal either above or below grade.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 11 13.13
DUCTILE IRON PIPE (AWWA C151, MODIFIED)

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall provide ductile iron pipe and appurtenant work, complete in place, in accordance with the Contract Documents.

B. Pipe shall be designed per the working pressures and burial indicated on the Drawings.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards (Other standards may also apply):**

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in for Water
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water
AWWA C153	Ductile-Iron Compact Fittings for Water Service
AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied
AWWA C600	Installation of Ductile-Iron Water Mains and their Appurtenances
AWWA C606	Grooved and Shouldered Joints
ASTM A183	Carbon Steel Track Bolts
ASTM A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Standard Specification for Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C150	Portland Cement
ASTM D1330	Rubber Sheet Gaskets
ANSI B1.1	Unified Inch Screw Threads (UN and UNR thread form)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
MilSpec QQ-P-416F	Plating, Cadmium Electro Deposited

1.3 CONTRACTOR SUBMITTALS

A. Furnish Shop Drawings of pipe and fittings in accordance with Section 01 33 00 - Contractor Submittals, the requirements of the referenced standards and the following supplemental requirements as applicable:

1. Design calculations for all pipe, based on the Contract Drawings and the requirements outlined in AWWA C150.
2. Certified dimensional drawings of all valves, fittings, and appurtenances.
3. For pipe 24-inches in diameter and larger, line layout and marking diagrams which indicate the specific number of each fitting and the location and the direction of each fitting in the completed line. In addition, the line layouts shall include: the pipe station and invert elevation at all changes in grade or horizontal alignment; all elements of curves and bends, both in horizontal and vertical alignment; and the limits of each reach of restrained joints, or of concrete encasement.
4. Rubber gasket joint design and details.
5. Calculations of restrained joint requirements and lengths.
6. Drawings showing the location, design, and details of bulkheads for hydrostatic testing of the pipeline, and details for removal of test bulkheads and rebar of lining.
7. Design details of all cased crossings, including but not limited to, restrained joints, installation, support, casing size, etc.

B. **Certifications:** The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section and as specified in the referenced standards and the following supplemental requirements:

1. Physical and chemical properties.
2. Hydrostatic test reports.
3. Rubber gasket tests and gasket material compliance information. All gaskets used shall be compatible with raw water containing 4.5 ppm of chloramines.
4. All materials and products used shall be domestic manufacture and shall meet all requirements of NSF Standard 61.

C. The Contractor shall be responsible for performing and paying for sampling and testing as necessary for the certifications.

1.4 QUALITY ASSURANCE

A. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

C. The Contractor shall perform said material tests at no additional cost to the Owner. The Engineer shall have the right to witness all testing conducted by the Contractor, provided that the Contractor's schedule is not delayed for the convenience of the Engineer.

D. In addition to those tests specifically required, the Engineer may request additional samples of any material including lining and coating samples for testing by the Owner. The additional samples shall be furnished as a part of the WORK.

E. **Field Testing:** Field Testing shall conform to the requirements of Section 33 12 00 – Piping Leakage Testing.

PART 2 -- PRODUCTS

PIPELINE SCHEDULE

	Material	Size	Pipe Class	Lining	Coating
Pipe In Structures	Ductile Iron	14" and 18"	Pressure Class 250	System 201 - Rich Portland Cement Mortar Lining	Standard Manufacturer's Shop Coat
Buried Pipeline	Ductile Iron	18"	Pressure Class 250	System 201 - Rich Portland Cement Mortar Lining	Polyethylene Encasement System 205

2.1 PIPE GENERAL

A. Mortar-lined and polyethylene-wrapped ductile iron pipe shall conform to AWWA C151, C104, and C105, subject to the supplemental requirements in this Section. The pipe shall be of the diameter and class indicated, shall be provided complete with rubber gaskets, specials, and fittings as required under the Contract Documents.

B. **Markings:** The Contractor shall legibly mark specials 24-inches in diameter and larger in accordance with the laying schedule and marking diagram. Each fitting shall be marked at each end with top field centerline.

C. **Handling and Storage:** The pipe shall be handled as a minimum at the 1/3 points by use of wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might injure the pipe coating/exterior will not be permitted. Stockpiled pipe shall be supported to prevent accidental rolling. All other pipe handling equipment and methods shall be acceptable to the Engineer.

D. **Laying Lengths:** Maximum pipe laying lengths shall be 20 ft, with shorter lengths provided as required by Contract Drawings.

E. **Finish:** The pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing, and roughness.

F. **Bonding and Electrical Conductivity:** All pipe joints shall be prepared for bonding for electrical conductivity in accordance with the details indicated. The Contractor shall furnish all materials required for joint bonding and electrolysis test station installations.

G. **Closures and Correction Pieces:** Closures and correction pieces shall be provided as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing on the Drawings. The locations of correction pieces and closure assemblies are shown on the Drawings. Any change in location or number of said items shall only be as accepted by the Engineer.

2.2 PIPE DESIGN CRITERIA

A. **General:** Ductile iron pipe shall be designed in accordance with the requirements of AWWA C150 as applicable and as modified in this Section.

B. **Pipe Wall Thickness for Internal Pressure:** The pipe shall be designed with a net thickness to withstand the design pressure in accordance with the hoop stress formula.

C. **Pipe Wall Thickness for External Load:** The pipe shall also be designed with a net thickness to withstand external loads using AWWA C150 with the appropriate bending moment and deflection coefficients for Laying Condition Type 4.

D. **Minimum Pipe Wall Thickness:** In addition to the requirements of this Section, the minimum wall thickness shall be in accordance with Table 5, AWWA C150.

2.3 MATERIALS

A. **Ductile Iron Pipe:** Pipe materials shall conform to the requirements of AWWA C151.

B. **Cement:** Cement for mortar lining shall conform to the requirements of AWWA C104; provided that cement for mortar lining shall be Type II or V. Cement shall not originate from kilns which burn metal-rich hazardous waste fuel, nor shall a fly ash or pozzolan be used as a cement replacement.

C. **Polyethylene Sleeve:** Material for the polyethylene sleeve shall conform to the requirements of AWWA C105. Contractor may choose between tubular 8-mil thick linear low-density film or 4-mil thick high-density cross-laminated film.

D. **Gaskets**: Gasket materials shall be compatible with pre-treated water service containing 4.5 parts per million of chloramines. Vendor shall verify selections for compatibility with this service and provide compliance information with submittals.

2.4 SPECIALS AND FITTINGS

A. Fittings for ductile iron pipe shall conform to the requirements of AWWA C153 or AWWA C110 and shall have a minimum pressure rating of 150 psi.

2.5 DESIGN OF PIPE

A. **General:** The pipe furnished shall be ductile iron pipe, mortar-lined and polyethylene- wrapped (for buried service), with rubber-gasketed joints as shown.

B. The pipe shall be designed, manufactured, tested, inspected, and marked according to AWWA C150 and C 151 except where modified by this Section.

C. **Pipe Dimensions:** The pipe shall be of the diameter and class indicated.

D. **Fitting Dimensions:** The fittings shall be of the diameter and class indicated.

E. **Joint Design:** Ductile iron pipe and fittings shall be furnished with mechanical joints, push-on joints, flanged joints, or restrained joints as required.

1. Mechanical and push-on joints shall conform to AWWA C111.
2. Flanged joints shall conform to AWWA C115.
3. Restrained joints shall be "TR FLEX" restrained joint, or equal.

F. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself, will provide watertight joints under all operating conditions when properly installed. The Contractor shall require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.

G. Shop-applied interior linings and exterior coatings shall be held back from the ends of the pipe as indicated.

2.6 CEMENT-MORTAR LINING

A. **Cement-Mortar Lining for Shop Application:** Except as otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with AWWA C104. During the lining operation and thereafter, the pipe shall be maintained in a round condition by suitable bracing or strutting. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at the Site, the damaged or unsatisfactory portions shall be replaced with lining conforming to these Specifications.

1. **Cement:** Cement for mortar lining shall conform to the requirements of AWWA C104; provided, that cement for mortar lining shall be Type II or V. Cement shall not originate from kilns that burn metal-rich hazardous waste fuel, nor shall a fly ash or pozzolan be used as a cement replacement.

B. The minimum lining thickness shall be as follows:

Nominal Pipe Diameter (in)	Minimum Lining Thickness (in)
3-12	1/16
14-24	3/32
30-64	1/8

C. **Protection of Pipe Lining/Interior:** Shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with AWWA C104.

2.7 EXTERIOR PROTECTION OF PIPE

A. **Exterior Coating of Exposed Piping:** The exterior surfaces of pipe which will be exposed to the atmosphere inside structures or above ground shall be thoroughly cleaned and then given a shop coat of rust-inhibitive primer conforming to the requirements of Section 09 90 00 - Protective Coating.

B. **Exterior Coating of Buried Piping:** The exterior coating shall be an asphaltic coating approximately 1 mil thick.

C. **Polyethylene Sleeve:** Sleeves shall conform to the requirements of AWWA C105, Contractor's choice between tubular 8 mil thick linear low-density film or 4 mil thick high-density cross-laminated film. Color shall be white.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE

A. **Handling and Storage:** All pipe, fittings, etc., shall be carefully handled and protected against damage, impact shocks, and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground but shall be supported in a manner which will protect the pipe against injury whenever stored at the trench site or elsewhere. No pipe shall be installed where the lining or coating show defects that may be harmful as determined by the Engineer. Such damaged lining or coating shall be repaired, or a new undamaged pipe shall be furnished and installed.

B. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.

C. The Contractor shall inspect each pipe and fitting prior to installation to insure that there are no damaged portions of the pipe. Pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.

D. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the WORK.

E. **Pipe Laying:** The pipe shall be installed in accordance with AWWA C600.

F. Pipe shall be laid directly on the bedding material. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints.

G. **Installation Tolerances:** Each section of pipe shall be laid in the order and position shown on the laying diagram or laying schedule and in accordance with the following:

1. Each section of pipe shall be laid to line and grade, within plus or minus 2 inches horizontal deviation and plus or minus 1-inch vertical deviation.

2. In addition to the horizontal and vertical tolerances above, lay the pipe so that no high or low points other than those on the laying diagram are introduced.

H. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed 75 percent of the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount that will be detrimental to the strength and water tightness of the finished joint.

I. Except for short runs that may be permitted by the Engineer, pipes shall be laid uphill on grades exceeding 10 percent. Pipe that is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. Bends shall be properly installed as indicated.

J. **Cold Weather Protection:** No pipe shall be installed upon a foundation into which frost has penetrated or at any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation before backfilling occurs.

K. **Pipe and Specials Protection:** The openings of all pipe and specials shall be protected with suitable bulkheads to prevent unauthorized access by persons, animals, water or any undesirable substance. At all times, means shall be provided to prevent the pipe from floating.

L. **Pipe Cleanup:** As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, mortar splatter, and any other debris following completion of pipe laying and shall perform any necessary interior repairs prior to testing and disinfecting the completed pipeline.

3.2 RUBBER GASKETED JOINTS

A. **Rubber Gasketed Joints:** Immediately before jointing pipe, the bell end of the pipe shall be thoroughly cleaned, and a clean rubber gasket shall be placed in the bell groove. The spigot end of the pipe and the inside surface of the gasket shall be carefully cleaned and lubricated. The lubricant shall be suitable for lubricating the parts of the joint for assembly and be a compound listed as in compliance with NSF Standard 61. The lubricant shall be nontoxic, shall not support the growth of bacteria, and shall have no deleterious effects on the gasket material. The lubricant shall not impart taste or odor to water in the pipe. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted.

3.3 POLYETHYLENE SLEEVE UNBONDED PROTECTION

A. Buried ductile iron pipe shall be polyethylene encased in accordance with the requirements of AWWA C105.

3.4 INSTALLATION OF PIPE APPURTENANCES

A. **Protection of Appurtenances:** Where the joining pipe is dielectric-coated, buried appurtenances shall be coated in kind. Where pipe is encased in polyethylene sleeves, buried appurtenances shall also be encased in polyethylene.

B. **Installation of Valves:** Valves shall be handled in a manner to prevent any injury or damage to any part of the valve. Joints shall be thoroughly cleaned and prepared prior to installation. The Contractor shall adjust all stem packing and operate each valve prior to installation to insure proper operation.

C. Valves shall be installed so that the valve stems are plumb and in the location indicated.

3.5 CORROSION CONTROL – ANODES, JOINT CONNECTIONS

A. **Pipeline Markers:** Markers shall be provided by the Contractor at all test stations. Markers shall be Carsonite utility markers.

B. **Installation of Flanged Joints:** Before the joint is assembled, the flange faces shall be thoroughly cleaned of all foreign material with a power wire brush. The gasket shall be centered and the connecting flanges drawn up watertight without unnecessarily stressing the flanges. All bolts shall be tightened in a progressive diametrically opposite sequence and torqued with a suitable,

approved, and calibrated torque wrench. Allow one flange free movement in any direction while bolts are being tightened. All clamping torque shall be applied to the nuts only. Full face reinforced gaskets shall be applied to the inside faces of blind flanges with adhesive.

C. **Flexible Coupled Joints:** When installing flexible couplings, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of all direct and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets, and couplings. The couplings shall be assembled and installed in conformity with the recommendation and instruction of the coupling manufacturer.

D. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe with all bolts tightened approximately the same amount. Diametrically opposite bolts shall be tightened progressively and evenly. Final tightening shall be done with a suitable, approved, and calibrated torque wrench set of the torque recommended by the coupling manufacturer. All clamping torque shall be applied to the nut only.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 12 00

PIPE LEAKAGE TESTING AND VIDEO INSPECTION

PART 1 -- GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Chlorine Institute (2001 L Street N.W., Washington D.C. 28036): Pamphlet 6, Piping Systems for Dry Chlorine.

1.2 SUBMITTALS

A. **Testing Plan:** Submit prior to testing and include at least the information that follows.

1. Testing dates.
2. Piping systems and section(s) to be tested.
3. Test type.
4. Method of isolation.
5. Calculation of maximum allowable leakage for piping section(s) to be tested.

B. **Certifications of Calibration**: Testing equipment.

C. Certified Test Report.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 PREPARATION

A. Notify Engineer in writing five (5) days in advance of testing. Perform testing in presence of Engineer.

B. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
4. New Piping Connected to Existing Piping:
    a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.
    b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer.
5. Items that do not require testing include: Piping between wet wells and wet well isolation valves, and equipment seal drains.
6. Test Pressure: 30 psi

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

3.2 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Each section of the newly installed 14” diameter and 18” diameter HPDE and DIP outlet pipeline (Lake 4 Outlet Tower 2 to Access Manhole #1, Access Manhole #1 to Access Manhole #2, Access Manhole #2 to Access Manhole #3, Access Manhole #3 to Access Manhole #4, and Access Manhole #4 to the Measurement Structure shall be pressure tested, including the vent pipe.

B. Hydrostatic Testing

1. Expel air from piping system during filling.
2. Vent piping during filling: Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Examine joints (when accessible) and connections for leakage.
5. Maintain hydrostatic test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
6. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
7. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

where:

L = Allowable leakage, in gallons per hour.

S = Length of pipe tested, in feet.

D = Nominal diameter of pipe, in inches.

P = Test pressure during leakage test, in pounds per square inch.

8. Correct leakage greater than allowable, and retest as specified.

3.3 HYDROSTATIC TEST FOR GRAVITY PIPING (NOT USED)

A. **Testing Equipment Accuracy:** Plus or minus 1/2-gallon water leakage under specified conditions.

B. **Maximum Allowable Leakage:** 0.16 gallon per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

C. **Defective Piping Sections:** Replace and retest as specified.

3.4 PIPELINE VIDEO INSPECTION

A. The complete pipeline interior shall be inspected and recorded by video camera after fill work is completed over the pipeline. Two copies of the completed video shall be supplied to the Owner in a format approved by the Engineer.

3.5 FIELD QUALITY CONTROL

A. Test Report Documentation

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by Contractor and Engineer to represent that test has been satisfactorily completed.

END OF SECTION

SECTION 33 41 01

HIGH DENSITY POLYETHLYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installing high-density polyethylene (HDPE) pipe and fittings.

B. Furnishing and installing piping, fittings, gaskets, bolts, connections, pipe insulation, and such other specialties as required for a complete and operable piping system.

1.2 RELATED SECTIONS

A. 31 23 23.15 – Trenching, Backfilling, and Compaction (Pipelines)

B. 33 12 00 – Pipe Leakage Testing

C. 33 05 13 – Precast Concrete Manhole

D. 35 20 19 – Valves and Gates - General

1.3 SUBMITTALS

A. Follow procedures of Section 01 33 00

B. Submit Product Data for piping materials, fittings, and jointing methods; and recommended methods of installation of pipe and construction of bends.

C. Submit Certificates of Compliance furnished by the manufacturer certifying that pipe materials comply with the requirements specified.

1.4 REFERENCES

A. American Water Works Association (AWWA)

1. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4” through 63” for Water Distribution.

B. ASTM International (ASTM)

1. ASTM A182 - Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe
2. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
3. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
4. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
5. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
6. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

C. Plastics Pipe Institute (PPI)

1. PPI TR-3 - Policies and Procedures for Developing Recommended Hydrostatic Design

Stresses for Thermoplastic Pipe Materials.

2. PPI TR-4 - Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds.

D. NSF International (NSF)

1. NSF Standard #14 - Plastic Piping Components and Related Materials.

1.5 **WARRANTY**

A. A two-year written guarantee from the date of final acceptance of the project shall be provided by the Contractor to guarantee that the piping, fittings, air release/vacuum valves, ball valves, and other ancillary piping items shall perform as stated in these Specifications. There shall be no defects in material or workmanship in any items supplied. The Contractor shall replace, at no cost to the Owner, any item he furnished which fails to perform as specified.

PART 2 - PRODUCTS

2.1 **HIGH DENSITY POLYETHYLENE (HDPE) PRESSURE PIPE**

A. Material Specifications

1. Materials used for the manufacturing of polyethylene pipe and fittings shall be PE 3408 High Density Polyethylene (HDPE) meeting the ASTM D3350 cell classification of 345464C.

2. The manufacturer shall certify that the materials used to manufacturer pipe and fittings meet the requirements of this specification.

3. The material shall have a minimum Hydrostatic Design Basis (HDR) of 1600 psi at 73° F when tested in accordance with PPI TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4.

4. The material used in the production of potable water pipe shall be approved by the National Sanitation Foundation (NSF).

B. Manufacturer Requirements and Qualifications

1. The Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these specifications. Given reasonable notice, the Manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. Qualified manufacturers shall be approved by the Project Engineer. Approved manufacturers include PLEXCO performance Pipe Division - Chevron Chemical Company, Titan Industries, Inc. or approved equal.

2. The manufacturer of the HDPE pipe and fittings shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rate, and contamination. The cell classification properties of the material shall be certified by the supplier. Incoming materials shall be approved by Quality Control before processing into finished goods. Outgoing products shall be tested as required by AWWA C-901 or C-906.

3. The Manufacturer shall maintain permanent Quality Control (QC) and Quality Assurance (QA) records. Certification of test results shall be delivered to the Owner.

C. Solid Pipe

1. The HDPE pipe shall be Ductile Iron Pipe Sized (DIPS) 14-inch and 18-inch nominal diameter with a dimension ratio of 17 (SDR17). Polyethylene pipe shall be manufactured in accordance with AWWA C906.

D. Fittings

1. Polyethylene fittings shall be made from material meeting the same requirements as the pipe. Polyethylene fittings shall be molded or fabricated by the manufacturer of the pipe.

2. Where applicable, fittings shall meet the requirements of AWWA C906.

3. Molded fittings shall be manufactured in accordance with either ASTM D2683 (socket fused) or ASTM D3261 (butt fused) and shall be so marked.

PART 3 - EXECUTION

3.1 GENERAL

A. Pipe Alignment and Grade

1. In laying pipe, maximum tolerance is permitted to set line within the following:

- Transmission pipeline: line +/- 0.1 ft, grade +/- 0.1 ft,

Deviations may be allowed, but only with written permission as obtained from the Engineer.

Fittings and valves shall be installed at the specified locations and elevations, unless written permission to deviate is obtained from the Engineer.

2. When laying pipe in curves, the intent is to lay to the alignment. The pipe shall be kept in alignment by deflecting joints, using short lengths or bends.

3. Any changes in alignment and grade must be authorized by the Engineer and shall be accomplished by the installation of additional fittings, or "breaking" of joints.

4.

B. Deviation from Alignment and Grade Occasioned by Other Structures

1. Whenever obstructions, not shown on the plans, interfere to such an extent that an alteration in the plans is required, the Engineer shall have the authority to determine the best method of correction. He may change the plans and order a deviation from line and grade, or he may instruct the Owner to arrange with the Contractor to arrange with the Owners of the structure for its removal, relocation or reconstruction, as best fits the economic and field conditions.

C. Temporary Bulkhead

1. Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be watertight and of such design as to prevent children, animals, or debris from entering the pipe. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

3.2 HDPE PIPE INSTALLATION

A. Installation Manual

1. The Manufacturer shall supply an Installation Manual to the Engineer which outlines guidelines for handling, joining, installing, embedding, and testing of polyethylene pipeline. These guidelines shall be used as reference materials for the Engineer in determination of the required procedures.

B. Welded Joints

1. Joints between plain ends of polyethylene pipe shall be made by either butt fusion or the

use of an electrofusion coupler. The welds shall be capable of withstanding the pressure requirement as the parent HDPE pipe. The Pipe Manufacturer's fusion procedures shall be followed at all times, as well as the recommendations of the Fusion Machine Manufacturer and/or the electrofusion coupler manufacturer. The wall thickness of the adjoining pipes and fittings shall have the same DR at the point of fusion.

2. When saddle connections are fusion welded, the Manufacturer's recommended saddle fusion procedures shall be used.

3. All techniques shall demonstrate proper document training and proficiency with the fusion procedure, equipment, and products being used.

C. Pipe String

1. If the pipe string is fabricated outside of the trench, then it may be pulled into place if allowed by and per the manufacturer's recommendations.

D. Grout and Concrete Encasement

1. The Contractor shall block, crib, tie down, or otherwise ensure that the pipe to be grouted in place or encased in concrete is secure and does not move during the placement and curing of grout or concrete encasement.

2. The Contractor's methods of securing the pipe in place prior to and during placement of the grout or concrete encasement shall not cause damage to the pipe.

E. Fusion Quality Testing

1. The Contractor shall ensure the proper field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operation while on-site. The Contractor shall verify field fusion quality by making the testing a trial fusion for the pipe. The trial fusion shall be allowed to cool completely before conducting a Bent Strap Test. The bend test straps shall be cut out and tested in accordance with ASTM F2620. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

3.3 FLEXIBLE COUPLED AND FLANGED JOINTS

A. Flexible Coupled Joint

1. When installing flexible couplings or flange adaptors, care shall be taken that the connecting pipe ends, couplings, and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contract surfaces of the pipe, gaskets and couplings. These couplings shall be assembled and installed in conformity with the recommendations and instructions of the coupling manufacturer.

2. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened so as to secure a uniform annular space between the follower rings and the body of the pipe and all bolts tightened approximately the same amount.

3. Diametrically opposite nuts shall be tightened progressively and evenly. Final tightening shall be done with a torque limiting wrench set for the torque recommended by the coupling manufacturer.

END OF SECTION

DIVISION 35 – VALVES

SECTION 35 20 19
VALVES AND GATES, GENERAL

PART 1 -- GENERAL

1.1 SUMMARY

A. Valves and Gates are located throughout the facility for the purpose of, but not limited to, directing flow, supplying water to the pump wet well, and isolating equipment.

1.2 DESIGN GUIDELINES

A. Install valves at all service connections, branch lines and risers. These valves are located in- and outside of building structures.

B. Provide extended stems where installation is required.

C. Provide valve and unions on each fixture and piece of equipment to allow removal without system shut down; unions not required for flanged connections.

D. Electric operators shall be used in all valve applications as called for on the plans. All other valves shall have a manual operator.

E. **Manual Operators:** Unless noted otherwise: Use quarter turn on valves up to, but not including, 6-inch. Use gear operators on quarter turn valves 6-inch and larger. Handwheels fastened to stems shall be used for valves other than quarter turn operators.

F. **Applications:** Use butterfly, ball and gate valves for shutoff; butterfly for throttling; butterfly valves may be used for balancing downstream of flow measuring devices.

G. Install check valves in proper direction of flow and oriented according to the manufacturer's instructions.

1.3 PERFORMANCE STANDARDS

A. Valve stem packing to be suitable for intended service and tight under conditions of actual service.

B. End Connections: threads: comply with ANSI B1.20 1. Flanges: comply with ANSI B16.1 for cast iron; ANSI B16.5 for steel.

1.4 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Codes**: All codes, as referenced herein, are specified in Section 01 42 19 – Reference Standards.

B. Commercial Standards:

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch).
ANSI/ASME B31.1	Power Piping.
ASTM A 36	Specification for Structural Steel.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM A 536	Specification for Ductile Iron Castings.
ASTM B 61	Specification for Steam or Valve Bronze Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 148	Specification for Aluminum-Bronze Castings.
ASTM B 584	Specification for Copper Alloy Sand Castings for General

	Applications.
ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems.
ANSI/AWWA C502	Dry-Barrel Fire Hydrants.
ANSI/AWWA C503	Wet-Barrel Fire Hydrants.
ANSI/AWWA C504	Rubber-Seated Butterfly Valves.
ANSI/AWWA C506	Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches.
AWWA C508	Swing-Check Valves for Waterworks Service, 2 Inches Through 24 Inches NPS.
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems.
AWWA C550	Protective Interior Coatings for Valves and Hydrants.
SSPC-SP-2	Hand Tool Cleaning.
SSPC-SP-5	White Metal Blast Cleaning.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to dezincification, to ASTM B 584.

PART 2 -- PRODUCTS

2.1 VALVES

A. **General**: The Contractor shall furnish all valves, gates, valve-operating units, stem extensions, and other accessories as shown or specified. All valves and gates shall be new and of current manufacture. All shut-off valves, 6-inch and larger, shall have operators with position indicators. Where buried, these valves shall be provided with valve boxes and covers containing position indicators, and valve extensions. Shut-off valves mounted higher than 5 feet-6 inches above working level shall be provided with chain operators, unless access is obtained through permanent grating as shown on the plans.

B. **Valve Flanges:** The flanges of valves shall be in accordance with Section 33 11 00 - Piping, General.

C. **Gate Valve Stems:** Where subject to dezincification, gate valve stems shall be of bronze conforming to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent of aluminum. Gate valve stems shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used.

D. **Protective Coating**: Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4-inch and larger, as well as the exterior surfaces of all submerged valves, shall be epoxy coated as specified in Section 09 90 00 - Protective Coating. Flange faces of valves shall not be epoxy coated. The valve manufacturer shall certify in writing that such coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications.

E. **Valve Operators:** Where shown, certain valves and gates shall be furnished with electric operators, provided by the valve or gate manufacturer. All operators shall be furnished by the same manufacturer. All valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant. Unless otherwise specified, all valve operators shall be in accordance with Section 40 05 57 - Valve and Gate Actuators.

F. **Valve Labeling:** Except when such requirement is waived by the Engineer in writing, a label shall be provided on all shut-off valves exclusive of hose bibs. The label shall be of 1/16-inch plastic or stainless steel, minimum 2 inches by 4 inches in size, and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the Engineer.

G. **Nuts and Bolts:** All nuts and bolts on valve flanges and supports shall be in accordance with Section 05 50 00 - Miscellaneous Metalwork. Where submerged or buried, all nuts and bolts on valve flanges and valve bodies shall be stainless steel.

2.2 PRODUCT DESCRIPTION

A. For Butterfly Valves, see Section 35 20 19.13

B. For Check Valves, see Section 35 20 19.33

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. **General**: All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access**: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 35 20 19.23
MISCELLANEOUS VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall provide miscellaneous valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.

PART 2 -- PRODUCTS

2.1 AIR/VACUUM AND AIR-RELEASE VALVES

A. **Air/Vacuum Valves:** Air/Vacuum valves shall be capable of venting large quantities of air while pipelines are being filled, and allowing air to re-enter while pipelines are being drained. They shall be of the size indicated, with flanged or screwed ends to match piping. Bodies shall be of high-strength cast iron. The float, seat, and all moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150 psi water-working pressure, unless otherwise indicated.

B. **Air-Release Valves:** Air-release valves shall vent accumulating air while system is in service under pressure and be of the size indicated. Valves shall meet the same general requirements as indicated for Air/Vacuum valves except that the vacuum feature will not be required. Valves shall be designed for a minimum water-working pressure of 150 psig, unless otherwise indicated.

C. **Combination Air Valves:** Combination air valves shall combine the characteristics of Air/Vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. Valves shall have the same general requirements as indicated for Air/Vacuum valves.

D. Valves shall be in accordance with ANSI/AWWA C512 standards.

E. Manufacturers, or Equal

1. **APCO (Valve and Primer Corporation)**
2. **Crispin - Multiplex Manufacturing Company**
3. **GA Industries**
4. **Val-Matic (Valve and Manufacturing Corporation)**

2.2 BACKFLOW PREVENTERS

A. Backflow preventers shall be installed in potable water lines where required by applicable codes or regulations, wherever there is any danger of contamination, and where indicated.

B. Backflow preventers shall be of suitable type, construction, and installation to meet all applicable local and state requirements.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Valves shall be installed in accordance with the manufacturer's printed recommendations, and with provisions of Section 35 20 19 – Valves and Gates, General.

B. Backflow preventers, as well as Air/Vacuum release valves, shall have piped outlets to the nearest acceptable drain, firmly supported, and installed in such a way as to avoid splashing and wetting of floors and obstruction of traffic.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

DIVISION 40 – PROCESS INTERCONNECTIONS

SECTION 40 71 69

OPEN CHANNEL FLOW METERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall provide a fabricated Parshall Flume and materials required for the complete installation of the work, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All codes, as referenced herein are specified in Section 01 42 19 – Reference Standards.

B. Design, fabricate Parshall Flumes and materials in accordance with manufacturer's recommended procedures and the following codes and standards:

ASTM A193	Stainless Steel Anchor Bolts
ASTM D256	Izod Impact Strength
ASTM D570	Water Absorption Rate
ASTM D638	Tensile Strength
ASTM D695	Compressive Properties of Rigid Plastic
ASTM D696	Coefficient of Linear Expansion
ASTM D790	Flexural Properties
ASTM D792	Density and Specific Gravity at 23° C
ASTM D1056	Polymer Grade
ASTM D2583	Indentation Harness
ASTM D2584	Resin, Glass & Filler Content
ISO1428/1-1980	Open Channel Flow Measurement

C. Composition of the Parshall Flume laminate shall be in accordance with the recommendations shown in the Quality Assurance Report for Reinforced Thermoset Plastic (RTP) Corrosion Resistant Equipment prepared under the sponsorship of the Society of the Plastics Industry, Inc. (SPI), and the Material Technology Institute (MTI) of the Chemical Process Industry for "Hand Lay-Up Laminates," and shall meet the specifications for Type I, Grade 10 laminates shown in Appendix M-1 of said report.

D. Manufacturer shall be experienced in the design and manufacture of specific Parshall Flumes and accessories for a minimum period of 20 years.

E. Manufacturer must provide warranty for 25 years against failure due to corrosion.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

B. Submit the following for acceptance:

1. Approval Drawings
    a. Showing all critical dimensions.
    b. Showing principal parts and materials.

1.4 DELIVERY, STORAGE AND HANDLING

A. Ship all Parshall Flumes with suitable packaging to protect products from damage.

B. Protect flume flanges, tabs and accessories from damage.

C. The flume shall be stored on a smooth, flat surface, free of sharp objects, and if laid horizontally, shall be placed in such a way as to avoid structural damage.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Flume body shall be:
1. Engineered composite fiberglass reinforced plastic (FRP).
    a. Molded in one piece to create a seamless corrosion barrier impervious to moisture.
    b. FRP resin shall be polyester.
2. Flume hardware (when applicable) shall be Type 316 stainless steel.

2.2 PARSHALL FLUMES

A. Acceptable Manufacturers:
1. Plasti-Fab Inc.
    a. Shall be Model 12-inch Parshall Flume.
2. The flume fabrication, engineering and customer support shall all be provided by the same company.
3. To assure quality control and single source accountability the same manufacturer shall fabricate and fully assemble the flume and components.
4. Or approved equal by Engineer.
    a. Manufacturer must have a qualified engineer on staff with at least 5 years experience with hydraulic measurement flumes.

2.3 DESIGN CRITERIA

A. Flume shall be dimensioned and shaped according to Dr. Ralph L. Parshall's design.

B. Composition of the Flume laminate shall be in accordance with the recommendations shown in the Quality Assurance Report for Reinforced Thermoset Plastic (RFP) Corrosion Resistant Equipment prepared under the sponsorship of the Society of the Plastics Industries, Inc. SPI) and the Material Technology Institute of the Chemical Process Industries, Inc. (MTI) for "Hand Lay-Up Laminates" and shall meet the specification for Type 1, Grade 10 laminates shown in Appendix M-1 of said report.
1. Visual inspection for defects shall be made without the aid of magnification and defects shall be classified as shown in Table 1 Level II of ANSI/ASTM D2563-0, approved 1977, (or any subsequent revision).

2.4 CONSTRUCTION

A. Flume
1. Flume throat size shall be 12-inches.
2. Parshall Flume body shall be totally manufactured of fiberglass reinforced polyester.
3. Each Flume shall be molded individually to the exact dimensions specified.
4. The thickness of the walls and floor of the flumes 60-inch and larger shall be not less than 3/8-inch (9.5mm) thick, and 7/16-inch (11mm) thick at the structural flanges. The thickness of the walls and floor of the flumes 48-inch and smaller shall be not less than 1/4-inch (6mm) thick.
5. Flumes shall be manufactured and reinforced thermoset plastic.
6. Flume inside surface shall be smooth, isophthalic gelcoat of 10-20 mil (0.25 – 0.51mm) thickness for UV resistance.
7. The surface shall be free of exposed reinforcing fibers.
8. The minimum glass content shall be 30% exclusive of gelcoat surfaces.
9. The flume shall be reinforced with box section stiffeners down the sides and across the bottom.
10. The stiffeners shall be joined at the knee to form a rigid dimensionally stable flume.

11. Reinforcing shall be designed to provide structural support throughout the length and width of the flume floor.
12. 60-inch and larger Parshall Flume body shall have 2-inch x 3-inch steel tube laminated to the bottom of the flume to provide additional stiffening for the floor. The steel tubing on the inlet and outlet end of the flume shall extend 3 inches beyond the side of the flume to assist the contractor in placement, leveling and tie-down of the flume during installation.
13. Flume shall be structurally designed to maintain dimensional integrity with a full head of water while being free standing.
14. Flume shall have a molded-in head gage with dual graduation in feet.
15. Stiffeners across the top shall be permanent FRP pultruded angle/channel or temporary wood spreaders as required for the job, and shall provide sufficient strength and structural support to resist the stresses that occur during shipping and proper installation of the flume.

B. Accessories
1. Provide with radial wingwalls.

2.5 PHYSICAL PROPERTIES

A. Structural characteristics for a 1/8-inch (3mm) glass mat laminate shall meet the following minimum physical properties:

Tensile Strength	15,000 psi (1034 ksc)
Flexural Modulus	1,000,000 psi (70307 ksc)
Flexural Strength	20,000 psi (1406 ksc)
Compressive Strength	22,000 psi (1547 ksc)
Impact Strength	9.0 ft-lbs/in. (1.24 kgf.m/25mm)
Water Absoprtion	0.13% (in 24 hours)

2.6 DIMENSIONS

A. The flume shall conform to the physical dimensions listed in Figure 19 of the U.S. Department of Interior, Water Measurement Manual, latest edition. Dimensional tolerances for 1-inch, 2-inch and 3-inch Parshall Flumes shall be plus or minus 1/16-inch (1.6mm) maximum in the throat, and plus or minus 1/8-inch (3mm) maximum elsewhere. Dimensional tolerances for all other flume sizes shall be plus or minus 1/8-inch (3mm) maximum in the throat, and plus or minus 1.4-inch (6mm) maximum elsewhere.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. PARSHALL FLUMES LARGER THAN 84-INCHES WILL BE SHIPPED IN FLANGED AND MATCH-DRILLED SECTIONS ALONGS WITH STAINELSS STEEL FASTENERS FOR ONSITE ASSEMBLY.
B. Verify that dimensions are correct and project conditions are suitable for installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
C. Thoroughly clean and remove all shipping materials prior to setting.
D. Install products in accordance with plans, general comments below and the Manufacturer's recommendations.

E. Care shall be taken in the handing, storage and placement of the flume in preparation for installation. The top spreaders shall be left on the flume until after installation is complete. They may be removed after the grout has cured if desired.

F. The flume shall be installed level end-to-end and side-to-side, and must remain level throughout installation. Flume assembly should be set into a pre-poured block-out / channel.

G. The contractor shall provide sufficient shoring and bracing of the floor and sidewalls to prevent lifting, floating, buckling or bulging of the sides and bottom during installation. The side locking clips are not intended to be used as anchorage points. Their function is to key the flume into the grout or concrete.

H. Concrete shall be poured in successive lifts of not more than 6 to 8 inches (152-203mm) per lift. Extra care shall be exercised during the first pour to insure that grout flows smoothly under the floor, and an even fill is achieved. The first lift shall be allowed to set so that excessive hydraulic forces are not transferred to the bottom of the flume by later lifts.

3.2 ADJUSTMENT AND START UP

A. Check flume for being level both directions, meeting dimensional requirements and cleaned per manufacturer's instructions.

B. Startup / calibration of meter per section _____ (NOT APPLICABLE)

C. Site to be left clean and free of any debris.

D. Representative shall complete a Certification of Proper Installation and provide copies to the Owner, Engineer, Contractor and Manufacturing Facility.

END OF SECTION

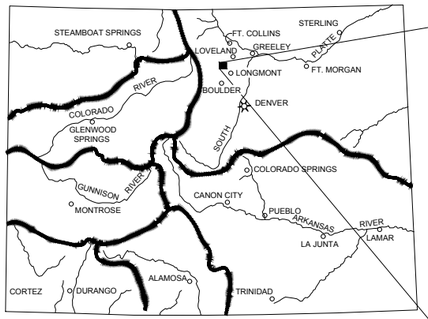
CONSTRUCTION PLANS FOR

LAKE 4
OUTLET PIPELINE REPLACEMENT

BOULDER COUNTY,COLORADO

PREPARED FOR:

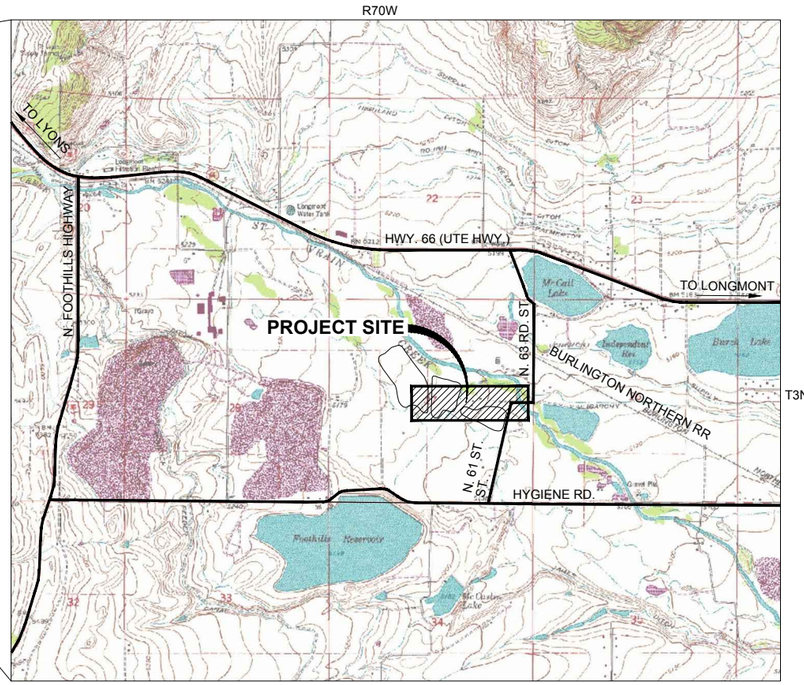
ST. VRAIN LEFT HAND WATER CONSERVANCY DISTRICT
9595 NELSON ROAD, SUITE 203
LONGMONT, COLORADO 80501



STATE OF COLORADO
PROJECT LOCATION MAP

NORTH

SCALE: NONE



PROJECT VICINITY MAP

NORTH

APPROX. SCALE: 1"=2000'

0 2000 4000

SCALE IN FEET

NOTES:

DEERE AND AULT CONSULTANTS, INC. IS NOT A GUARANTOR OF THE PERFORMANCE OF THE WORK.

DEERE AND AULT CONSULTANTS, INC. IS NOT RESPONSIBLE FOR SAFETY IN, ON, OR ABOUT THE PROJECT SITE, NOR FOR COMPLIANCE BY THE APPROPRIATE PARTY WITH ANY REGULATIONS RELATED THERETO.

DEERE AND AULT CONSULTANTS, INC. EXERCISES NO CONTROL OVER THE SAFETY OR ADEQUACY OF ANY EQUIPMENT, BUILDING COMPONENTS, FORMS, OR OTHER WORK AIDS USED, IN, ON OR ABOUT THE PROJECT, OR OVER THE SUPERINTENDING OF THE SAME.

WRITTEN SCALES ON PLAN ARE FOR FULL SIZED 22" x 34" PLANS AND DO NOT APPLY TO REDUCED PLAN SETS.

811 Know what's **below.** **Call before you dig.**

CALL 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

DEERE & AULT CONSULTANTS, INC. ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS (HORIZONTAL AND VERTICAL). THE EXISTING UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

I SEAN CRONIN, EXECUTIVE DIRECTOR OF THE ST. VRAIN AND LEFT HAND WATER CONSERVANCY DISTRICT, OWNER, HEREBY ACCEPT THESE THE PLANS FOR THE LAKE 4 OUTLET PIPELINE REPLACEMENT.

_____
EXECUTIVE DIRECTOR

I ERIC LANE, DIRECTOR OF BOULDER PARKS AND OPEN SPACE DEPARTMENT, OWNER, HEREBY ACCEPT THESE THE PLANS FOR THE LAKE 4 OUTLET PIPELINE REPLACEMENT.

_____
DIRECTOR

Sheet List Table

CERTIFICATION:

I HEREBY CERTIFY THAT THESE PLANS FOR THE CONSTRUCTION OF LAKE 4 OUTLET PIPELINE REPLACEMENT WERE PREPARED UNDER MY DIRECT SUPERVISION FOR THE OWNERS THEREOF

BY: _____ COLO. P.E. NO. 25061
MARK A. McLEAN P.E.

THESE PLANS REPRESENT THE AS-CONSTRUCTED PLANS FOR THE LAKE 4 OUTLET PIPELINE REPLACEMENT TO THE BEST OF OUR KNOWLEDGE AND JUDGEMENT. BASED IN PART ON THE INFORMATION FURNISHED BY OTHERS AS OF THE DAY OF .

BY: _____ COLO. P.E. NO. 25061
MARK A. McLEAN P.E.

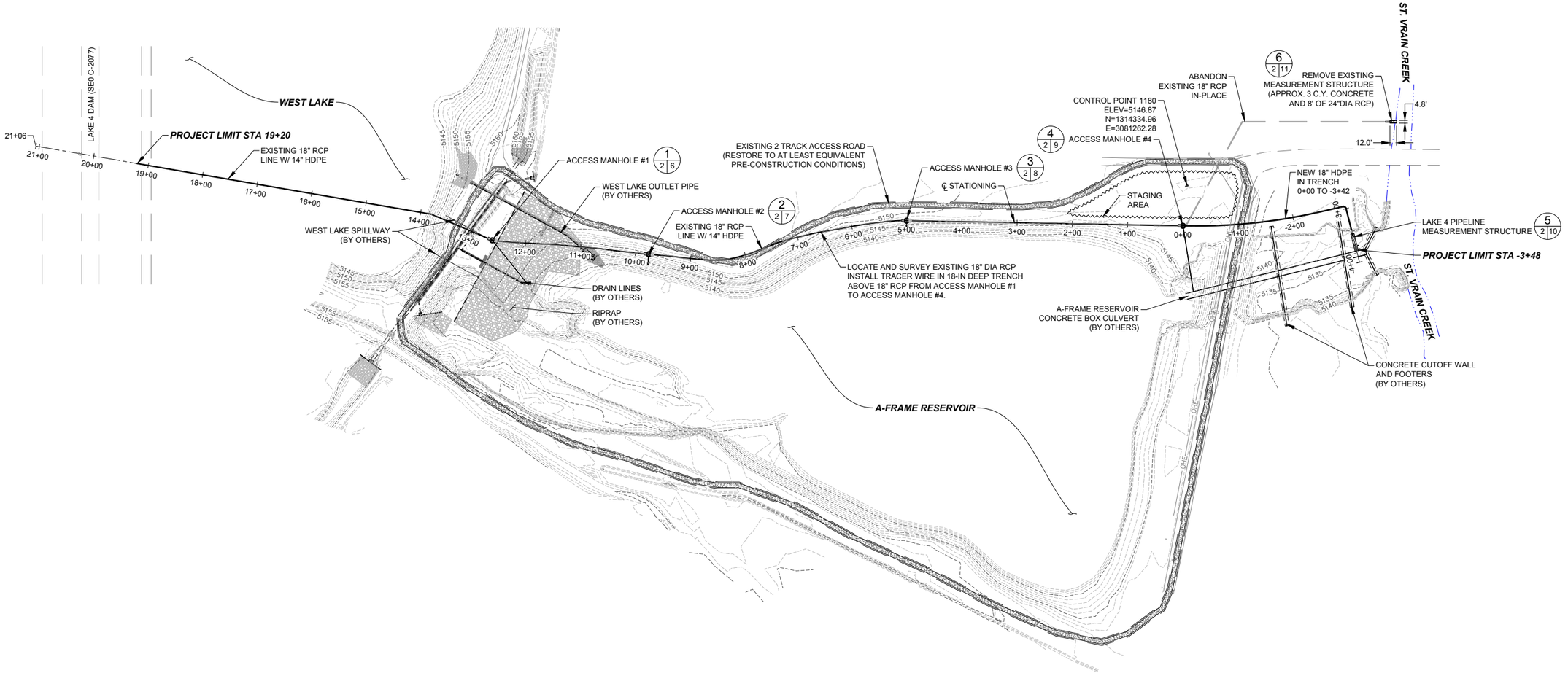
NO.	REVISIONS DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

COVER SHEET

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. 0155.005.02 | SHEET: 1 of 11
DRAWN BY: HOG | DATE: JUNE 2018
CHECKED BY: MMC | SCALE: AS NOTED



PLAN VIEW

0 100 200

SCALE IN FEET
CONTOUR INTERVAL = 1 FT

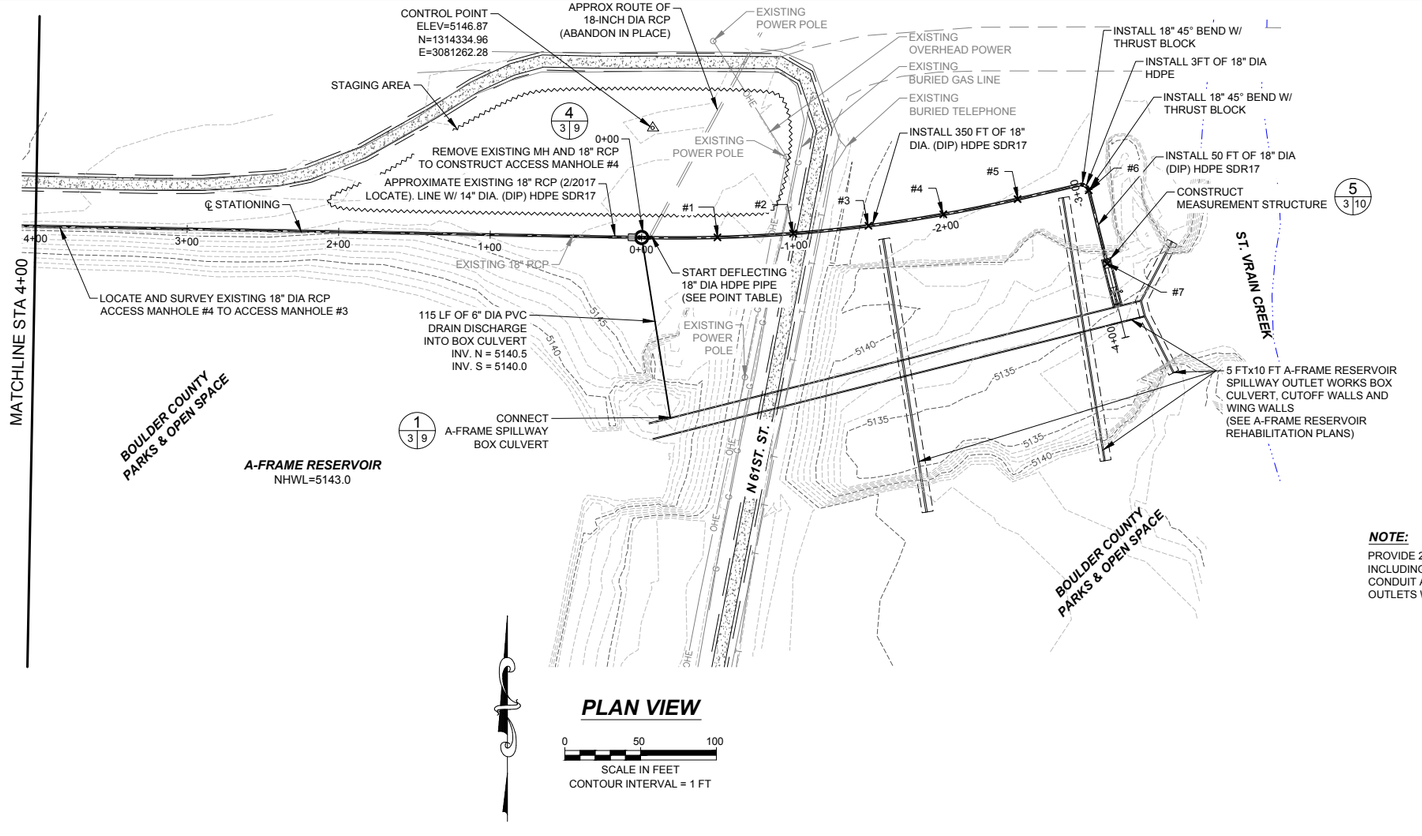
LAKE 4 OUTLET PIPELINE REPLACEMENT

GENERAL SITE PLAN

NO.	REVISIONS DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC	APPROVED BY: MMC	JOB NO.	SHEET:
DRAWN BY: HOG	DATE: JUNE 2018	0155.005.02	2 of 11
CHECKED BY: MMC	SCALE: AS NOTED		



POINT TABLE		
DESCRIPTION	NORTHING	EASTING
#1	1314262.69	3081305.05
#2	1314265.27	3081354.98
#3	1314270.35	3081404.72
#4	1314277.91	3081454.14
#5	1314287.92	3081503.12
#6	1314293.75	3081550.08
#7	1314245.24	3081562.20

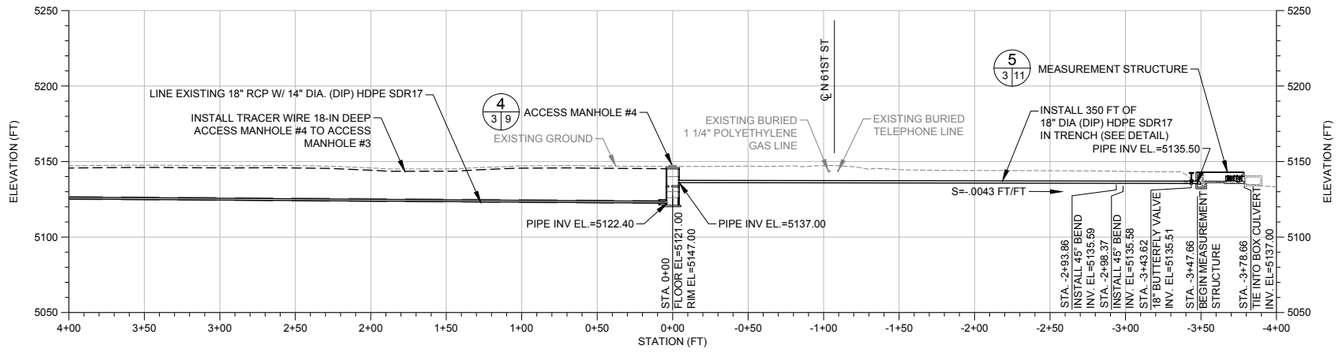
NOTE:

PROVIDE 208V, 100A 1Ø ELECTRICAL SERVICE TO ACCESS MANHOLE #4 INCLUDING CONNECTION TO CITY OF LONGMONT ELECTRIC, BURIED CONDUIT AND UNISTRUT MOUNTED SERVICE DISCONNECT METER AND OUTLETS WITH ENCLOSURES LOCATED ADJACENT TO ACCESS MANHOLE #4.

PLAN VIEW

0 50 100

SCALE IN FEET
CONTOUR INTERVAL = 1 FT



ST. VRAIN CREEK TO STA 4+00

0 50 100

SCALE IN FEET

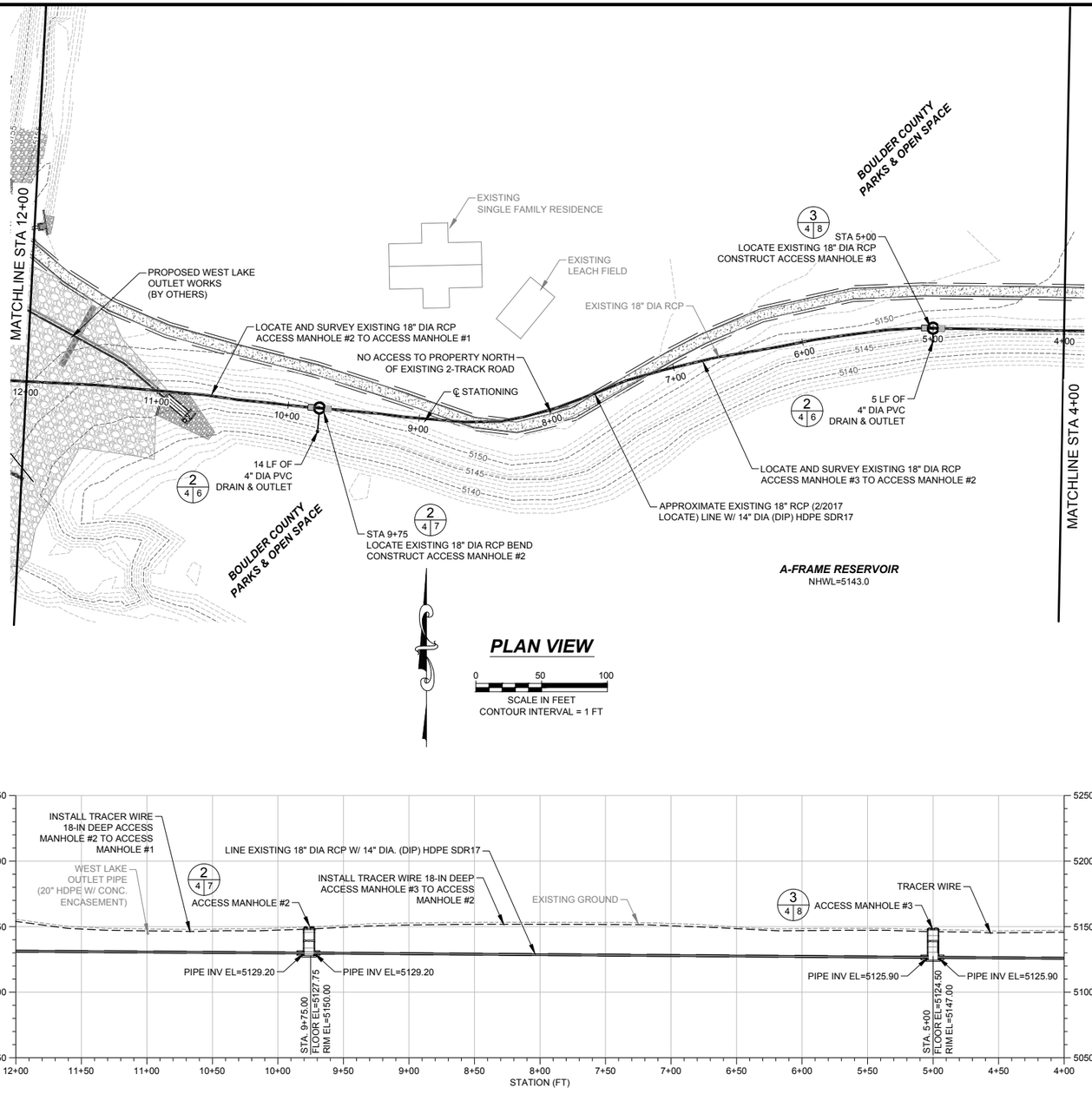
REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

PLAN & PROFILE - ST. VRAIN CREEK TO STA 4+00

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. | SHEET:
DRAWN BY: HOG | DATE: JUNE 2018 | 0155.005.02 | 3 of 11
CHECKED BY: MMC | SCALE: AS NOTED



PLAN VIEW

0 50 100

SCALE IN FEET
CONTOUR INTERVAL = 1 FT

PROFILE STATION 4+00 TO 12+00

0 50 100

SCALE IN FEET

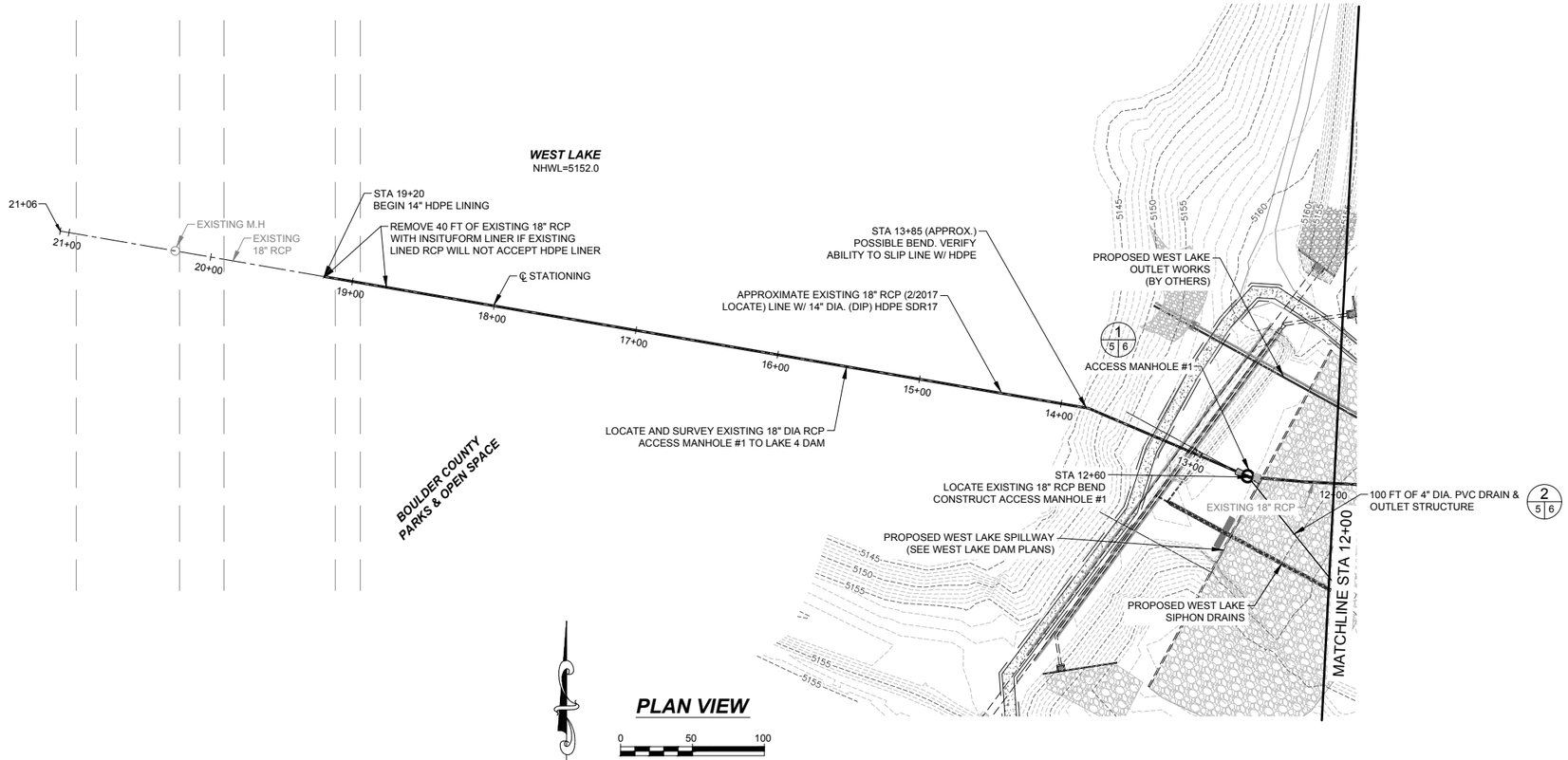
NO.	REVISIONS DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

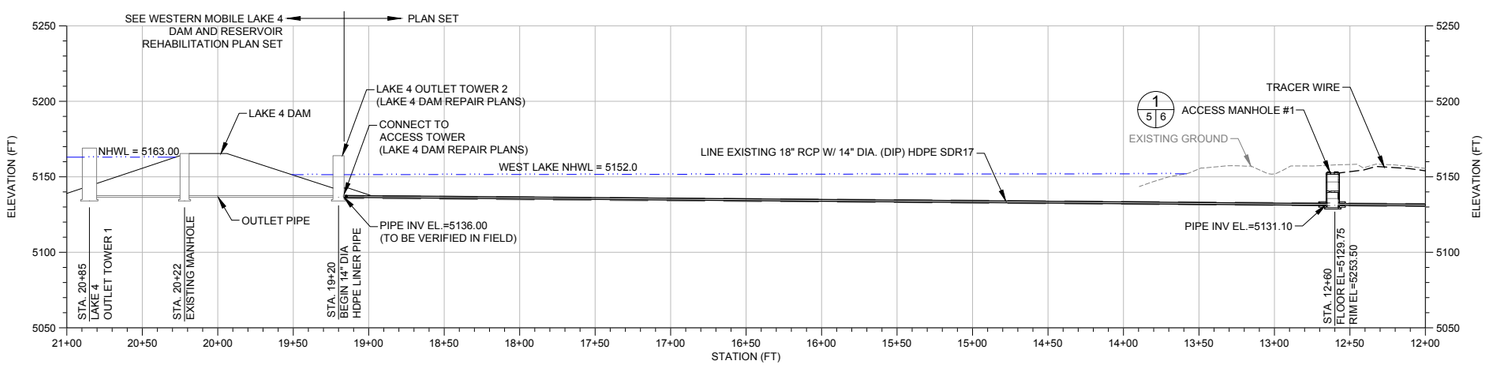
LAKE 4 OUTLET PIPELINE REPLACEMENT

PLAN & PROFILE - STA 4+00 TO STA 12+00

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. 0155.005.02 | SHEET: 4 of 11
DRAWN BY: HOG | DATE: JUNE 2018
CHECKED BY: MMC | SCALE: AS NOTED





PROFILE STATION 12+00 TO END

0 50 100
SCALE IN FEET

REVISIONS NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

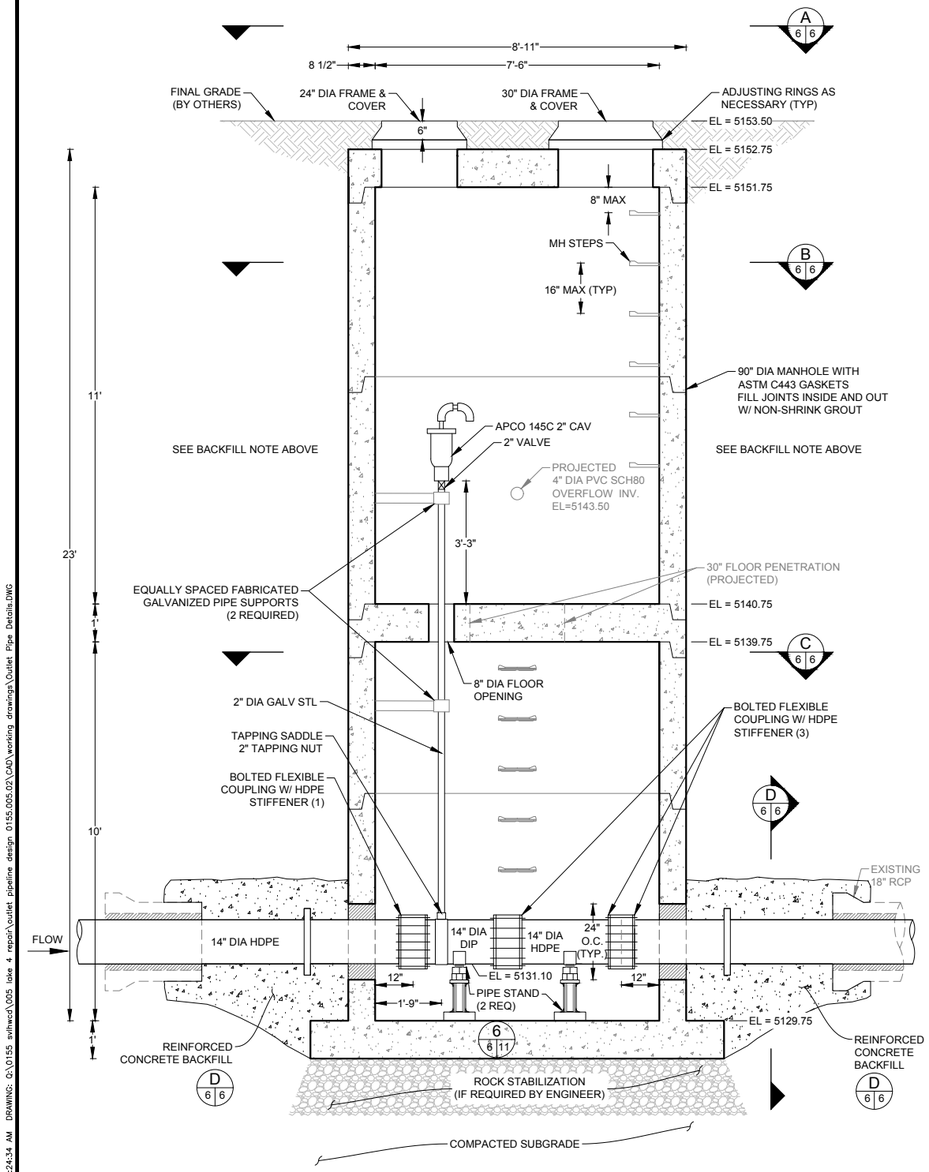
PLAN & PROFILE - STA 12+00 TO END

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. 0155.005.02 | SHEET: 5 of 11
DRAWN BY: HOG | DATE: JUNE 2018
CHECKED BY: MMC | SCALE: AS NOTED

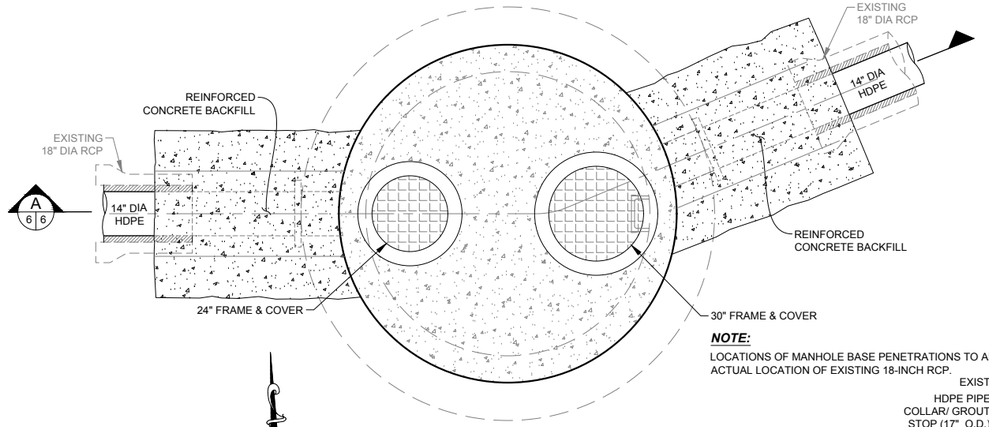
NOTE:

ACCESS MANHOLE #1 (ONLY) BACKFILL SHALL BE CLAY CORE MATERIAL CONFORMING TO THE WEST LAKE DAM REPAIR PLAN MATERIAL AND INSTALLATION SPECIFICATIONS, INCLUDING TESTING REQUIREMENTS.



ACCESS MANHOLE 1 SECTION VIEW

0 2' 4'
SCALE IN FEET

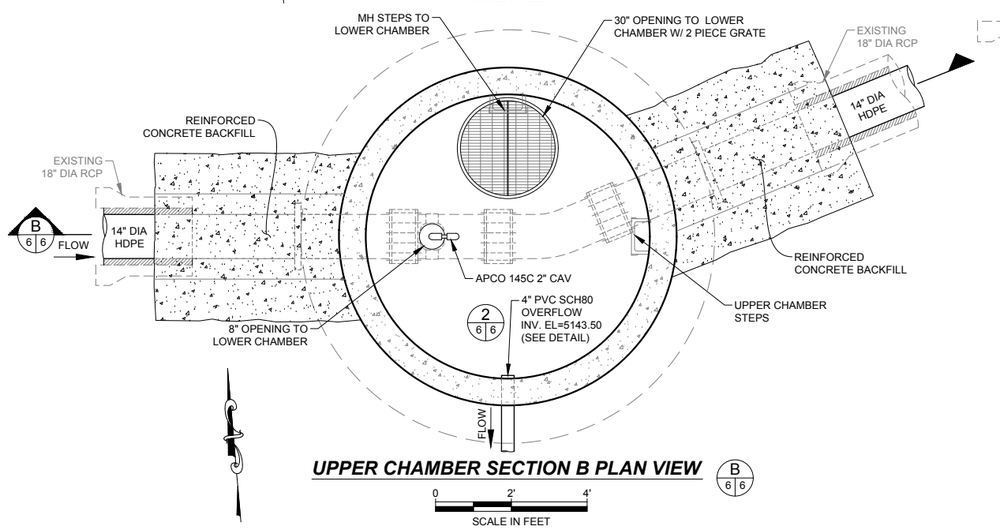


SECTION A PLAN VIEW

0 2' 4'
SCALE IN FEET

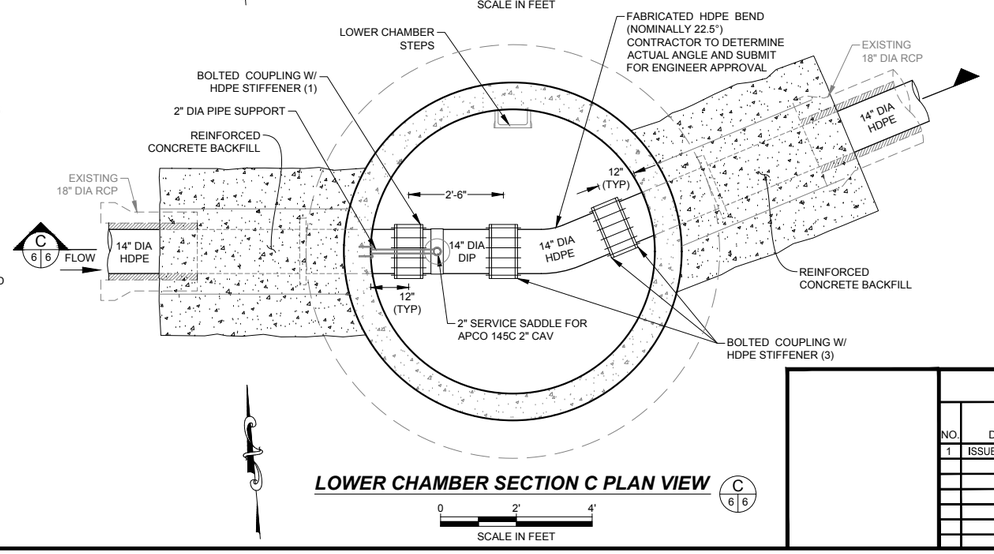
NOTE:

LOCATIONS OF MANHOLE BASE PENETRATIONS TO ALIGN WITH ACTUAL LOCATION OF EXISTING 18-INCH RCP.



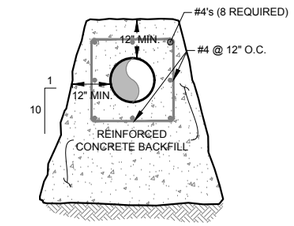
UPPER CHAMBER SECTION B PLAN VIEW

0 2' 4'
SCALE IN FEET



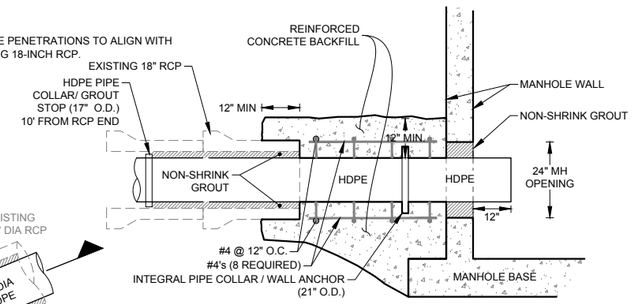
LOWER CHAMBER SECTION C PLAN VIEW

0 2' 4'
SCALE IN FEET



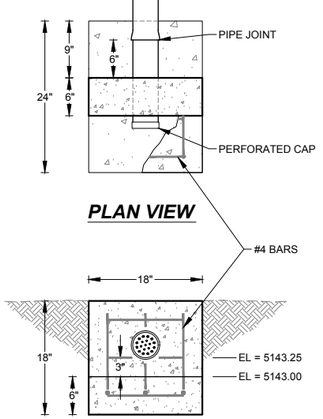
SECTION D

0 2' 4'
SCALE IN FEET



MANHOLE WALL PENETRATION DETAIL (TYP.)

0 2' 4'
SCALE IN FEET



PLAN VIEW

PROFILE VIEW

MANHOLE DRAIN OUTLET (TYP.)

0 1' 2'
SCALE IN FEET

REVISIONS NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

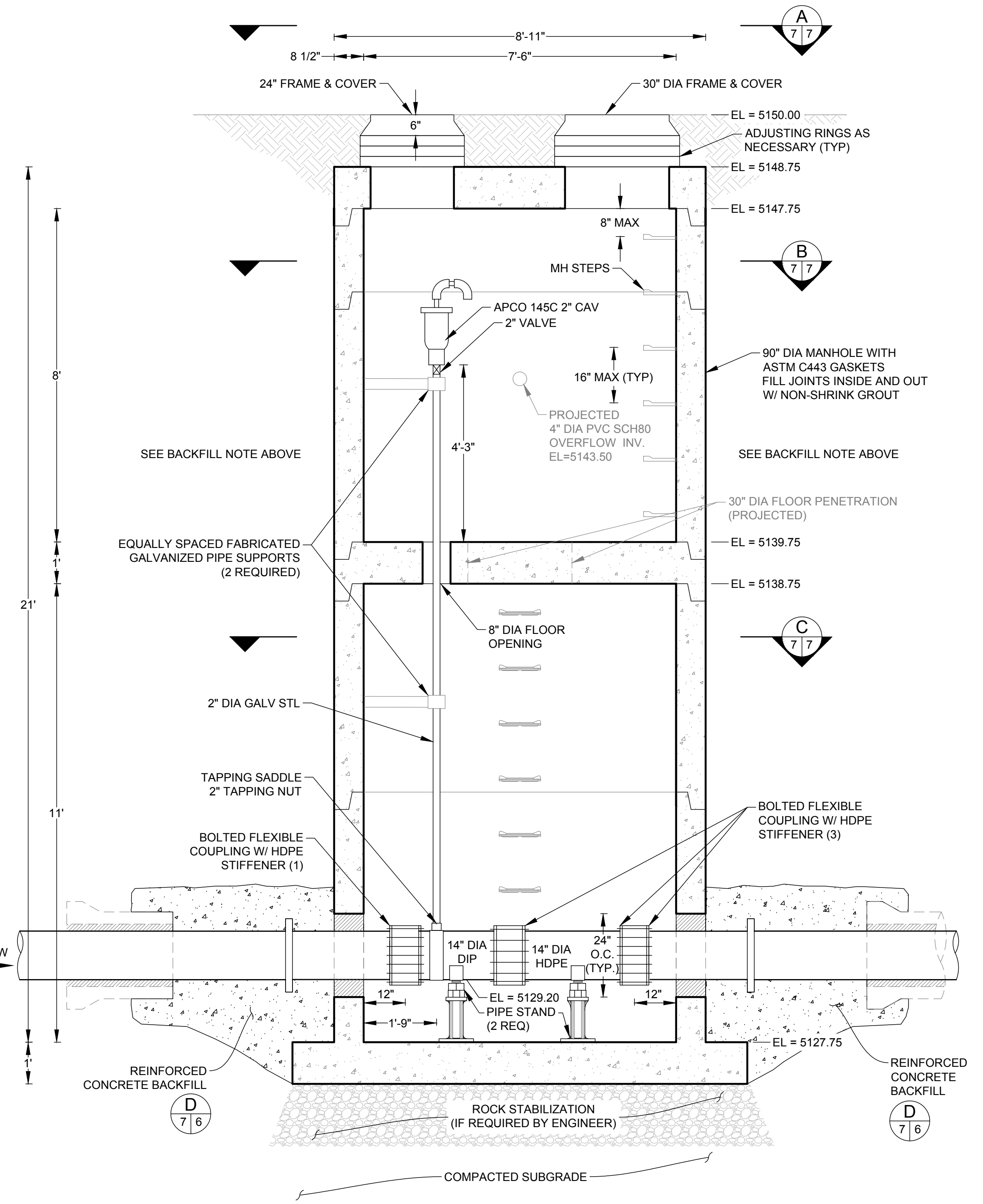
ACCESS MH #1 PLAN & SECTIONS

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. 0155.005.02 | SHEET: 6 of 11
DRAWN BY: HOG | DATE: JUNE 2018
CHECKED BY: MMC | SCALE: AS NOTED

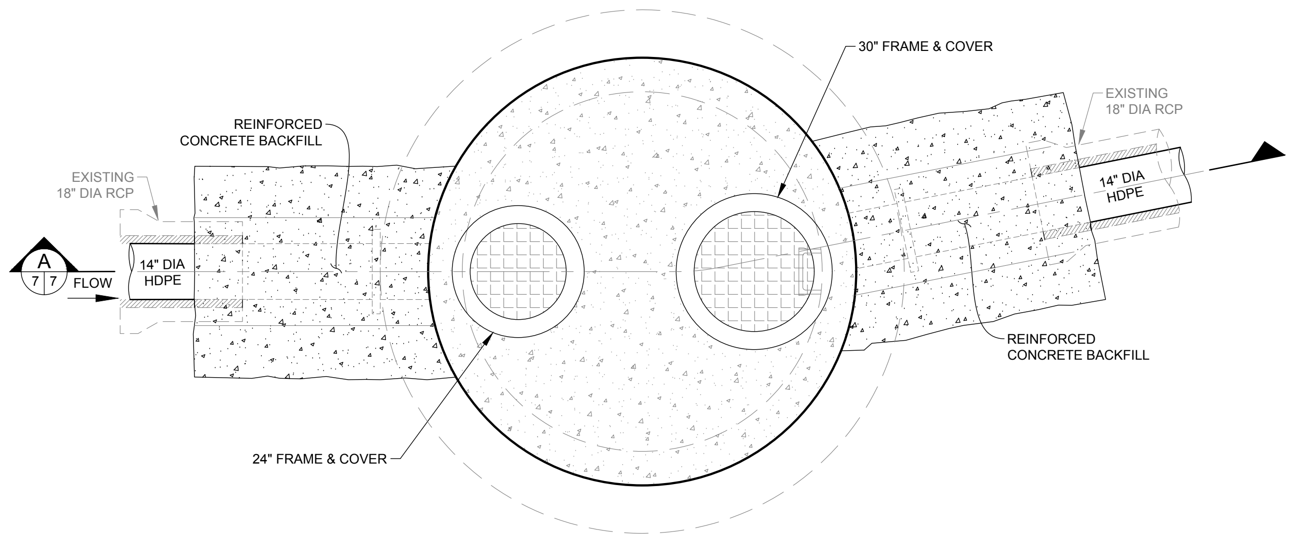
NOTE:

BACKFILL WITH COMPACTED NATIVE MATERIAL FROM EXCAVATION.
COMPACT TO 95% STD PROCTOR DENSITY AT ±2% OF OPTIMUM MOISTURE.



ACCESS MANHOLE 2 SECTION VIEW

0 2' 4'
SCALE IN FEET

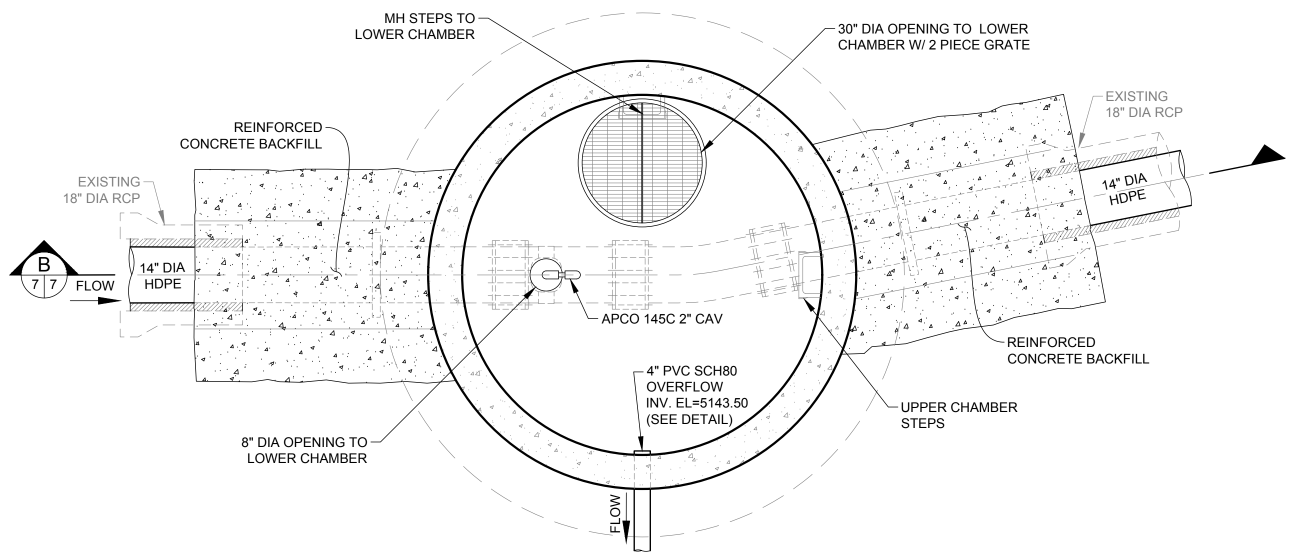


SECTION A PLAN VIEW A 7|7

0 2' 4'
SCALE IN FEET

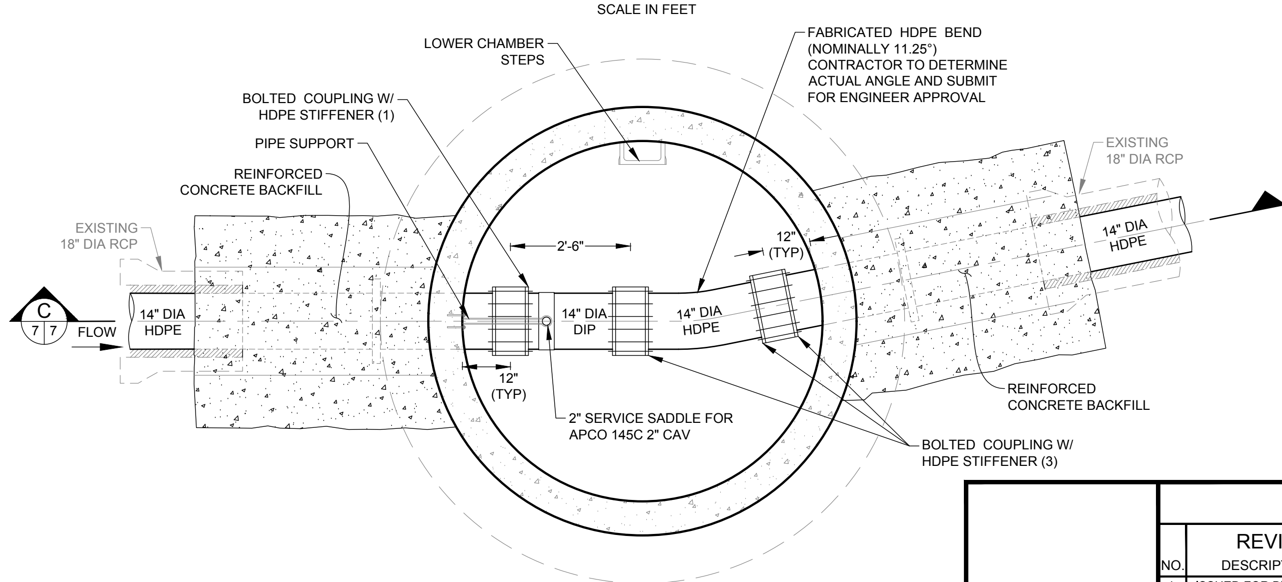
NOTE:

LOCATIONS OF MANHOLE BASE PENETRATIONS TO ALIGN WITH ACTUAL LOCATION OF EXISTING 18-INCH RCP.



UPPER CHAMBER SECTION B PLAN VIEW B 7|7

0 2' 4'
SCALE IN FEET



LOWER CHAMBER SECTION C PLAN VIEW C 7|7

0 2' 4'
SCALE IN FEET

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

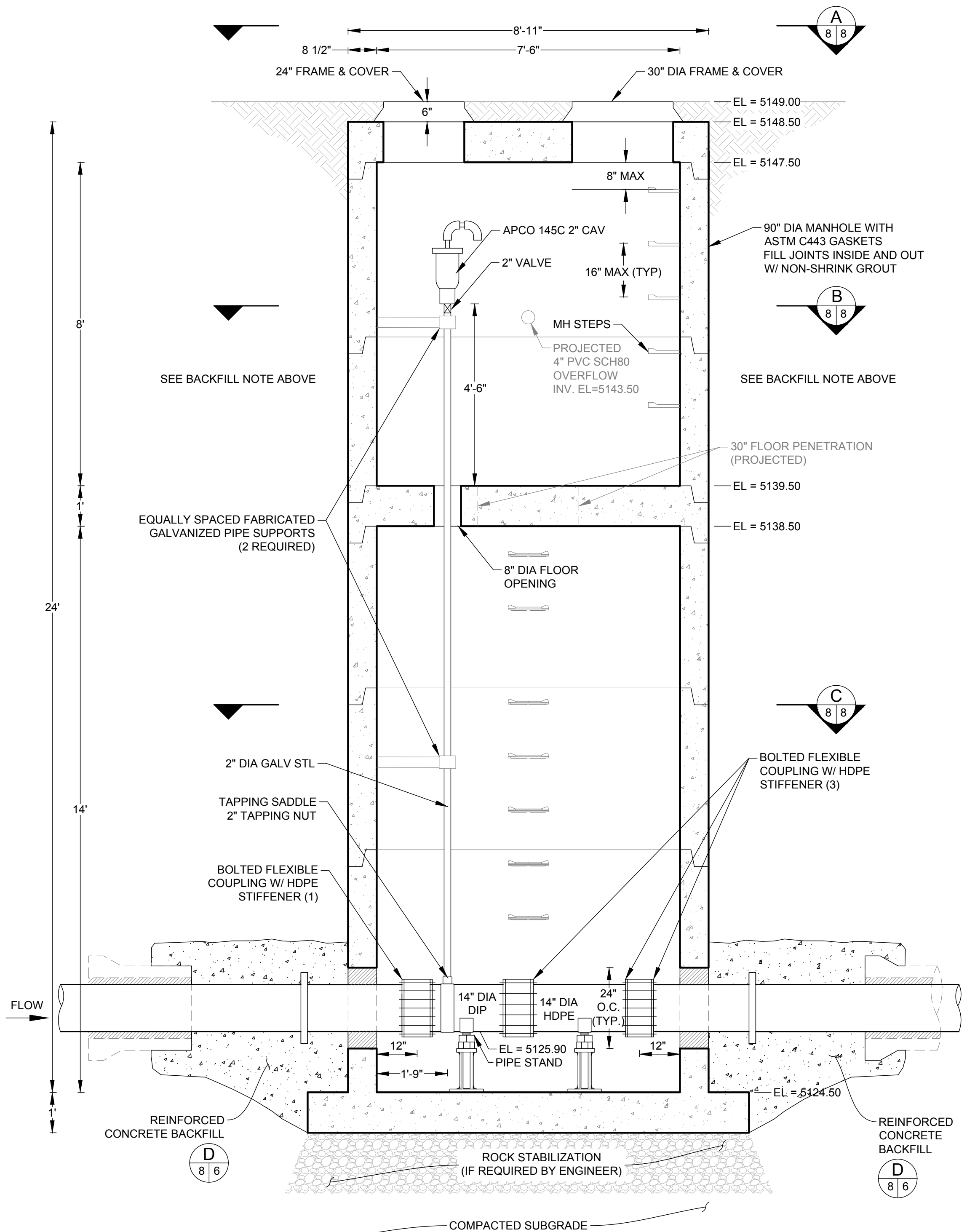
ACCESS MH #2 PLAN & SECTIONS

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC	APPROVED BY: MMC	JOB NO.	SHEET:
DRAWN BY: HOG	DATE: JUNE 2018	0155.005.02	7 of 11
CHECKED BY: MMC	SCALE: AS NOTED		

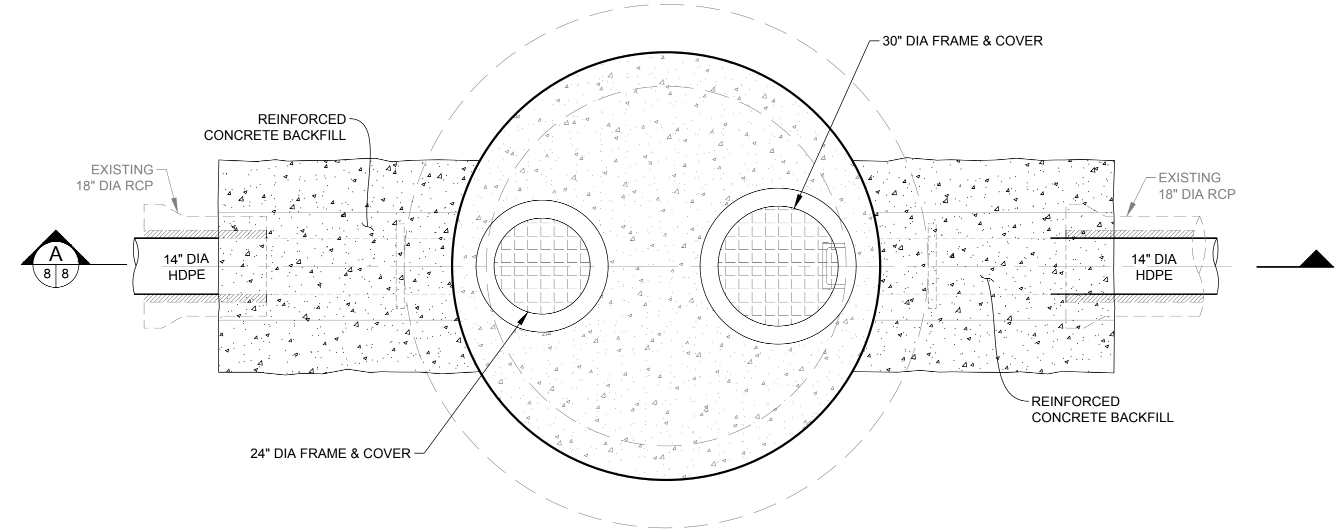
Wednesday, October 24, 2018 8:24:35 AM DRAWING: Q:\0155 svfwcd\005 lake 4 repair\outlet pipeline design 0155.005.02\CAD\working drawings\Outlet Pipe Details.DWG

NOTE:
BACKFILL WITH COMPACTED NATIVE MATERIAL FROM EXCAVATION.
COMPACT TO 95% STD PROCTOR DENSITY AT ±2% OF OPTIMUM MOISTURE.



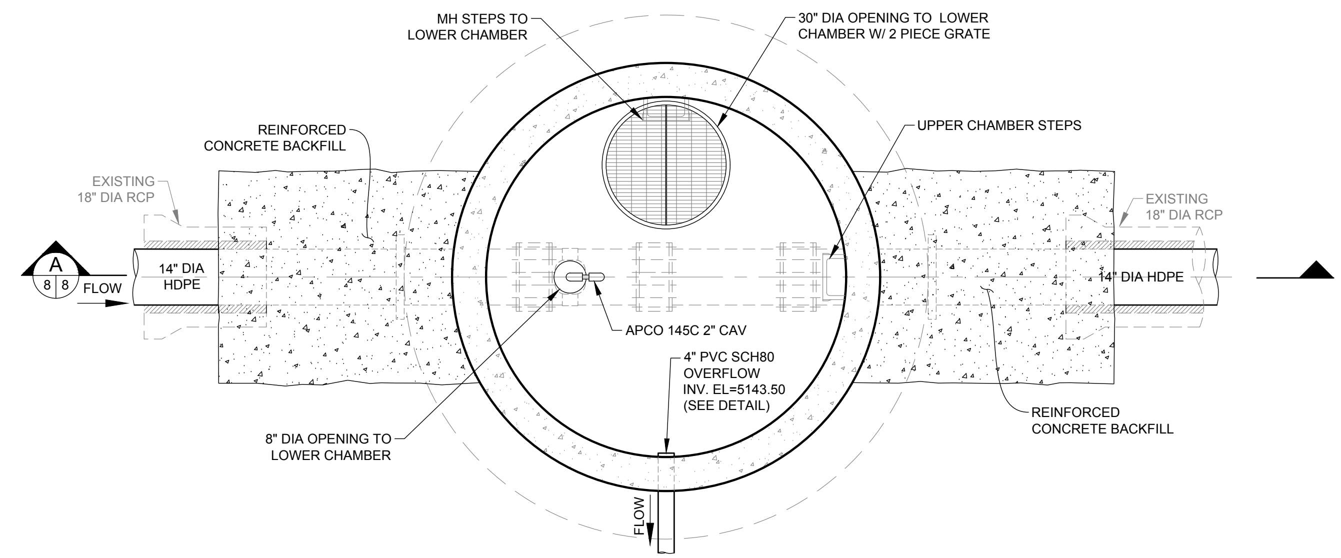
ACCESS MANHOLE 3 SECTION VIEW

0 2' 4'
SCALE IN FEET



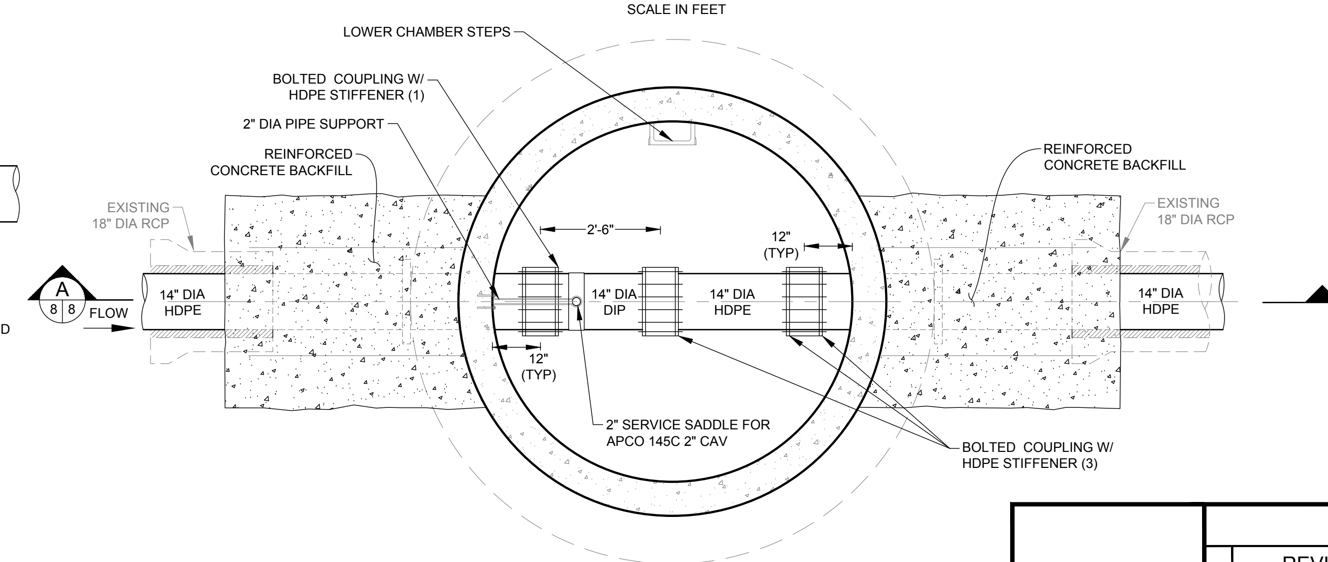
SECTION A PLAN VIEW A 8|8

0 2' 4'
SCALE IN FEET



UPPER CHAMBER SECTION B PLAN VIEW B 8|8

0 2' 4'
SCALE IN FEET



LOWER CHAMBER SECTION C PLAN VIEW C 8|8

0 2' 4'
SCALE IN FEET

NO.	REVISIONS DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

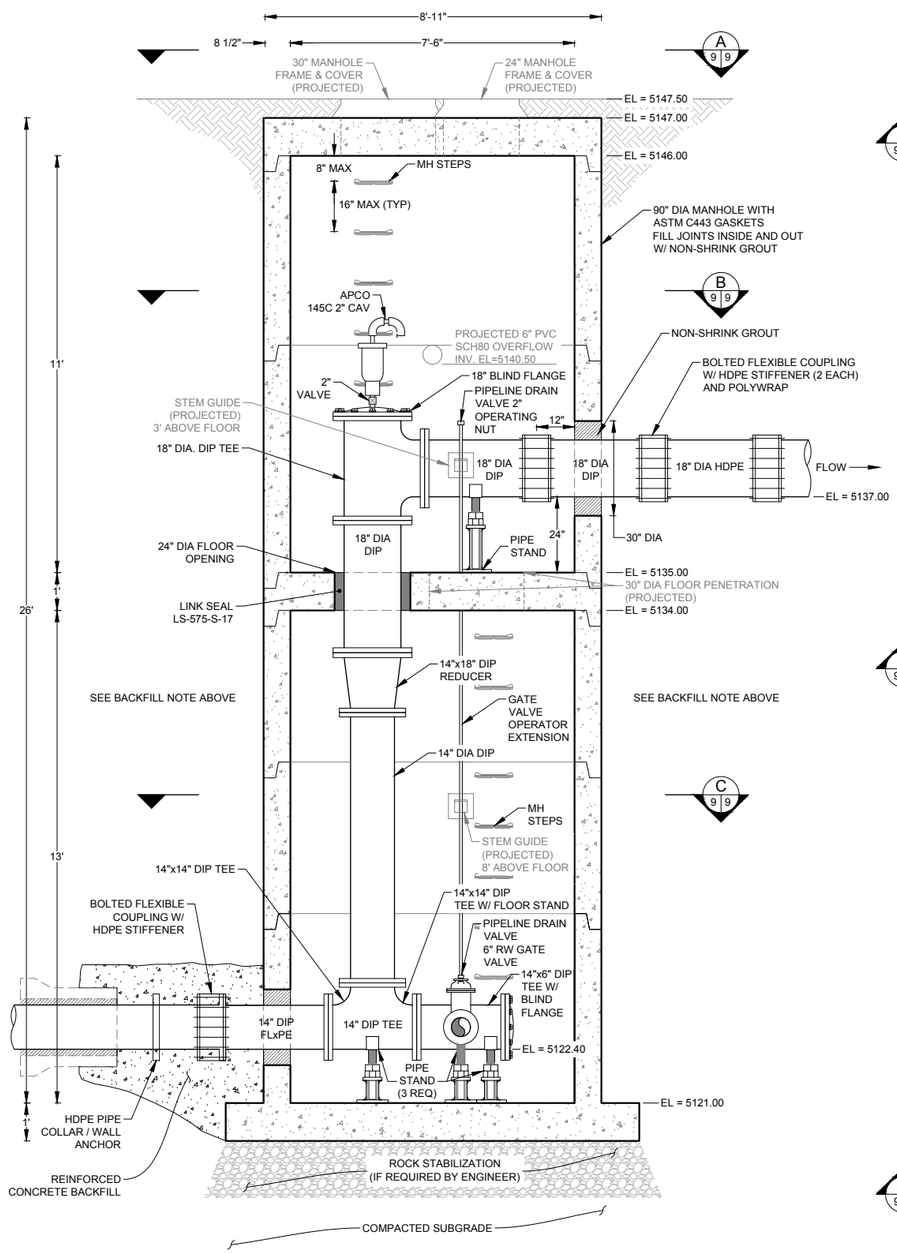
ACCESS MH #3 PLAN & SECTIONS

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC	APPROVED BY: MMC	JOB NO.	SHEET:
DRAWN BY: HOG	DATE: JUNE 2018	0155.005.02	8 of 11
CHECKED BY: MMC	SCALE: AS NOTED		

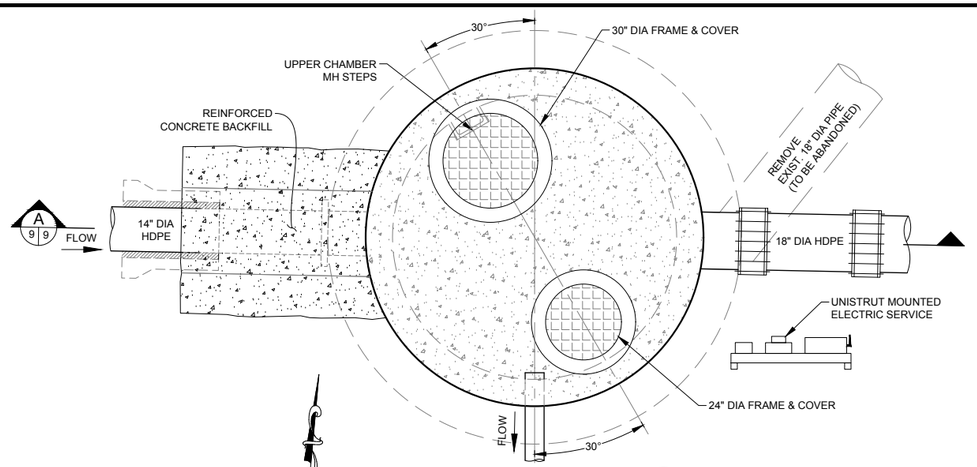
NOTE:

BACKFILL WITH COMPACTED NATIVE MATERIAL FROM EXCAVATION.
COMPACT TO 95% STD PROCTOR DENSITY AT ±2% OF OPTIMUM MOISTURE.



ACCESS MANHOLE 4 SECTION VIEW

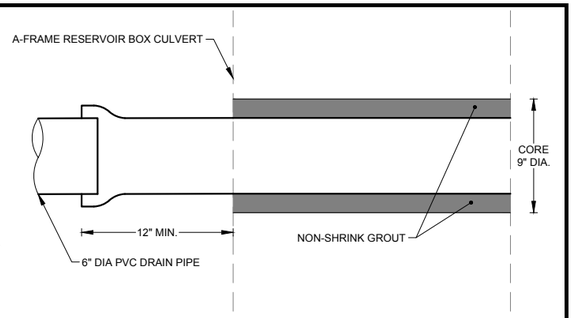
0 2' 4'
SCALE IN FEET



SECTION A PLAN VIEW

A 9|9

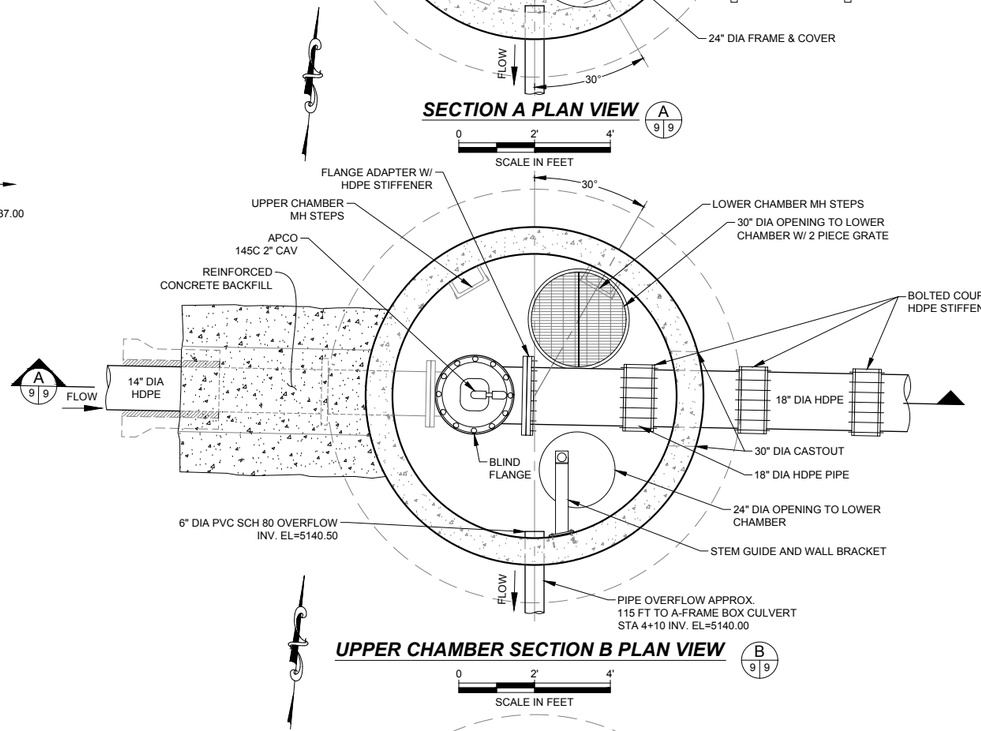
0 2' 4'
SCALE IN FEET



DRAIN CONNECTION

1 3|9

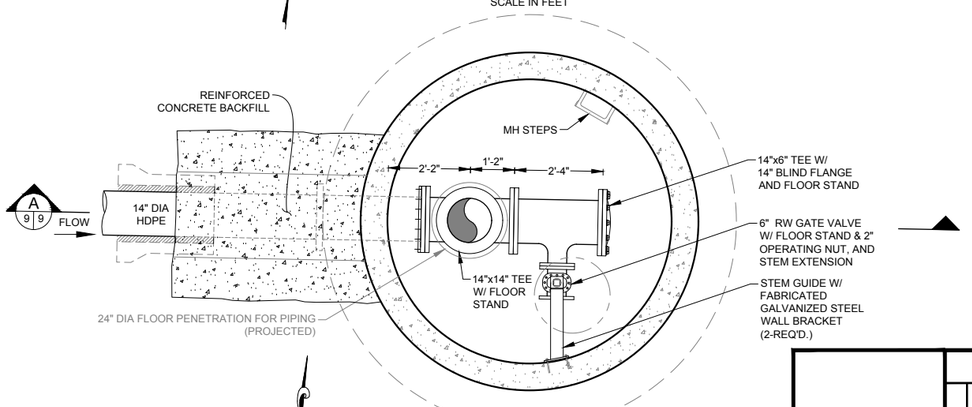
0 2' 4'
SCALE IN FEET



UPPER CHAMBER SECTION B PLAN VIEW

B 9|9

0 2' 4'
SCALE IN FEET



LOWER CHAMBER SECTION C PLAN VIEW

C 9|9

0 2' 4'
SCALE IN FEET

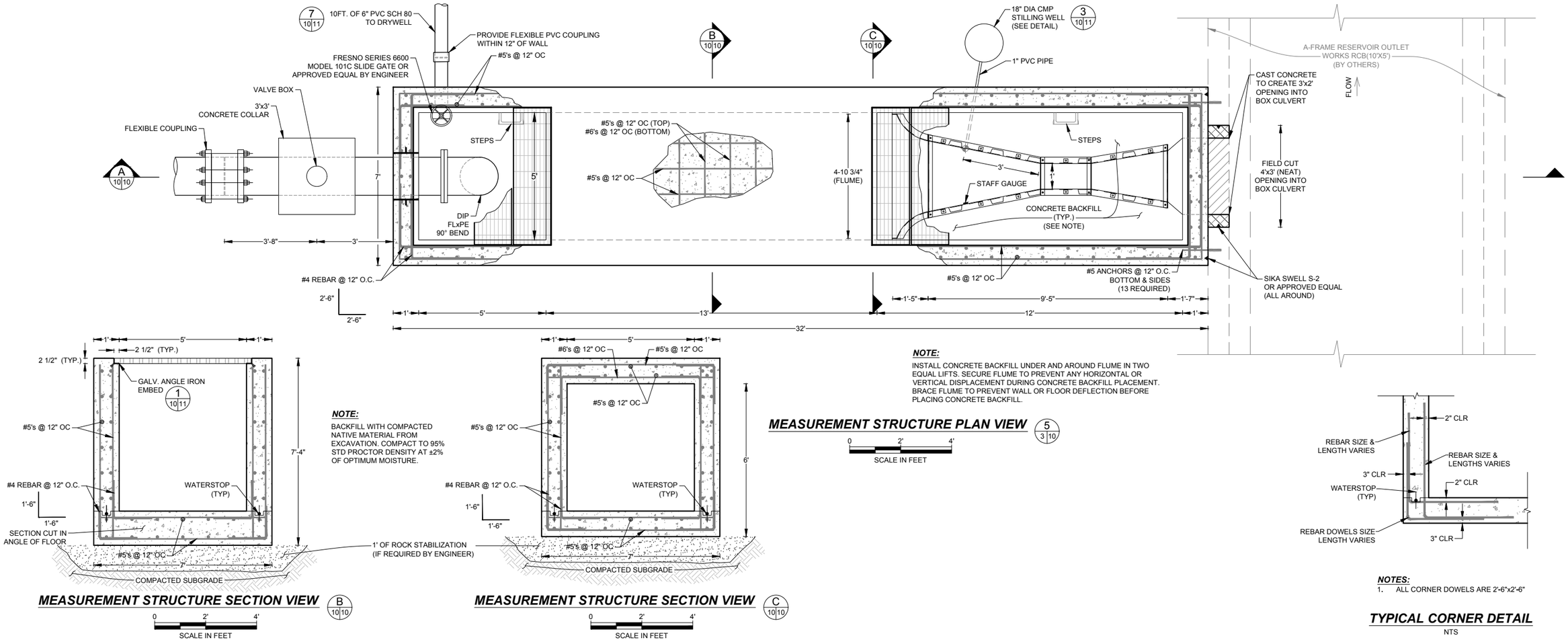
REVISIONS NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

ACCESS MH #4 PLAN & SECTIONS

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC | APPROVED BY: MMC | JOB NO. | SHEET:
DRAWN BY: HOG | DATE: JUNE 2018 | 0155.005.02 | 9 of 11
CHECKED BY: MMC | SCALE: AS NOTED



NOTE:
BACKFILL WITH COMPACTED NATIVE MATERIAL FROM EXCAVATION. COMPACT TO 95% STD PROCTOR DENSITY AT ±2% OF OPTIMUM MOISTURE.

1' OF ROCK STABILIZATION (IF REQUIRED BY ENGINEER)

MEASUREMENT STRUCTURE SECTION VIEW B 10|10

0 2' 4'
SCALE IN FEET

MEASUREMENT STRUCTURE SECTION VIEW C 10|10

0 2' 4'
SCALE IN FEET

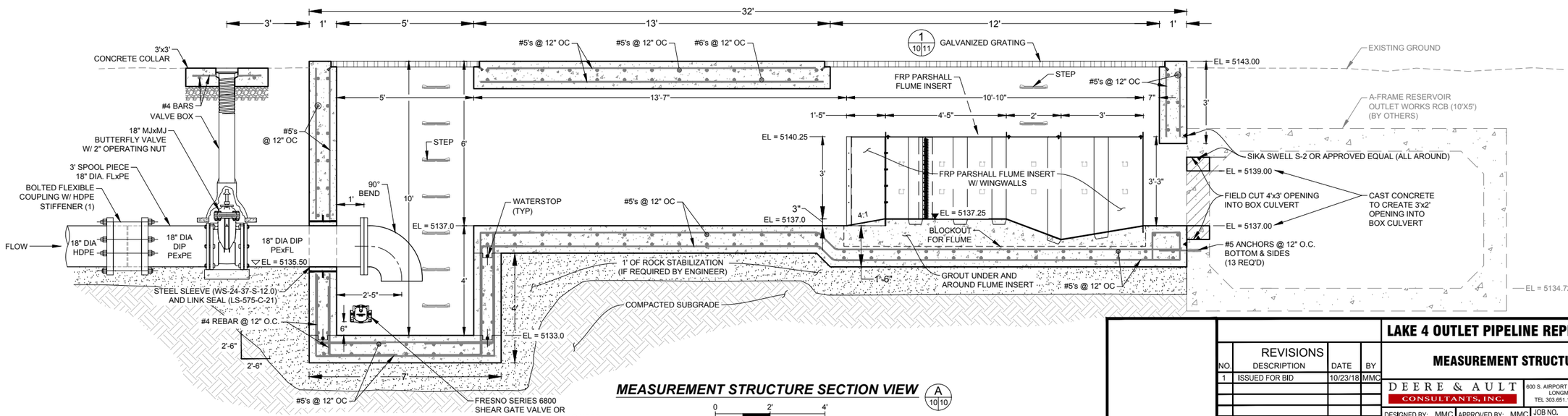
NOTE:
INSTALL CONCRETE BACKFILL UNDER AND AROUND FLUME IN TWO EQUAL LIFTS. SECURE FLUME TO PREVENT ANY HORIZONTAL OR VERTICAL DISPLACEMENT DURING CONCRETE BACKFILL PLACEMENT. BRACE FLUME TO PREVENT WALL OR FLOOR DEFLECTION BEFORE PLACING CONCRETE BACKFILL.

MEASUREMENT STRUCTURE PLAN VIEW 5 3|10

0 2' 4'
SCALE IN FEET

NOTES:
1. ALL CORNER DOWELS ARE 2'-6"x2'-6"

TYPICAL CORNER DETAIL
NTS



MEASUREMENT STRUCTURE SECTION VIEW A 10|10

0 2' 4'
SCALE IN FEET

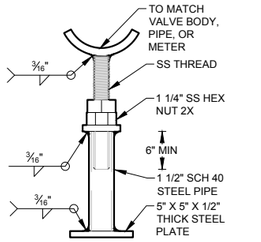
REVISIONS NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

MEASUREMENT STRUCTURE

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A. SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC	APPROVED BY: MMC	JOB NO.	SHEET:
DRAWN BY: HOG	DATE: JUNE 2018	0155.005.02	10 of 11
CHECKED BY: MMC	SCALE: AS NOTED		



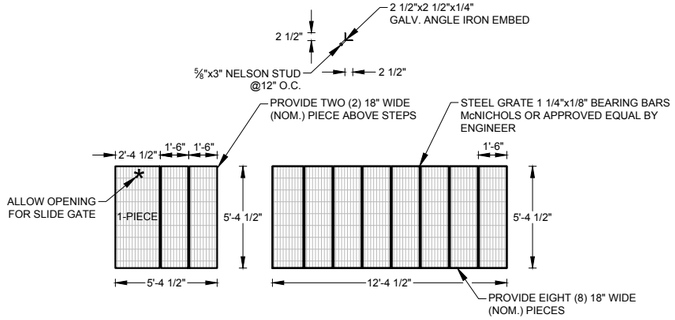
PIPE STAND DETAIL (2 | 6 | 11)

0 ½ 1

SCALE IN FEET

NOTE:

1. HOT DIPPED GALVANIZED (EXCEPT THREAD).



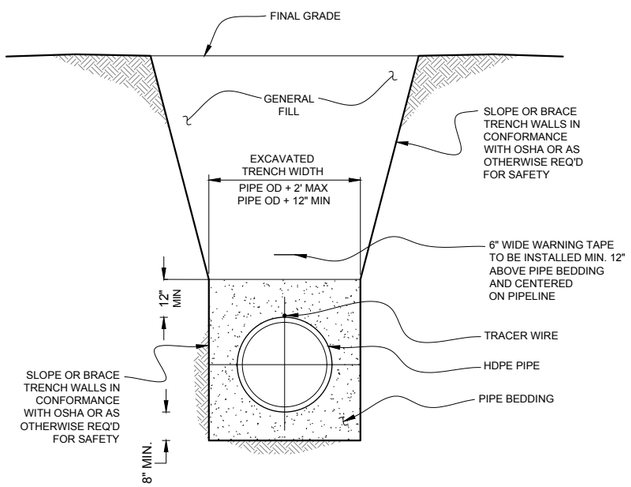
GALVANIZED GRATING DETAIL

0 4' 8'

SCALE IN FEET

GRATE NOTES:

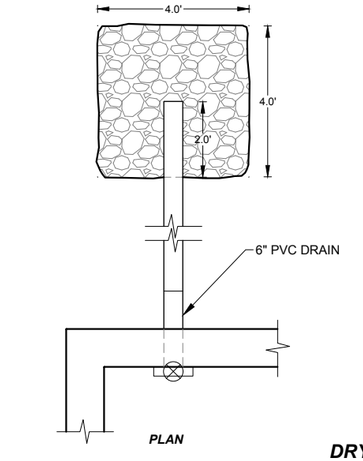
1. DIMENSIONS ARE PLANNED GRATING OUTSIDE DIMENSIONS TO PROVIDE 1/2" CLEARANCE ALL AROUND.
2. CONTRACTOR TO FIELD VERIFY DIMENSIONS PRIOR TO GRATE FABRICATION.
3. LAYOUT TO BE APPROVED BY ENGINEER.
4. CONTRACTOR TO SUBMIT TO ENGINEER FOR REVIEW AND APPROVAL BEFORE FABRICATION.
5. BAND ALL EDGES.
6. EMBEDS AND GRATING SHALL BE HOT-DIPPED GALVANIZED.
7. FASTENERS, ANCHOR, BOLTS, NUTS & WASHERS SHALL BE STAINLESS STEEL.
8. GRATING TO BE INSTALLED FIRMLY IN PLACE USING BAR GRATING ANCHORING CLIPS.



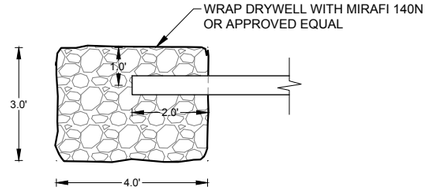
TYPICAL TRENCH DETAIL (4 | 3 | 11)

0 2' 4'

SCALE IN FEET



PLAN

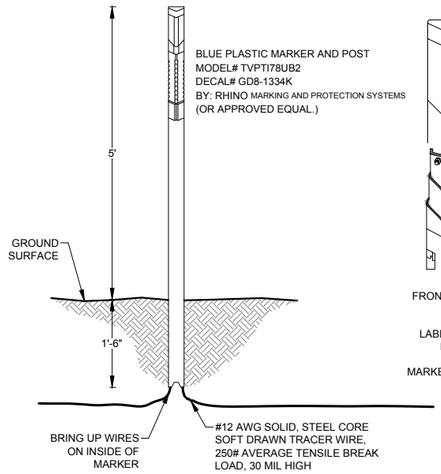


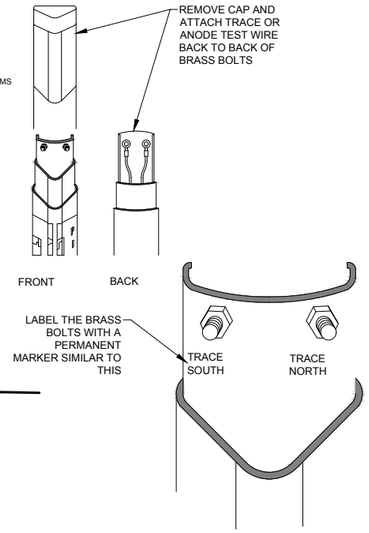
PROFILE

DRY WELL DETAIL (7 | 10 | 11)

0 2' 4'

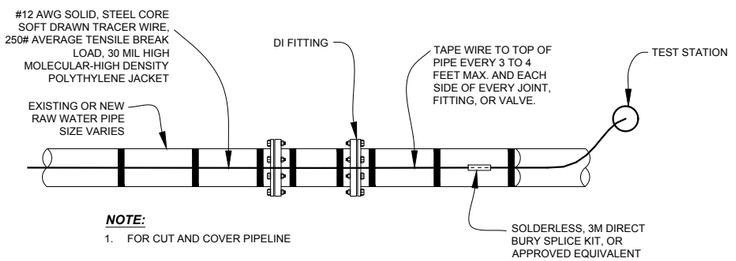
SCALE IN FEET





TRACER WIRE & MARKER DETAIL

NTS



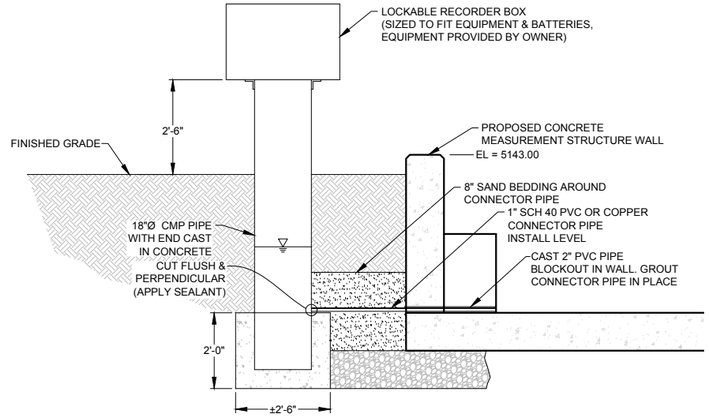
NOTE:

1. FOR CUT AND COVER PIPELINE

TRACER WIRE DETAIL (5 | 3 | 11)

0 2' 4'

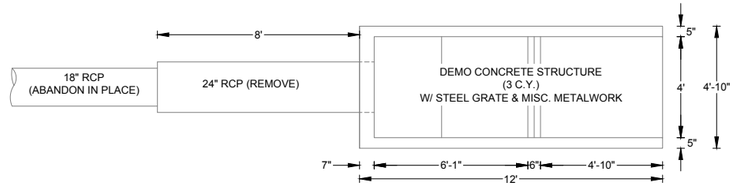
SCALE IN FEET



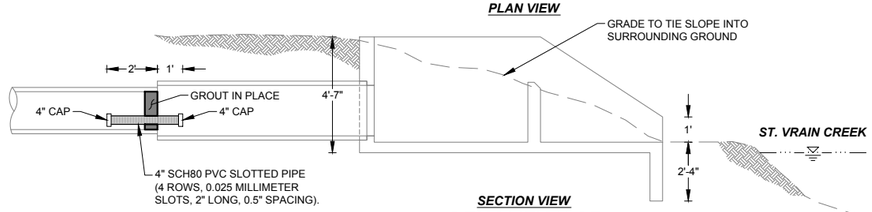
MEASURING FLUME STILLING WELL DETAIL (3 | 10 | 11)

0 2' 4'

SCALE IN FEET



PLAN VIEW



SECTION VIEW

DEMOLITION OF EXISTING CONCRETE MEASUREMENT STRUCTURE (6 | 2 | 11)

0 3' 6'

SCALE IN FEET

NOTES:

1. COORDINATE ACCESS WITH ENGINEER AND PROPERTY OWNER.
2. DEMO STRUCTURE AND PIPE AND DISPOSE OFFSITE.
3. GRADE AREA TO BLEND INTO EXISTING CONTOURS AND PREPARE SURFACE FOR REVEGETATION (BY OTHERS).
4. PROPERTY OWNED BY OLIGARCHY IRRIGATION COMPANY.

NO.	REVISIONS DESCRIPTION	DATE	BY
1	ISSUED FOR BID	10/23/18	MMC

LAKE 4 OUTLET PIPELINE REPLACEMENT

MISCELLANEOUS DETAILS

DEERE & AULT CONSULTANTS, INC.
600 S. AIRPORT RD., BLDG. A, SUITE 205
LONGMONT, CO 80503
TEL 303.651.1468 FAX 303.651.1469

DESIGNED BY: MMC	APPROVED BY: MMC	JOB NO.	SHEET:
DRAWN BY: HOG	DATE: JUNE 2018	0155.005.02	11 of 11
CHECKED BY: MMC	SCALE: AS NOTED		