PROJECT MANUAL FOR:

College and 11th Water Main Replacement

MONTANA STATE UNIVERSITY
BOZEMAN, MONTANA

April 1, 2025

PPA No. 22-0543

MONTANA STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
BOZEMAN, MONTANA
PHONE: (406) 994-5413 FAX: (406) 994-5665

MONTANA
RORY SCOTT ROMEY
No. 40776PE
12/11/2024
LICENSED
PROFESSIONAL ENGINEER

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CONSTRUCTION DRAWINGS

MONTANA
STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
Sixth Avenue and Grant Street
P.O. Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

PERMIT NOTICE

At the time of Bidding, the City of Bozeman, Building Inspection Division, has determined that this project does not require building permits of any kind as the work is considered Repair and Maintenance. Prior to the pre-construction meeting, the successful bidder must obtain a street cut permit and shall have submitted a traffic plan to the city. Should the scope of the project change in the future, additional building permits may be required. Bidders are encouraged to contact the City of Bozeman, Building Inspection Division, for further information regarding permits.

CITY OF BOZEMAN
BUILDING INSPECTION DIVISION
20 EAST OLIVE STREET
SUITE 208
BOZEMAN, MONTANA 59715
(406) 582-2375

MONTANA
STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
Sixth Avenue and Grant Street
P.O. Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

INVITATION TO BID

Sealed bids will be received until **2:00 PM** on **Tuesday, April 15, 2025,** and will be publicly opened and read aloud in the offices of **MSU University Facilities Management, Plew Building, 6th & Grant, Bozeman, Montana**, for: **College & 11th Water Main Replacement, PPA No. 22-0543.**

Bids shall be submitted on the form provided within the Contract Documents. Contract documents may be obtained at the offices of:

Montana State University
UNIVERSITY FACILITIES MANAGEMENT
Plew Building, 6th & Grant
PO Box 172760
Bozeman, Montana 59717-2760

On the web at:
http://www.montana.edu/pdc/bids.html

A PRE-BID WALK-THROUGH IS SCHEDULED FOR Monday, April 7, 2025, AT 10:00 AM PARTICIPANTS SHOULD MEET AT THE PLEW BUILDING. ATTENDANCE IS STRONGLY RECOMMENDED. QUESTIONS RECEIVED AFTER APRIL 7, 2025, WILL BE RESPONDED TO AT THE OWNER'S DISCRETION. Bidders should thoroughly review the contract documents before the pre-bid conference.

Bids equal to or greater than $150,000 must be accompanied by a bid security meeting the requirements of the State of Montana in the amount of 10% of the total bid. After award, the successful bidder must furnish an approved Performance Security and a Labor & Material Payment Security each in the amount of 100% of the contract for contracts equal to or greater than $150,000.

No bidder may withdraw his bid for at least thirty (30) calendar days after the scheduled time for receipt of bids except as noted in the Instructions to Bidders.

The Owner reserves the right to reject any or all bids and to waive any and all irregularities or informalities and the right to determine what constitutes any and all irregularities or informalities.

Time of Completion
Bidder agrees to commence work after receipt of the Contract for Construction, on the specified date of commencement, and to substantially complete the project by **AUGUST 8, 2025**.

The State of Montana makes reasonable accommodations for any known disability that may interfere with an applicant's ability to compete in the bidding and/or selection process. In order for the state to make such accommodations, applicants must make known any needed accommodation to the individual project managers or agency contacts listed in the contract documents.

State of Montana - Montana State University

MONTANA STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

INSTRUCTIONS TO BIDDERS

1. Table of Contents

Provided in the Printed Project Manual:
Invitation to Bid
Instruction to Bidders
Bid Proposal, Form 098
Sample Standard Form of Contract
State of Montana General Conditions
MSU Supplementary Conditions
Specifications
Drawings

These additional forms can be found on our website or will be provided upon request:
http://www.montana.edu/pdc/docs/index.html
Substitution Request, Form 99
Schedule of Values, Form 100
Periodic Estimate for Partial Payment, Form 101
Acknowledgement of Subcontractors, Form 102
Consent of Surety to Final Payment, Form 103
Contract Change Order, Form 104
Contractor's Affidavit, Form 106
Certificate of Substantial Completion, Form 107
Construction Change Directive, Form 109
Request for Information, Form 111
Performance Bond, Form 112
Labor and Material Payment Bond, Form 113
Certificate of Final Acceptance, Form 118
Buy-Safe Montana Form

For most current Montana Prevailing Wage Rates applicable to this project download from this site: http://erd.dli.mt.gov/labor-standards/state-prevailing-wage-rates

2. Viewing of Contract Documents
   2.1. The Contract Documents may be viewed at the following locations:

Builders Exchange of Billings
2050 Broadwater STE A
Billings MT 59102
406/652-1311
bbx@billingsplanroom.com

Bozeman Builders Exchange
1105 Reeves RD W STE 800
Bozeman MT 59718
406/586-7653
exchange@bozemanplanroom.com

Butte Builders Exchange
4801 Hope Road
Butte MT 59701
406/782-5433
butteplans@gmail.com

NW MT - Flathead Builders Exchange
2303 Hwy 2 E
Kalispell, MT 59901
406/755-5888
planex@kalcopy.com

Great Falls Builders Exchange
202 2ND Avenue S
Great Falls MT 59401
406/453-2513
gfbe@greatfallsplans.com

Helena Plans Exchange
1530 Cedar Street Suite C
Helena MT 59601
406/457-2679
helenaplanex@helenacopycenter.com

Missoula Plans Exchange
201 N Russell ST
Missoula MT 59801
406/549-5002
mpe@vemcoinc.com

3. Borrowing of Documents: Up to two hard copy sets may be obtained for General Contractors. Additionally, Contract Documents will be available electronically. If shipping of hard copies is required, it will be at the contractor's expense.

   3.1. Contract Documents may be obtained at the office of:
   MONTANA STATE UNIVERSITY
   UNIVERSITY FACILITIES MANAGEMENT
   PLEW BUILDING 1st FLOOR
   6TH AND GRANT
   BOZEMAN, MONTANA 59717-2760
   406/994-5413

   3.2. All borrowed Contract Documents shall be returned to University Facilities Management within ten (10) calendar days after the bid opening for the deposit refund (if deposit was required). However, if the Contract Documents are not in a condition where they can be reused by the

Owner to construct the project, the Owner may at its sole discretion may retain the deposit or levy costs to contractor in order to reproduce a replacement set.

4. Visits to Site

   4.1. Prospective bidders are requested to contact the following for inspection of the site:

   Ken Chase, Project Manager
   Montana State University
   University Facilities Management
   6th and Grant, PO Box 172760
   Bozeman, Montana 59717-2760
   Ph: 406/994-4480; Fax: 406/994-5665

   4.2. Failure to visit site will not relieve the Contractor of the conditions of the contract.

5. Requests for Substitution

   5.1 Any requests for product substitutions must be submitted on the "Substitution Request" Form 099, to the Architect/Engineer at least ten (10) days prior to the date of the bid opening for consideration by the Architect/Engineer. Any request for substitution made after this time restriction, including those made after award during project construction may be rejected without consideration by either the Architect/Engineer or the Owner.

6. Bids/Proposals

   6.1. The bidder shall submit his bid on the Bid Proposal Form furnished with the Contract Documents.

   6.2. DO NOT send the Contract Documents with the Proposal. The Contract Documents shall be returned as noted in Article 3.2 of the Instructions to Bidders.

   6.3. If the project is funded by any portion of federal funds, the following may apply: on Federally-funded projects, a "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" form must be submitted with the bid proposal. If the debarment form is not included within the Construction Documents, federal funds (if included) do not require the form or are not included in the project and the debarment form is not required.

   6.4. Proposals shall be in a sealed envelope and addressed to:
   STATE OF MONTANA, MONTANA STATE UNIVERSITY
   UNIVERSITY FACILITIES MANAGEMENT
   PLEW BUILDING 1ST FLOOR
   6TH AND GRANT
   PO BOX 172760, BOZEMAN, MONTANA 59717-2760

   6.5. The envelope shall state that it contains a "BID PROPOSAL" and indicate the following information:

   Name of Project: **College & 11th Water Main Replacement**
   Location: **Montana State University Bozeman Campus**
   MSU PPA Project Number: **22-0543**
   Name of Bidder: _____
   Acknowledge Addendum Number: __, __, __, __

   6.6. It is the bidder's responsibility to deliver or ensure delivery of the bid proposal to Montana State University, University Facilities Management. Proposals received after the scheduled closing time for bids by either the bidder, a delivery service (e.g. Federal Express, U.S. Postal Service, United Parcel Service, etc.), or the state's own mail delivery system, will be rejected. Proposals entitled for consideration must be time-stamped in the Owner's office prior to the closing time for receipt of bids. The official time clock for receipt of bids and fax modifications is the Owner's time and date stamp clock located in the reception area of the Owner's office. No other clocks, calendars or timepieces are recognized. All bidders are responsible to ensure all bids and fax modifications are received in the Owner's office prior to the scheduled closing time.

6.7. If requested on the Bid Proposal, any person making a bid to perform the Work shall, as a requirement of a responsible bid, set forth the name of each subcontractor specified in the "List of Subcontractors" which is part of the bid proposal. The bidder shall list only one subcontractor for each such portion or work listed. The bidder whose bid is accepted shall not:

6.7.1. Substitute any other subcontractor in place of the subcontractor listed in the original bid, except by specific consent of the Owner. The Owner, at its sole discretion, may grant substitution with consent of the originally listed subcontractor, or in consideration of other factor(s) involved if deemed relevant to the successful performance of the Contract.

6.7.2. Permit any such subcontract to be voluntarily assigned, transferred or allow it to be performed by any party other than the subcontractor listed in the original bid without the consent of the Owner.

6.8. Bid Proposals entitled to consideration shall be made in accordance with the following instructions:

6.8.1. Made upon form provided;
6.8.2. All blank spaces properly filled;
6.8.3. All numbers stated in both writing and in figures;
6.8.4. Shall contain no additions, conditional or alternate bids, erasures or other irregularities;
6.8.5. Shall acknowledge receipt of all addenda issued.

6.9. Bid Proposals entitled to consideration shall be signed by the proper representative of the firm submitting the proposal as follows:

6.9.1. The principal of a single owner firm;
6.9.2. A principal of a partnership firm;
6.9.3. An officer of an incorporated firm, or an agent whose signature is accompanied by a certified copy of the resolution of the Board of Directors authorizing that agent to sign; or,
6.9.4. Other persons signing for a single-owner firm or a partnership shall attach a power-of-attorney evidencing his authority to sign for that firm.

6.10. Unit Prices: When a Bid Proposal Form contains unit prices, any errors discovered in the extension of those unit prices will be corrected by the Owner using the unit price figures. The adjusted extended amount will then be used to determine the correct total bid. Only after the amounts have been checked and adjusted, if necessary, will the valid low bid be determined.

6.11. Estimated Quantities: All estimated quantities stipulated in the Bid Proposal and other Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the work and for the purpose of comparing proposals submitted for the work. It is understood and agreed that the actual amounts of work done, and materials furnished under unit price items may vary from such estimated quantities. The actual quantities will depend on the conditions encountered at the time the work is performed.

6.12. Any bidder may modify his bid by fax communication only.

6.12.1 It is the bidder’s responsibility to ensure that the entire modification is received at the bid opening location prior to the scheduled closing time for receipt of bids. The modification shall not reveal the bid price but shall only provide the ADDITION or SUBTRACTION from the original proposal.

6.12.2 The Owner is not responsible for the performance of the facsimile/printer machine, maintaining adequate paper levels, toner levels, the telephone connection, quality of the facsimile, or any other factors affecting receipt of the fax. Unreadable or difficult-to-read facsimiles may be rejected at the sole discretion of the Owner.

6.12.3 Changes in the listed subcontractors, if any, shall also be provided.

6.12.4 Bid modifications must be verified by hard copy provided to the Owner within two (2) business days after the bid opening.

6.12.5 Bid modifications shall be directed to fax phone (406) 994-5665.

6.12.6 All facsimiles shall be date and time stamped on the same time-stamp clock in the Owner’s office that is used for receipt of bids in order to be considered valid. The Owner may also use the date and time on the automatically-generated email notification of

facsimile receipt as generated by the State's system. Any date and time indicated at the top of the facsimile on either the bidder's or the Owner's facsimile/printer machine will not be used in determining time of arrival of the modification.

6.13. The Owner reserves the sole right to reject any or all bids and to waive any irregularities or informalities. The Owner also reserves the sole right to determine what constitutes irregularities or informalities and/or what is material and/or immaterial to the bids received.

7. Bid Security

7.1. IF THE PROJECT COST IS LESS THAN $25,000, AT ITS SOLE DISCRETION THE STATE OF MONTANA MAY OR MAY NOT REQUIRE BID SECURITY (18-2-302 MCA).

7.2. Proposals over $150,000 shall be accompanied by a bid security in the amount of 10% of the bid price, as evidence of good faith (18-2-302 MCA).

7.3. Bid security shall be in the form of lawful moneys of the United States, cashier's check, certified check, bank money order or bank draft, bid bond or bonds payable to the State of Montana (18-2-302 MCA).

7.4. If the bidder, to whom a contract is awarded, fails to enter into and execute the proposed contract within fifteen (15) calendar days of award, the bidder shall forfeit the bid security (18-1-204 MCA).

7.5. The bid security of unsuccessful bidders will be returned when the contract has been awarded to the successful bidder or when all bids have been rejected (18-1-205 MCA).

7.6. Execution of and entering into a contract includes providing all necessary insurance certificates, bonds, signed contract and current copy of the construction contractor registration certificate.

7.7. **NOTE: PER STATE POLICY, IF CASH, CHECK, MONEY ORDER, OR BANK DRAFT ARE PROVIDED AS BID SECURITY, IT WILL BE DEPOSITED IN THE TREASURY. UNSUCCESSFUL BIDDERS WILL HAVE THEIR SECURITY RETURNED UPON CONTRACT AWARD. THE SUCCESSFUL BIDDER'S SECURITY MAY BE RETURNED UPON THE SIGNATURE BY BOTH CONTRACTOR AND OWNER ON THE CONTRACT FOR CONSTRUCTION.**

8. Withdrawal of Bids

8.1. Any bidder may withdraw his bid proposal at any time prior to the scheduled closing time for the receipt of bids.

8.2. Once the closing time for the receipt of bids is reached, a bid may not be withdrawn for a period of thirty (30) calendar days.

9. Interpretation of Contract Documents

9.1. Bidders shall promptly notify the Architect/Engineer of any ambiguity, inconsistency, or error which they may discover upon examination of the Contract Documents or of the site and local conditions.

9.2. Bidders requiring clarification or interpretation of the Contract Documents shall request, in writing, clarification from the Architect/Engineer at least ten (10) calendar days prior to the date set for receipt of bids.

9.3. Any interpretations, corrections, or change in the Contract Documents prior to the bid opening will be made by written addendum issued by the Architect/Engineer. The Architect/Engineer will endeavor to notify all plan holders of any addenda issued but it shall be the responsibility of the individual bidders to insure they have received all addenda prior to the submission of their bid.

9.4. All written addenda issued by the Architect/Engineer will become part of the Contract Documents and all bidders shall be bound by such addenda whether or not received and/or acknowledged by the bidder. No oral or telephone modifications of the Contract Documents will be considered or allowed.

10. Award of Bids

10.1. All bids received by the stated hour will be opened and publicly read aloud.

10.2. The Owner reserves the right to reject any and all bids and to waive any informality or irregularity in any bid received. Owner reserves the right to determine what constitutes material and/or immaterial informalities and/or irregularities.

10.3. The low bid shall be determined on the basis of the lowest Base Bid or the lowest combination of Base Bid and Alternate Bids, accepted in consecutive order.

10.4. The Owner shall award such contract to the lowest responsible bidder (18-1-102 MCA).

10.4.1. The Owner may make such investigations as it deems necessary to determine whether or not any or all bidders are responsible.
10.4.2. The term “responsible” does not refer to pecuniary ability only, nor the ability to tender sufficient performance and payment bonds.
10.4.3. The term “responsible” includes, but is not limited to:
10.4.3.1. Having adequate financial resources to perform the contract or the ability to obtain them;
10.4.3.2. Being able to comply with the required delivery, duration, and performance schedule;
10.4.3.3. Having a satisfactory record of integrity and business ethics;
10.4.3.4. Having the necessary organization, experience, accounting, and operational controls;
10.4.3.5. Having the necessary production, construction, technical equipment, and facilities; and,
10.4.3.6. Having the technical skill, ability, capacity, integrity, performance, experience, lack of claims and disputes, lack of actions on bonds, lack of mediations, arbitrations and/or lawsuits related to construction work or performance, and such like.
10.4.4. Bidders shall furnish to the Owner all information and data for this purpose as the Owner may request.
10.4.5. The Owner reserves the right to reject any bid if the investigation or evidence of any Bidder fails to satisfy the Owner that such Bidder is properly and adequately qualified to suitably perform and satisfactorily execute the obligations of the Contract and Work defined in the Contract Documents.

10.5. The Owner shall award such contract to the lowest responsible bidder without regard to residency except on a reciprocal basis: a resident bidder will be allowed a preference on a contract against the bid of any non-resident bidder from any state or country that enforces a preference for resident bidders. The preference given to resident bidders of the State of Montana must be equal to the preference given in the other state or country (18-1-102, MCA). This does not apply when prohibited by Federal requirements.

10.6. The State of Montana may negotiate deductive changes, not to exceed 15% of the total cost of the project, with the lowest responsible bidder when the lowest responsible bids causes the project cost to exceed the appropriation; or with the lowest responsible bidders if multiple contracts will be awarded on the projects when the total of the lowest responsible bids causes the project cost to exceed the appropriation. A bidder is not required to negotiate his bid but is required to honor his bid for the time specified in the bidding documents. The Owner may terminate negotiations at any time (18-2-105(7) MCA).

11. Contract

11.1. The sample Standard Form of Contract between Contractor and Owner, as issued by the Owner, will be used as the contracting instrument and is bound within the Contract Documents.

11.2. The form shall be signed by a proper representative of the bidder as defined above in these instructions.

11.3. The contractor shall also complete and return a federal form W-9 with the Contract.

12. Performance, Labor and Material Payment Security

    12.1. IF THE PROJECT COST IS LESS THAN $150,000, AT ITS SOLE DISCRETION THE STATE OF MONTANA MAY OR MAY NOT REQUIRE A PERFORMANCE OR LABOR AND MATERIAL PAYMENT SECURITY (18-2-201 MCA). (**MSU REQUIRES BONDS ON ALL PROJECTS ABOVE $150,000.)**

    12.2. THE CONTRACTOR SHALL PROVIDE BOTH SECURITIES FOR THIS PROJECT AS SPECIFIED BELOW, UNLESS SPECIFICALLY DIRECTED THAT THIS REQUIREMENT HAS BEEN WAIVED ELSEWHERE IN THESE DOCUMENTS.

    12.3. The Owner shall require the successful bidder to furnish a Performance Bond in the amount of 100% of the contract price as security for the faithful performance of his contract (18-2-201, MCA).

    12.4. The Owner shall require the successful bidder to furnish a Labor and Material Payment Bond in the amount of 100% of the contract price as security for the payment of all persons performing labor and furnishing materials in connection therewith (18-2-201 MCA).

    12.5. The bonds shall be executed on forms furnished by the Owner. No other forms will be acceptable.

    12.6. The bonds shall be signed in compliance with State statutes (33-17-111 MCA).

    12.7. Bonds shall be secured from a State licensed bonding company.

    12.8. Power of Attorney

        12.8.1. Attorneys-in-fact who sign contract bonds must file with each bond a certified and effectively dated copy of their power of attorney;
        12.8.2. One original copy shall be furnished with each set of bonds.
        12.8.3. Others furnished with a set of bonds may be copies of that original.

13. Notice To Proceed

    13.1. The successful bidder who is awarded the contract for construction will **NOT** be issued a Notice to Proceed document for this project. The contract for construction shall include the dates for project commencement and completion and shall serve as a Notice to Proceed for the outlined work.

14. Laws and Regulations

    14.1. The bidders' attention is directed to the fact that all applicable federal and state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over the project shall apply to the contract throughout and will be deemed to be included in this contract as if bound herein in full.

15. Payments

    15.1. NOTICE OF APPROVAL OF PAYMENT REQUEST PROVISION. Per Title 28, Chapter 2, Part 21, this contract allows the Owner to change the number of days to approve a Contractor's payment request. This contract allows the Owner to approve the Contractor's payment request within thirty-five (35) calendar days after it is received by the Owner without being subject to the accrual of interest.

16. Buy Safe Montana Provisions

    16.1. The successful bidder who is awarded the contract for construction shall provide their incident rate, experience modification ratio (EMR) and loss ratio via the Buy-Safe Montana form with the Award documents.

17. Time of Completion

17.1. Bidder agrees to commence work after receipt of the Standard Form of Contract Between Owner and Contractor for Construction upon the specified date of commencement, and to substantially complete the project by **August 8, 2025**.

17.2. If liquidated damages are assessed for exceeding the completion date, they shall accrue at the rate of **ONE HUNDRED AND NO/100 ($100.00) DOLLARS** per calendar day. Liquidated damages charges will be deducted from the amount due the Contractor

~END OF INSTRUCTIONS~

MONTANA
STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
Sixth Avenue and Grant Street
PO Box 172760 • Bozeman, Montana • 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

BID PROPOSAL

College & 11th Water Main Replacement
PPA No. 22-0543

TO:
State of Montana, Montana State University
University Facilities Management
Attn: Contract Administrator
Plew Building, 6th & Grant,
PO Box 172760
Bozeman, Montana 59717-2760

Prospective Bidders:

The undersigned, having familiarized themselves with the Contract Documents, site, location, and conditions of the Work as prepared by **Allied Engineering Services, Inc., 32 Discovery Drive, Bozeman, MT 59718, 406-582-0221,** by submission of this Bid Proposal, hereby agrees to provide all materials, systems, equipment and labor necessary to complete the Work for the total sum as follows:

BASE BID: ABANDON AND REPLACEMENT OF EXISTING WATER MAIN AND ANY OTHER CHANGES AS INDICATED ON THE PLANS.

_____ and _____ /100 DOLLARS
(ALPHA notation)

$_____
(NUMERIC notation)

REMAINDER OF PAGE INTENTIONALLY LEFT BLANK

LIST OF SUBCONTRACTORS

This section must be completed to meet the requirements of a responsive bid (The Owner still retains the right to determine whether or not this requirement is an irregularity or informality in the bids submitted). If work will be performed by the General Contractor, enter the name of the General Contractor. Should Alternates be included in the bid proposal, and the listed subcontractors change based upon the pricing of the alternates, the General Contractor shall provide a listing or notation of the change in subcontractors for each alternate for each description of the work.

DESCRIPTION OF WORK	SUBCONTRACTOR
[i.e. Mechanical insert here]	_____
[i.e. Electrical insert here]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____
[Description of Work]	_____

This bidder acknowledges receipt of the following addenda:

ADDENDUM No.: _____ Dated: _____
ADDENDUM No.: _____ Dated: _____
ADDENDUM No.: _____ Dated: _____

By signing below, the bidder agrees to all terms specified and AGREES TO fulfill the requirements of the CONTRACT in strict accordance with the bidding documents.

Company Name: _____

Business Address: _____

_____

_____

Construction Contractor Registration No.: _____

Phone No.: _____

Fax No.: _____

Email: _____

Date: _____

Bid Proposals entitled to consideration shall be signed by the proper representative of the firm submitting the proposal as follows (Initial which requirement you meet):

☐ The principal of a single owner firm;

☐ A principal of a partnership firm;

☐ An officer of an incorporated firm, or an agent whose signature is accompanied by a certified copy of the resolution of the Board of Directors authorizing that agent to sign; or (attach a copy of the resolution),

☐ Other persons signing for a single-owner firm or a partnership shall attach a power-of-attorney evidencing his authority to sign for that firm.

Signature: _____

Print Name: _____

Title: _____

Contract documents should be sent to the firm representative with information as follows:

Signature: _____

Print Name: _____

Email: _____

MONTANA
STATE UNIVERSITY

FACILITIES SERVICES
Sixth Avenue and Grant Street • PO Box 172760 • Bozeman, Montana 59717-2760
Phone: (406) 994-5413 • Fax: (406) 994-5665

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

(Form Revision Date: February 2025)

ARTICLE 1 – GENERAL PROVISIONS

1.1. BASIC DEFINITIONS

1.1.1. CONTRACT DOCUMENTS. The Contract Documents consist of the Contract between Owner and Contractor (hereinafter the "Contract"), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Contract and Modifications issued after execution of the Contract. A Modification is: (1) a written amendment to the Contract signed by both parties; (2) a Change Order; (3) a Construction Change Directive; or, (4) a written order for a minor change in the Work issued by the Architect/Engineer. The Contract Documents shall include the bidding documents and any alterations made thereto by addenda. In the event of a conflict, discrepancy, contradiction, or inconsistency within the Contract Documents and for the resolution of same, the following order of hierarchy and control shall apply and prevail:

1) Contract; 2) Addenda; 3) Supplementary General Conditions; 4) General Conditions; 5) Specifications; 6) Drawings; 7) Instructions to Bidders; 8) Invitation To Bid; 9) Sample Forms.

1.1.1.1. If a conflict, discrepancy, contradiction, or inconsistency occurs within or between the Specifications and the Drawings, resolution shall be controlled by the following:

1.1.1.1.1. As between figures, dimensions, or numbers given on drawings and any scaled measurements, the figures, dimensions, or numbers shall govern;
1.1.1.1.2. As between large scale drawings and small scale drawings, the larger scale drawings shall govern;
1.1.1.1.3. As between the technical specifications and drawings; the technical specifications shall govern.
1.1.1.1.4. Shop Drawings and Submittals: Shop drawings and other submittals from the Contractor, subcontractors, or suppliers do not constitute a part of the Contract Documents.

1.1.1.2. The Contractor acknowledges, understands and agrees that the Contract Documents cannot be changed except as provided herein by the terms of the Contract. No act(s), action(s), omission(s), or course of dealing(s) by the Owner or Architect/Engineer with the Contractor shall alter the requirements of the Contract Documents and that alteration can be accomplished only through a written Modification process defined herein.

1.1.2. THE DRAWINGS. The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, intent, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.3. THE SPECIFICATIONS. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

1.1.4. THE CONTRACT. The entire Contract for Construction is formed by the Contract Documents. The Contract represents the entire, complete, and integrated agreement between the Owner and Contract

hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between: (1) the Architect/Engineer and Contractor; (2) the Owner and any Subcontractor, Sub-subcontractor, or Supplier; (3) the Owner and Architect/Engineer; or, (4) between any persons or entities other than the Owner and Contractor. However, the Architect/Engineer shall at all times be permitted and entitled to performance and enforcement of its obligations under the Contract intended to facilitate performance of the Architect/Engineer's duties.

1.1.5. THE WORK. The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to completely fulfill the Contract and the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.1.6. THE PROJECT. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.7. TIME. Time is of the essence in performance, coordination, and completion of the Work contemplated herein. The Owner may suffer damages if the Work is not completed as specified herein. When any duration or time period is referred to in the Contract Documents by days, the first day of a duration or time period shall be determined as the day following the current day of any event or notice starting a specified duration. All durations in the Contract Documents are calendar days unless specifically stated otherwise.

1.2. CORRELATION, INTER-RELATIONSHIP, AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1. The intent of the Contract Documents is to include all items and all effort necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and inter-related, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

1.2.2. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. It is the Contractor’s responsibility to control the Work under the Contract.

1.2.3. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3. CAPITALIZATION

1.3.1. Terms capitalized in these General Conditions include those which are: (1) specifically defined; and, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document.

1.4. INTERPRETATION

1.4.1. In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.5. EXECUTION OF THE CONTRACT AND CONTRACT DOCUMENTS

1.5.1. The Contract shall be signed by the Owner and Contractor. Execution of the Contract by the Contractor constitutes the complete and irrevocable binding of the Contractor and his Surety to the Owner for complete performance of the Work and fulfillment of all obligations. By execution of the Contract, the Contractor acknowledges that it has reviewed and familiarized itself with all aspects of the Contract Documents and agrees to be bound by the terms and conditions contained therein.

1.5.2. Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

1.5.3. The Contractor acknowledges that it has taken all reasonable actions necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to: (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, gas, electric power, phone service, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation, topography, and conditions of the ground; and, (5) the character of equipment and facilities needed for performance of the Work. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory geotechnical work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the action described and acknowledged in this paragraph will not relieve the Contractor from responsibility for properly ascertaining and estimating the difficulty and cost of successfully performing the Work or for proceeding to successfully perform the Work without additional expense to the Owner.

1.5.4. The Owner assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Owner, nor does the Owner assume responsibility for any understanding reached or representation made by any of its officers, agents, or employees concerning conditions which can affect the Work unless that understanding or representation is expressly stated in the Contract Documents.

1.5.4.1. Performance of any portion of the Work beyond that required for complying with the specifications and all other requirements of the Contract, shall be deemed to be for the convenience of the Contractor and shall be at the Contractor's sole expense.

1.5.4.2. There shall be no increase in the contract price or time allowed for performance which is for the convenience of the Contractor.

1.6. OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER INSTRUMENTS OF SERVICE

1.6.1. The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect/Engineer and the Architect/Engineer's consultants are Instruments of Service through which the Work to be executed by the Contractor is described. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect/Engineer or the Architect/Engineer's consultants. Unless otherwise indicated, the Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors of them and will retain all common law, statutory and other reserved rights, in addition to the copyrights except as defined in the Owner’s Contract with the Architect/Engineer. All copies of Instruments of Service, except the Contractor's record set, shall be returned or suitably accounted for to the Architect/Engineer upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect/Engineer, and the Architect/Engineer's consultants. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings Specifications and other documents prepared by the Architect/Engineer and the Architect/Engineer's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect/Engineer's or Architect/Engineer's consultants' copyrights or other reserved rights.

1.6.2. Owner's Disclaimer of Warranty: The Owner has requested the Architect/Engineer prepare the Contract Documents for the Project which are adequate for bidding and constructing the Project. However, the Owner makes no representation, guarantee, or warranty of any nature whatsoever to the Contractor concerning such documents. The Contractor hereby acknowledges and represents that it has not, does not, and will not rely upon any such representation, guarantee, or warranty concerning the Contract Documents as no such representation, guarantee, or warranty have been or are hereby made.

ARTICLE 2 – THE OWNER

2.1. THE STATE OF MONTANA

2.1.1. The Owner is the State of Montana and is the sole entity to be identified as Owner in the Contract and as referred to throughout the Contract Documents as if singular in number.

2.1.2. Except as otherwise provided in Subparagraph 4.2.1, the Architect/Engineer does not have authority to bind the Owner. The observations and participations of the Owner or its authorized representative do not alleviate any responsibility on the part of the Contractor. The Owner reserves the right to observe the work and make comment. Any action or lack of action by the Owner shall not be construed as approval of the Contractor's performance.

2.1.3. The Owner reserves the right to require the Contractor, all sub-contractors and material suppliers to provide lien releases at any time. The Owner reserves the right to withhold progress payments until such lien releases are received for all work for which prior progress payments have been made. Upon the Owner's demand for lien releases (either verbally or written), the Contractor, all sub-contractors and material suppliers shall provide such releases with every subsequent application for payment through Final Acceptance of the Project.

2.1.4. Except for permits and fees, including those required under Subparagraph 3.7.1, which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

2.1.5. Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness. Any other information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.1.6. Unless otherwise provided in the Contract Documents, the Contractor will be furnished electronic copies of Drawings and Specifications as are reasonably necessary for execution of the Work.

2.2. OWNER'S RIGHT TO STOP WORK

2.2.1. If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated. However, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3. The issuance of a stop work order by the Owner shall not give rise to a claim by the Contractor or any subcontractor for additional cost, time, or other adjustment.

2.3. OWNER'S RIGHT TO CARRY OUT THE WORK

2.3.1. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a three-day period. If the Contractor within such three-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be

issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and increased costs, and compensation for the Architect/Engineer's additional services made necessary by such default, neglect, or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2.4. **OWNER'S RIGHT TO PERSONNEL**

2.4.1. The Owner reserves the right to have the Contractor and/or subcontractors remove person(s) and/or personnel from any and all work on the project with cause but without cost to the Owner. Such requests from the Owner may be made verbally or in writing and may be done directly with the Contractor or indirectly through the Architect/Engineer. Cause may be, but not limited to, any of the following: incompetence, poor workmanship, poor scheduling abilities, poor coordination, disruption to the facility or others, poor management, causes delay or delays, disruption of the Project, will not strictly adhere to facility procedures and Project requirements either knowingly or unknowingly, insubordination, drug/alcohol use, possession of contraband, belligerent acts or actions, etc. The Contractor shall provide replacement person(s) and/or personnel acceptable to the Owner at no cost to the Owner.

2.4.2. Any issue or circumstance relating to or resulting out of this clause shall not be construed or interpreted to be interference with or impacting upon the Contractor's responsibilities and liabilities under the Contract Documents.

2.4.3. Person(s) and/or personnel who do not perform in accordance with the Contract Documents, shall be deemed to have provided the Owner with cause to have such persons removed from any and all involvement in the Work.

2.4.4. The Contractor agrees to indemnify and hold harmless the Owner from any and all causes of action, demands, claims, damages, awards, attorneys' fees, and other costs brought against the Owner and/or Architect/Engineer by any and all person(s) or personnel as a result of actions under this clause.

ARTICLE 3 – THE CONTRACTOR

3.1. **GENERAL**

3.1.1. The Contractor is the person or entity identified as such in the Contract and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

3.1.2. Construction Contractor Registration: The Contractor is required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. A bidder must demonstrate that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work. If the prevailing bidder cannot or does not register in time for the Owner to execute the Contract within fifteen (15) days of the date on the notice of award, the Owner may award, at its sole discretion, to the next lowest responsible bidder who meets this requirement. The Owner will not execute a contract for construction to a Contractor who is not registered per 39-9-401(a) MCA. It is solely the Contractor's responsibility to ensure that all Subcontractors are registered in accordance with Title 39, Chapter 9, MCA.

3.1.3. The Owner's engagement of the Contractor is based upon the Contractor's representations by submission of a bid to the Owner that it:

3.1.3.1. has the requisite skills, judgment, capacity, expertise, and financial ability to perform the Work;

3.1.3.2. is experienced in the type of labor and services the Owner is engaging the Contractor to perform;

3.1.3.3. is authorized, licensed and registered to perform the type of labor and services for which it is being engaged in the State and locality in which the Project is located;

3.1.3.4. is qualified, willing and able to perform the labor and services for the Project in the manner and scope defined in the Contract Documents; and,

3.1.3.5. has the expertise and ability to provide labor and services that will meet the Owner's objectives, intent and requirements, and will comply with the requirements of all governmental, public, and quasi-public authorities and agencies having or asserting jurisdiction over the Project.

3.1.4. The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.5. The Contractor shall provide on minimum of a bi-weekly basis the onsite Superintendent's daily reports/logs

3.1.6. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect/Engineer in the Architect/Engineer's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.1.7. Quality Control (i.e. ensuring compliance with the Contract Documents) and Quality Assurance (i.e. confirming compliance with the Contract Documents) are the responsibility of the Contractor. Testing, observations, and/or inspections performed or provided by the Owner are solely for the Owner's own purposes and are for the benefit of the Owner. The Owner is not liable or responsible in any form or fashion to the Contractor regarding quality control or assurance or extent of such assurances. The Contractor shall not, under any circumstances, rely upon the Owner's testing or inspections as a substitute or in lieu of its own Quality Control or Assurance programs.

3.1.8. Buy-Safe Montana Provision: The Owner shall review the Buy-Safe Montana Form provided by the Bidder under Articles 16 of the Instructions to Bidders. To promote a safe work environment, the Owner encourages an incidence rate less than the latest average for non-residential building construction for Montana as established by the federal Bureau of Labor Statistics for the prior year; an experience modification rating (EMR) less than 1.0; and a loss ratio of less than 100%. The Contractor with a greater-than-average incidence rate, an EMR greater than 1.0, and a loss ratio of more than 100% shall schedule and obtain a Comprehensive Safety Consultation from the Montana Department of Labor & Industry, Employment Relations Division, Safety Bureau before the Owner grants Substantial Completion of the Work. For assistance in obtaining the Comprehensive Safety Consultation, visit http://erd.dli.mt.gov/safety-health/onsite-consultation.

3.2. REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1. Since the Contract Documents are complementary and inter-related, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relative to that portion of the Work, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions affecting the Work. These obligations are for the purpose of facilitating construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents. However, any errors, inconsistencies or omissions discovered by the Contractor shall be reported promptly to the Architect/Engineer as a request for information in such form as the Architect/Engineer may require.

3.2.2. Any errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect/Engineer, but it is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

3.2.3. If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect/Engineer in response to the Contractor's notices or requests for information pursuant to Subparagraphs 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Subparagraphs 4.3.4 and 4.3.5. If the Contractor fails to perform the obligations of Subparagraphs 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect/Engineer for damages resulting from errors, inconsistencies, or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents

unless the Contractor recognized such error, inconsistency, omission or difference and failed to report it to the Architect/Engineer.

3.2.4. Except as otherwise expressly provided in this Contract, the Contractor assumes all risks, liabilities, costs, and consequences of performing any effort or work in accordance with any written or oral order (including but not limited to direction, instruction, interpretation, or determination) of a person not authorized in writing by the Owner to issue such an order.

3.2.5. By entering into this Contract, the Contractor acknowledges that it has informed itself fully regarding the requirements of the Drawings and Specifications, the General Conditions, the Supplementary General Conditions, all other documents comprising a part of the Contract Documents and all applicable laws, building codes, ordinances and regulations. Contractor hereby expressly acknowledges, guarantees, and warrants to the Owner that:

3.2.5.1. the Contract Documents are sufficient in detail and scope to enable Contractor to construct the finished project;

3.2.5.2. no additional or further work should be required by Owner at the time of Owner's acceptance of the Work; and,

3.2.5.3. when the Contractor's work is finished and the Owner accepts, the Work will be complete and fit for the purpose intended by the Contract Documents. This acknowledgment and guarantee does not imply that the Contractor is assuming responsibilities of the Architect/Engineer.

3.2.6. Sufficiency of Contract Documents: Prior to submission of its bid, and in all events prior to and upon signing the Contract, the Contractor certifies, warrants and guarantees that it has received, carefully reviewed, and evaluated all aspects of the Contract Documents and agrees that said Documents are adequate, consistent, coordinated, and sufficient for bidding and constructing the Work requested, intended, conceived, and contemplated therein.

3.2.6.1. The Contractor further acknowledges its continuing duty to review and evaluate the Contract Documents during the performance of its services and shall immediately notify the Architect/Engineer of any problems, conflicts, defects, deficiencies, inconsistencies, errors, or omissions it discovers in the Contract Documents and the Work to be constructed; and, any variances it discovers between the Contract Documents and applicable laws, statutes, building codes, rules or regulations.

3.2.6.2. If the Contractor performs any Work which it knows or should have known due to its experience, ability, qualifications, and expertise in the construction industry, that involves problems, conflicts, defects, deficiencies, inconsistencies, errors, or omissions in the Contract Documents and the Work to be constructed and, any variances between the Contract Documents and applicable laws, statutes, building codes, rules or regulations, without prior written notification to the Architect/Engineer and without prior authorization to proceed from the Architect/Engineer, the Contractor shall be responsible for and bear the costs and delays (including costs of any delay) of performing such Work and all corrective actions as directed by the Architect/Engineer.

3.2.6.3. Any and all claims resulting from the Contractor’s failure, including those of any subcontractor or supplier, to carefully review, evaluate, and become familiar with all aspects of the Contract Documents shall be deemed void and waived by the Contractor.

3.2.7. Sufficiency of Site Conditions: Prior to submission of its bid, and in all events prior to and upon signing the Contract, the Contractor certifies, warrants and guarantees that it has visited, carefully reviewed, evaluated, and become familiar with all aspects of the site and local conditions at which the Project is to be constructed. The Contractor agrees that the Contract Documents are an adequate, consistent, coordinated, and sufficient representation of the site and local conditions for the Work.

3.2.7.1. The Contractor has reviewed and become familiar with all aspects with the Site Survey and Geotechnical Report for the Project and has a full understanding of the information provided therein.

3.2.7.2. If the Work involves modifications, renovations, or remodeling of an existing structure(s) or other man-made feature(s), the Contractor certifies, warrants and guarantees that it has reviewed, evaluated, and become familiar with all available as-built and record drawings, plans and specifications, and has thoroughly inspected and become familiar with the structure(s) or man-made feature(s).

3.2.7.3. Any and all claims resulting from the Contractor's failure, including those of any subcontractor or supplier, to visit, carefully review, evaluate, and become familiar with all aspects of the site, available geotechnical information, and local conditions at which the Project is to be constructed shall be deemed void and waived by the Contractor.

3.3. SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1. The Contractor shall supervise and direct the Work using the Contractor's best skill and attention recognizing that time and quality are of the essence of the Work. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. It is the responsibility of and incumbent upon the Contractor to ensure, confirm, coordinate, inspect and oversee all Work (which is inclusive of but not limited to all submittals, change orders, schedules, workmanship, and appropriate staffing with enough competent and qualified personnel) so that the Work is not impacted in terms of any delays, costs, damages, or additional time, or effort on the part Architect/Engineer or Owner. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect/Engineer and shall not proceed with that portion of the Work without further written instructions from the Architect/Engineer. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Architect/Engineer or Owner as appropriate shall be solely responsible for any resulting loss or damage. The Contractor will be required to: review any specified construction or installation procedure; advise the Architect/Engineer if the specified procedure deviates from good construction practice; to advise the Architect/Engineer if following the procedure will affect any warranties, including the Contractor's general warranty, or of any objections the Contractor may have to the procedure and shall propose any alternative procedure which the Contractor will warrant and guarantee. The Contractor is required to: review any specified construction or installation procedure; advise the Architect/Engineer if the specified procedure deviates from good construction practice; to advise the Architect/Engineer if following the procedure will affect any warranties, including the Contractor's general warranty, or of any objections the Contractor may have to the procedure and to propose any alternative procedure which the Contractor will warrant.

3.3.2. The Contractor shall furnish management, supervision, coordination, labor and services that: (1) expeditiously, economically, and properly completes the Work; (2) comply with all requirements of the Contract Documents; and, (3) are performed in a quality workmanlike manner and in accordance with the standards currently practiced by persons and entities performing or providing comparable management, supervision, labor and services on projects of similar size, complexity, cost, and nature to this Project. However, the standards currently practiced within the construction industry shall not relieve the Contractor of the responsibility to perform the Work to the level of quality, detail, and excellence defined and intended by the Contract Documents as interpreted by the Architect/Engineer.

3.3.3. All services and labor rendered by the Contractor, including any subcontractors or suppliers, shall be performed under the immediate supervision at the site of persons possessing expertise and the requisite knowledge in the discipline or trade of service being rendered. The Contractor shall maintain such supervision and personnel at all times that the Contractor's personnel, subcontractors, and/or suppliers are at the site. The Contractor shall never be absent from the site during performance of any portion of the Work by any entity under the supervision and direction of the Contractor. Full time attendance by the Contractor from the date of project commencement through Final Acceptance is an explicit requirement of this Contract.

3.3.4. The Contractor shall be responsible to the Owner for acts, damages, errors, and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

3.3.5. The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

3.4. LABOR, WAGES, AND MATERIALS

3.4.1. Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, permits, licenses, goods, products, equipment, tools, construction equipment and machinery, water, heat, all utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work in accordance with the Contract Documents, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.4.2. The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect/Engineer and in accordance with a Change Order. This opportunity to request substitutions does not negate or waive any requirement for the Contractor to follow a pre-bidding “prior approval” requirement nor obligate the Owner to approve any substitution request.

3.4.3. The Contractor shall enforce strict discipline, appropriate behavior, and good order among the Contractor's employees, subcontractors at every tier and level, and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.4.4. Prevailing Wages and Montana Residents.

3.4.4.1. The Contractor and all subcontractors at any level or tier of the Work shall give preference to the employment of bona fide Montana residents in the performance of the Work and shall pay the standard prevailing rate of wages, including fringe benefits for health and welfare and pension contributions and travel allowance provisions in effect and applicable to the county or locality in which the work is being performed. (18-2-403, MCA)

3.4.4.2. At least 50% of the workers, as defined by the Department of Labor & Industry (DOLI), must be bona fide Montana residents. (18-2-401, 18-2-402, MCA)

3.4.4.3. Indian Employment Preference within the Boundaries of an Indian Reservation. All contractors that are awarded a state agency construction contract within the exterior boundaries of an Indian Reservation shall extend a hiring preference to qualified Indians as provided herein:

3.4.4.3.1. “State agency” means a department, office, board, bureau, commission, agency, or other instrumentality of the executive or judicial branches of the government of this State. “Indian” means a person who is enrolled or who is a lineal descendent of a person enrolled in an enrollment listing of the Bureau of Indian Affairs or in the enrollment listing of a recognized Indian tribe domiciled in the United States.

3.4.4.3.2. Qualified Indians – Employment Criteria: An Indian shall be qualified for employment in a permanent, temporary, or seasonal position if he or she has substantially equal qualifications for any position and resides on the reservation where the construction contract is to be performed.

3.4.4.3.3. Non-Applicability: The Indian Employment Preference Policy does not apply to a project partially funded with federal-aid money from the United States Department of Transportation or when residency preference laws are specifically prohibited by federal law. It does not apply to independent contractors and their employees, student interns, elected officials, or appointed positions.

3.4.4.4. The Commissioner of The Montana Department of Labor and Industry (DOLI) has established the standard prevailing rate of wages in accordance with 18-2-401 and 18-2-402, MCA. A copy of the Rates entitled "State of Montana, Prevailing Wage Rates" are bound herein. The Commissioner of the Montana DOLI has established the resident requirements in accordance with 18-2-409, MCA. The Contractor and all subcontractors at any level or tier of the Work

shall direct any and all questions concerning prevailing wage and Montana resident issues for all aspects of the Work to DOLI.

3.4.4.5. The Contractor and all subcontractors at any tier or level of the Work, and as determined by the Montana DOLI, shall classify all workers in the project in accordance with the State of Montana, Prevailing Wage Rates. In the event the Contractor is unable to classify a worker in accordance with these rates he shall contact DOLI for a determination of the classification and the prevailing wage rate to be paid.

3.4.4.6. The Contractor and all subcontractors at any tier or level of the Work shall be responsible for obtaining wage rates for all workers prior to their performing any work on the project. The Contractor is required to pay and insure that its subcontractors at any tier or level and others also pay the prevailing wage determined by the DOLI, insofar as required by Title 18 of the MCA and the pertinent rules and standards of DOLI.

3.4.4.7. It is not the responsibility of the Owner to determine who classifies as a subcontractor, sub-subcontractor, material man, supplier, or any other person involved in any aspect of the Work at any tier or level. All such determinations shall be the sole responsibility of the Contractor, subcontractors, sub-subcontractors, material men, suppliers and others involved in the project at any tier or level. The Contractor, subcontractors, sub-subcontractors, material men, suppliers and others involved in the project shall indemnify and hold harmless the Owner from all claims, attorneys' fees, damages and/or awards involving prevailing wage or Montana resident issues. Any changes to wages or penalties for failure to pay the correct wages will be the sole responsibility of the Contractor and/or his subcontractors and no further charges or claims shall be made to the Owner. If the parties mutually agree or an arbitrator or court determines that any change in wages is due and any part is attributable to the Owner, the Owner's sole liability shall be for the amount of wages ordered only and not for other expenses, charges, penalties, overhead, profit or other mark-ups.

3.4.4.8. In accordance with 18-2-422(1) MCA, each job classification's standard prevailing wage rate, including fringe benefits, that the contractors and employers shall pay during construction of the project is included herein by both reference to DOLI's "Building" or 'Heavy/Highway" schedules and as part of these Contract Documents.

3.4.4.9. The Contractor and every employer, including all subcontractors at any tier or level, is required by 18-2-422(2) MCA to maintain payroll records in a manner readily capable of being certified for submission under 18-2-423 MCA, for a period of not less than 3 years after the contractor's, subcontractor's, or employer's completion of work on the project or the Final Acceptance by the Owner, whichever is later.

3.4.4.10. Each contractor is required by 18-2-422(3) MCA to post in a visible and accessible location a statement of all wages and fringe benefits in compliance with 18-2-423.

3.4.4.11. The contractor and all subcontractors are required by MCA 18-2-417 to make wage rate adjustments for projects with a construction duration exceeding 30 months.

3.5. **WARRANTY AND GUARANTEE**

3.5.1. The Contractor warrants to the Owner and Architect/Engineer that materials and equipment furnished under the Contract will be new and of good quality unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and rejected. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect/Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

3.5.2. The Contractor shall and does hereby warrant and guarantee all work, workmanship, and materials for the full warranty period as specified in the Contract Documents. The warranty period shall be defined as

commencing with Substantial Completion (or with each Substantial Completion if there is more than one) of the Project, or any portion thereof, and continuing for one (1) calendar year from the date of Final Acceptance of the entire project by the Owner. The date of Final Acceptance shall be the date of the Architect/Engineer's signature on the final request for payment unless otherwise agreed upon in writing for the entire project or any portion thereof, by the Owner, Architect/Engineer and Contractor.

3.5.3. In addition to the one (1) calendar year warranty and guarantee specified in this herein above, the Contractor warrants and guarantees all materials and workmanship for the roofing system for a period of two (2) calendar years from the date of Final Acceptance. This warranty shall cover all labor and materials for roof and roofing finish systems (e.g. flashing, terminations, parapet caps, etc.) repairs from moisture penetration and/or defects in workmanship.

3.5.4. Manufacturer and product warranties and guarantees, as provided by the manufacturer or as specified in the Contract Documents, are in addition to the Contractor's warranty.

3.6. TAXES

3.6.1. The Contractor is responsible for and shall pay all sales, consumer, use, and similar taxes for the Work provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.6.2. In compliance with 15-50-206 MCA, the Contractor will have 1% of his **gross** receipts withheld by the Owner from all payments due and sent to the Montana Department of Revenue. Each subcontractor who performs work greater than $80,000 shall have 1% of its gross receipts withheld by the Contractor and sent to the Montana Department of Revenue. The Contractor shall notify the Department of Revenue on the Department's prescribed form.

3.7. PERMITS, FEES, AND NOTICES

3.7.1. Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract, including but not limited to, the building permit fee, electrical, plumbing, sewer connection fee and mechanical permit fee, and any required impact fees and which are legally required when bids are received or negotiations concluded.

3.7.2. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities applicable to performance of the Work.

3.7.3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations, and does so without providing notice to the Architect/Engineer and Owner, the Contractor shall assume responsibility for such Work and shall bear the costs attributable to correction. The Contractor shall be solely responsible to insure that all work it performs is in full compliance with all prevailing and applicable codes and regulations.

3.7.4. Incident Reporting: The Contractor shall immediately notify the Owner and Architect/Engineer, both orally and in writing, of the nature and details of all incidents which may adversely affect the quality or progress of the Work, including, but not limited to, union disputes, accidents, delays, damages to Work, and other significant occurrences. Such notices are in addition to any other notices required regarding claims.

3.8. ALLOWANCES

3.8.1. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct.

3.8.2. Unless otherwise provided in the Contract Documents:

3.8.2.1. allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

3.8.2.2. Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included by the Contractor in the Contract Sum but not in the allowances;

3.8.2.3. whenever costs are more than or less than stated allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect: (1) the difference between actual costs and the allowances under Clause 3.8.2.1; and, (2) changes in Contractor's costs under Clause 3.8.2.2.

3.8.3. Materials and equipment under an allowance shall be selected by the Owner.

3.9. CONTRACTOR'S PERSONNEL

3.9.1. The Contractor shall employ competent personnel, supervisors, project managers, project engineers, project superintendent, and all others who shall be assigned to the Work throughout its duration. Contractor's personnel extend to those employed by the Contractor whether at the site or not. The Owner shall have right to review and approve or reject all replacement of Contractor's personnel. All personnel assigned by the Contractor to the Work shall possess the requisite experience, skills, abilities, knowledge, and integrity to perform the Work.

3.9.2. The superintendent and others as assigned shall be in attendance at the Project site during the performance of any and all Work. The superintendent shall represent the Contractor. All communications given to the Contractor's personnel such as the project manager or the superintendent, whether verbal, electronic or written, shall be as binding as if given to the Contractor.

3.9.3. It is the Contractor's responsibility to appropriately staff, manage, supervise and direct the Work which is inclusive of the performance, acts, and actions of his personnel and subcontractors. As such, the Contractor further agrees to indemnify and hold harmless the Owner and the Architect/Engineer, and to protect and defend both from and against all claims, attorneys' fees, demands, causes of action of any kind or character, including the cost of defense thereof, arising in favor of or against the Owner, Architect/Engineer, Contractor, their agents, employees, or any third parties on account of the performance, behavior, acts or actions of the Contractor's personnel or subcontractors.

3.9.4. Prior to the commencement of any work, the Contractor shall prepare and submit a personnel listing and organizational chart in a format acceptable to the Owner which lists by name, phone number (including cell phone), job category, and responsibility the Contractor's key/primary personnel who will work on the Project. The Contractor shall promptly inform the Owner in writing of any proposed replacements, the reasons therefore, and the name and qualifications of any proposed replacements. The Owner shall have the right to reject any proposed replacements without cost or claim being made by the Contractor. The chart shall be provided to the Owner at the time of the pre-construction conference.

3.9.5. The Contractor shall immediately remove for the duration of the Project, any person making an inappropriate racial, sexual, or ethnic comment, statement, joke, or gesture toward any other individual.

3.9.6. The Contractor shall immediately remove for the duration of the Project, any person who is incompetent, careless, disruptive, or not working in harmony with others.

3.10. CONSTRUCTION SCHEDULES

3.10.1. The Contractor shall, promptly after being awarded the Contract, prepare and submit for the Owner's and Architect/Engineer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and per the requirements of the Contract Documents, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor's schedule shall be in the "Critical Path Method" and shall show the Critical Path of the Work in sufficient detail to evaluate the Contractor's progress. A request for time extension by the Contractor will not be allowed unless a change in the Work is approved by the Owner and materially affects the Critical Path. It is the Contractor's responsibility to demonstrate that any time extensions requests materially affect the Critical Path.

3.10.2. The Contractor shall prepare and keep current, for the Architect/Engineer's approval, a schedule of submittals which is coordinated with the Contractor's Construction Schedule and allows the Architect/Engineer reasonable time to review submittals.

3.10.3. The Contractor shall perform the Work in accordance with the most recent schedule submitted to the Owner and Architect/Engineer.

3.10.4. The Contractor's operations (including but not limited to the Contractor's forces employed, sequences of operations, and methods of operation) at all times during the performance of the contract shall be: (a) subject to the review of the Owner or the Architect/Engineer; and, (b) sufficient to insure the completion of the Work within the specified performance period.

3.10.5. The Critical Path Method Construction Schedule prepared by the Contractor must be in a form that is acceptable to both the Architect/Engineer and the Owner.

3.10.5.1. The Schedule shall show the estimated progress of the entire Project through the individual time periods allowed for completion of each discipline, trade, phase, section, and aspect of the Work.

3.10.5.2. The Schedule shall show percent complete, progress to date, project work, and projected time to complete the work for all activities. The percent complete and minor schedule changes, including additions of activities, change orders, construction change directives, changes to sequences of activities and significant changes in activity demands must be shown by a revised Schedule. A written report providing details about the changes and what actions are anticipated to get the work completed in the contractual time period shall be submitted with the revised schedule.

3.10.5.3. The Construction Schedule shall include coordinate dates for performance of all divisions of the Work, including shipping and delivery, off-site requirements and tasks, so the Work can be completed in a timely and orderly fashion consistent with the required dates of Substantial Completion and Final Acceptance.

3.10.5.4. The Construction Schedule shall include: (i) the required commencement date, the required dates of Substantial Completion(s) and Final Acceptance for the complete Project and all phases (if any); (ii) any guideline and milestone dates required by the Owner or the Contract Documents; (iii) subcontractor and supplier schedules; (iv) a submittal schedule which allows sufficient time for review and action by the Architect/Engineer; (v) the complete sequence of all construction activities with start and completion dates; and, (vi) required decision dates.

3.10.5.5. By receiving, reviewing, and/or commenting on the Construction Schedule or any portion thereof (including logic and resource loading), neither the Owner or Architect/Engineer assume any of the Contractor’s responsibility or liability that the Schedule be coordinated or complete, or for timely and orderly completion of the Work.

3.10.5.6. Receiving, reviewing, and/or commenting on the Schedule, any portion thereof, or any revision thereof, does not constitute an approval, acknowledgement, or acceptance of any duration, dates, milestones, or performance indicated therein.

3.10.5.7. A printout of the Schedule’s logic showing all activities is required with the Schedule and with all updates to the Schedule.

3.10.6. The Contractor shall review and compare, at a minimum on a weekly basis, the actual status of the Work against its Construction Schedule.

3.10.7. The Contractor shall routinely, frequently, and periodically (but not less than monthly) update and/or revise its Construction Schedule to show actual progress of the Work through the date of the update or revision, projected level of completion of each remaining activity, activities modified since the previous update or revision, and major changes in scope or logic. The updated/revised Schedule shall be accompanied by a narrative report which: (1) states and explains any modifications of the critical path, if

any, including any changes in logic; (2) defines problem areas and lists areas of anticipated delays; (3) explains the anticipated impact the change in the critical path or problems and delays will have on the entire Schedule and the completion of the Work; (4) provides corrective action taken or proposed; and, (5) states how problems or delays will be resolved in order to deliver the Work by the required phasing milestones (if any), Substantial Completion(s), and Final Acceptance dates.

3.10.8. Delay in Performance: If at any time the Contractor anticipates that performance of the Work will be delayed or has been delayed, the Contractor shall: (1) immediately notify the Architect/Engineer by separate and distinct correspondence of the probable cause and effect of the delay, and possible alternatives to minimize the delay; and, (2) take all corrective action reasonably necessary to deliver the Work by the required dates. Nothing in this paragraph or the Contract Documents shall be construed by the Contractor as a granting by the Architect/Engineer or Owner of constructive acceleration. The results of failure to anticipate delays, or to timely notify the Owner and Architect/Engineer of an anticipated or real delay, are entirely the responsibility of the Contractor whether compensable or not.

3.10.9. Early Completion: The Contractor may attempt to achieve Substantial Completion(s) on or before the date(s) required in the Contract. However, such early completion shall be for the Contractor's sole convenience and shall not create any real or implied additional rights to Contractor or impose any additional obligations on the Owner or Architect/Engineer. The Owner will not be liable for nor pay any additional compensation of any kind to the Contractor for achieving Substantial Completion(s) or Final Acceptance prior to the required dates as set forth in the Contract. The Owner will not be liable for nor pay any additional compensation of any kind should there by any cause whatsoever that the Contractor is not able to achieve Substantial Completion(s) earlier than the contractually required dates of Substantial Completion(s) or Final Acceptance.

3.10.10. Float in Schedule. Any and all float time in the Contractor's schedule, regardless of the path or activity, shall accrue to the benefit of the Owner and the Work, and not to the Contractor. Float also includes any difference shown between any early completion dates shown on the Contractor's Schedule for any phasing milestone(s), Substantial Completion(s) or Final Acceptance and the dates or durations as required by the Contract Documents.

3.10.11. Modification of Required Substantial Completion(s) or Final Acceptance Dates: Modification of the required dates shall be accomplished only by duly authorized, accepted, and approved change orders stating the new date(s) with specificity on the change order form. All rights, duties, and obligations, including but not limited to the Contractor's liability for actual, delay, and/or liquidated damages, shall be determined in relation to the date(s) as modified.

3.11. DOCUMENTATION AND AS-BUILT CONDITIONS AT THE SITE

3.11.1. The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and accurately marked to record current field changes and selections made during construction, and one record copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect/Engineer or Owner at any time and shall be delivered to the Architect/Engineer for submittal to the Owner upon completion of the Work.

3.11.2. The Owner shall not be required to process final payment until all documentation and data required by the Contract Documents is submitted to and approved by the Architect/Engineer including, but not limited to, the As-Built Drawings. The Owner will not process any final request for payment until the Architect/Engineer has received and verified that the Contractor has performed the requirements pertaining to the as-built drawings.

3.11.3. The as-built drawings shall be neatly and clearly marked during construction to record all deviations, variations, changes, and alterations as they occur during construction along with such supplementary notes and details necessary to clearly and accurately represent the as-built condition. The as-built drawings shall be available at all times to the Owner, Architect/Engineer and Architect/Engineer's consultants.

3.12. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.1. Definitions:

3.12.1.1. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

3.12.1.2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.12.1.3. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.2. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required by the Contract Documents the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect/Engineer is subject to the limitations of Subparagraph 4.2.7. Informational submittals upon which the Architect/Engineer is not expected to take responsive action may be so identified in the Contract Documents. Submittals which are not required by the Contract Documents may be returned by the Architect/Engineer without action.

3.12.3. The Contractor shall review, approve, and submit to the Architect/Engineer, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents within sixty (60) calendar days of the project commencement date unless noted otherwise and shall do so in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Any and all items submitted by the Contractor which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor, or in the opinion of the Architect/Engineer, have not been reviewed for compliance by the Contractor even if marked as such, may be returned by the Architect/Engineer without action and shall not result in any accusation or claim for delay or cost by the Contractor. Any submittal that, in the opinion of the Architect/Engineer, is incomplete in any area or detail may be rejected and returned to the Contractor. It is the responsibility of and incumbent upon the Contractor to ensure and confirm that all submittals are complete, accurate, and in conformance to the Contract Documents prior to submission.

3.12.4. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents and guarantees to the Architect/Engineer and Owner that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.12.5. The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect/Engineer. Should the Contractor, Subcontractors or Sub-subcontractors install, construct, erect or perform any portion of the Work without approval of any requisite submittal, the Contractor shall bear the costs, responsibility, and delay for removal, replacement, and/or correction of any and all items, material, and /or labor.

3.12.6. The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect/Engineer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect/Engineer in writing of such deviation at the time of submittal and: (1) the Architect/Engineer has given written approval to the specific deviation as a minor change in the Work; or, (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect/Engineer's approval thereof.

3.12.7. The Contractor shall direct specific attention, in writing or on re-submitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect/Engineer on previous submittals. In the absence of such written notice the Architect/Engineer's approval of a re-submission shall not apply to such revisions.

3.12.8. The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect/Engineer will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect/Engineer. The Owner and the Architect/Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided the Owner and Architect/Engineer have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this subparagraph, the Architect/Engineer will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents but shall be responsible and held liable for review and verification of all performance or design criteria as required by Paragraph 3.2.

3.12.9. Unless noted otherwise in the Contract Documents, the Contractor shall submit to the Architect/Engineer within sixty (60) days from the date of project commencement electronic copies of all shop/setting drawings, schedules, cut sheets, products, product data, and samples required for the complete Work. Copies shall be reviewed, marked, stamped and approved on each and every copy by the Contractor prior to submission to the Architect/Engineer or they shall be returned without review or action. The Architect/Engineer shall review with reasonable promptness, making corrections, rejections, or other actions as appropriate. The Architect/Engineer’s approval or actions on shop/setting drawings, schedules, cut sheets, products, product data, or samples shall not relieve the Contractor from responsibility for, nor deviating from, the requirements of the plans and specifications. Any deviations from the plans and specifications requested or made by the Contractor shall be brought promptly to the attention of the Architect/Engineer.

3.12.10. Cost for Re-Submissions: the Contractor is responsible for ensuring that all shop drawings, product data, samples, and submittals contain all information required by the Contract Documents to allow the Architect/Engineer to take action. The costs and expenses to the Architect/Engineer for making exhaustive reviews of each Shop Drawing, Product Data item, sample, or submittal of the Contractor may be billed by the Architect/Engineer directly to the Contractor or, if otherwise agreed by the Owner in writing, may be reimbursed by the Owner to the Architect/Engineer and deducted from the Contractor’s contract via change order by the Owner. The Owner will not be liable to the Architect/Engineer for multiple reviews.

3.13. **USE OF SITE**

3.13.1. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

3.13.2. The Contractor shall not damage, endanger, compromise or destroy any part of the Project or the site, including but not limited to work performed by others, monuments, stakes, bench marks, survey points, utilities, existing features or structures. The Contractor shall be fully and exclusively responsible for and bare all costs and delays (including and costs of delay) for any damage, endangerment, compromise, or destruction of any part of the Project or site.

3.14. **CUTTING AND PATCHING**

3.14.1. The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

3.14.2. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.15. CLEAN UP AND SITE CONTROL

3.15.1. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract during performance of the Work and at the direction of the Owner or Architect/Engineer. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.

3.15.2. If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.16. ACCESS TO WORK

3.16.1. The Contractor shall provide the Owner and Architect/Engineer access to the Work at all times wherever located.

3.17. ROYALTIES, PATENTS AND COPYRIGHTS

3.17.1. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect/Engineer harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect/Engineer. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect/Engineer.

3.18. INDEMNIFICATION

3.18.1. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect/Engineer, Architect/Engineer's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph. The Contractor agrees that it will defend, protect, indemnify and save harmless the State of Montana and the Owner against and from all claims, liabilities, demands, causes of action, judgments (including costs and reasonable attorneys' fees), and losses from any cause whatever (including patent, trademark and copyright infringement) except the Owner's sole or partial negligence. This includes any suits, claims, actions, losses, costs, damages of any kind, including the State and Owner's legal expenses, arising out of, in connection with, or incidental to the Contract, but does not include any such suits, claims, actions, losses, costs or damages which are the result of the negligent acts, actions, losses, costs, or damages which are acts, omissions or misconduct of the Owner if they do not arise out of, depend upon or relate to a negligent act, omission or misconduct of the Contractor in whole or in part.

3.18.2. In claims against any person or entity indemnified under this Paragraph 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts

they may be liable, the indemnification obligation under Subparagraph 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 – ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.1. THE ARCHITECT/ENGINEER

4.1.1. The Architect/Engineer is the person lawfully licensed to practice or an entity lawfully practicing identified as such in the Agreement with the Owner and is referred to throughout the Contract Documents as if singular in number. The term "Architect/Engineer" means the Architect/Engineer's duly authorized representative.

4.1.2. Duties, responsibilities and limitations of authority of the Architect/Engineer as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner.

4.1.3. If the employment of the Architect/Engineer is terminated, the Owner shall employ a new Architect/Engineer at the sole choice and discretion of the Owner, whose status under the Contract Documents shall be that of the former Architect/Engineer.

4.2. ARCHITECT/ENGINEER'S ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.2.1. The Architect/Engineer will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative throughout the complete duration of the Project, including the warranty period. The Architect/Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with the Architect/Engineer Contract.

4.2.2. The Architect/Engineer, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations to: (1) become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed; (2) endeavor to guard the Owner against defects and deficiencies in the Work; and, (3) to determine in general if the Work is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Owner and Architect/Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Contractor's Work. The Owner and Architect/Engineer will neither have control over or charge of, nor be responsible for, the construction means, methods, techniques, sequences or procedures, for the safety of any person involved in the work, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

4.2.3. The Architect/Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect/Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

4.2.4. Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect/Engineer about matters arising out of or relating to the Contract. Communications by and with the Architect/Engineer's consultants shall be through the Architect/Engineer. Communications by and with Subcontractors and material suppliers shall be through the Contractor to the Architect/Engineer. Communications by and with separate contractors shall be through the Owner to the Architect/Engineer.

4.2.5. Based on the Architect/Engineer's evaluations of the Contractor's Applications for Payment, the Architect/Engineer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts. The Contractor is fully aware that the Owner (i.e. the State of Montana) has established a billing cycle for processing payments in Article 9 of these General Conditions. The Contractor and all Subcontractors are subject to all provisions of Title 28, Chapter 2, Part 21 MCA regarding all aspects of the Work.

4.2.6. The Architect/Engineer will have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect/Engineer considers it necessary or advisable, the Architect/Engineer will have authority to require inspection or testing of the Work in accordance with the General Conditions and any applicable technical specification requirements, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect/Engineer nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect/Engineer to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

4.2.7. The Architect/Engineer will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect/Engineer's action will be taken with such reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect/Engineer's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect/Engineer's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Architect/Engineer's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect/Engineer, of any construction means, methods, techniques, sequences or procedures. The Architect/Engineer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.2.8. The Architect/Engineer will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

4.2.9. The Architect/Engineer will conduct inspections to determine the date or dates of Substantial Completion(s) and the date of Final Acceptance, will receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

4.2.10. If the Owner and Architect/Engineer agree, the Architect/Engineer will provide one or more project representatives to assist in carrying out the Architect/Engineer's responsibilities. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in the Owner’s Agreement with the Architect/Engineer.

4.2.11. The Architect/Engineer will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the Owner or Contractor. The Architect/Engineer's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect/Engineer shall be furnished in compliance with this Paragraph 4.2, then delay shall not be recognized on account of failure by the Architect/Engineer to furnish such interpretations until 15 days after written request is made for them.

4.2.12. Interpretations and decisions of the Architect/Engineer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect/Engineer will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will render such interpretations and decisions in good faith.

4.2.13. The Architect/Engineer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

4.2.14. The Architect/Engineer's or Owner's observations or inspections do not alleviate any responsibility on the part of the Contractor. The Architect/Engineer and the Owner reserves the right to observe and inspection

the work and make comment. Action or lack of action following observation or inspection is not to be construed as approval of Contractor's performance.

4.3. CLAIMS AND DISPUTES

4.3.1. Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extensions of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes, controversies, and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest solely with the party making the Claim.

4.3.1.1. Time Limits on Claims. Claims by either party must be initiated within 21 calendar days after occurrence of the event giving rise to such claim. The following shall apply to the initiation of a claim:

4.3.1.1.1. A written notice of a claim must be provided to the Architect/Engineer and the other party within 21 calendar days after the occurrence of the event or the claim is waived by the claiming party and void in its entirety.

4.3.1.1.2. Claims must be initiated by separate, clear, and distinct written notice within the 21 calendar day time frame to the Architect/Engineer and the other party and must contain the notarized statement in Sub-Paragraph 4.3.1.5 when the claim is made by the Contractor. Discussions in any form with the Architect/Engineer or Owner, whether at the site or not, do not constitute initiation of a claim. Notes in project meeting minutes, email correspondence, change order proposals, or any other form of documentation does not constitute initiation of a claim. The written notice must be a separate and distinct correspondence provided in hardcopy to both the Architect/Engineer and Owner and must delineate the specific event and outline the causes and reasons for the claim whether or not cost or time have been fully determined. Written remarks or notes of a generic nature are invalid in their entirety. Comments made at progress meetings, project site visits, inspections, emails, voice mails, and other such communications do not meet the requirement of providing notice of claim.

4.3.1.1.3. Physical Injury or Physical Damage. Should the Owner or Contractor suffer physical injury or physical damage to person or property because of any error, omission, or act of the other party or others for whose acts the other party is legally and contractually liable, claim will be made in writing to the other party within a reasonable time of the first observance of such physical injury or physical damage but in no case beyond 30 calendar days of the first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose. In all such cases, the indemnification provisions of the Contract shall be effectual and the Contractor’s insurance shall be primary and in full effect.

4.3.1.2. All Claims must contain sufficient justification and substantiation with the written notice or they may be rejected without consideration by the Architect/Engineer or other party with no additional impact or consequence to the Contract Sum, Contract Time, or matter(s) in question in the Claim.

4.3.1.3. If additional compensation is claimed, the exact amount claimed and a breakdown of that amount into the following categories shall be provided with each and every claim:

4.3.1.3.1. Direct costs (as listed in Subparagraph 7.3.9.1 through 7.3.9.5);
4.3.1.3.2. Indirect costs (as defined in Paragraph 7.2.5); and,
4.3.1.3.3. Consequential items (i.e. time extensions, credits, logic, reasonableness, impacts, disruptions, dilution) for the change.

4.3.1.4. If additional time is claimed the following shall be provided with each and every claim:

4.3.1.4.1. The specific number of days and specific dates for which the additional time is sought;

4.3.1.4.2. The specific reasons, causes, and/or effects whereby the Contractor believes that additional time should be granted; and,

4.3.1.4.3. The Contractor shall provide analyses, documentation, and justification of its claim for additional time in accordance with the latest Critical Path Method schedule in use at the time of event giving rise to the claim.

4.3.1.5. With each and every claim, the Contractor shall submit to the Architect/Engineer and Owner a notarized statement containing the following language:

"Under penalty of law (including perjury and/or false/fraudulent claims against the State), the undersigned,

_____, _____
(Name) (Title)

Of _____ _____
(Company) (Date)

hereby certifies, warrants, and guarantees that this claim made for Work on this Contract is a true statement of the costs, adjustments and/or time sought and is fully documented and supported under the contract between the parties.

_____, _____
(Signature) (Date)"

4.3.2. Continuing Contract Performance.

4.3.2.1. Pending final resolution of a Claim except as otherwise agreed in writing or as provided in Subparagraph 9.7.1 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents on the portion of the Work not involved in a Claim.

4.3.3. Claims for Cost or Time for Concealed or Unknown Conditions.

4.3.3.1. If conditions are encountered at the site which are: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents; or, (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed.

4.3.3.2. The Architect/Engineer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect/Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect/Engineer shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the date of the Architect/Engineer's decision.

4.3.3.3. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect/Engineer for initial determination, subject to further proceedings pursuant to Paragraph 4.4.

4.3.3.4. Nothing in this paragraph shall relieve the Contactor of its obligation to adequately and sufficiently investigate, research, and examine the site, the site survey, topographical

information, and the geotechnical information available whether included by reference or fully incorporated in the Contract Documents.

4.3.4. Claims for Additional Cost.

4.3.4.1. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.6.

4.3.4.2. If the Contractor believes additional cost is involved for reasons including but not limited to: (1) a written interpretation from the Architect/Engineer; (2) an order by the Owner to stop the Work solely for the Owner's convenience or where the Contractor was not at least partially at fault; (3) a written order for a minor change in the Work issued by the Architect/Engineer; (4) failure of payment by the Owner per the terms of the Contract; (5) termination of the Contract by the Owner; or, (6) other reasonable grounds, Claim must be filed in accordance with this Paragraph 4.3.

4.3.5. Claims for Additional Time

4.3.5.1. If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as specified in these General Conditions shall be provided along with the notarized certification. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay for the same event or cause only one Claim is necessary. However, separate and distinct written notice is required for each separate event.

4.3.5.2. Weather Delays:

4.3.5.2.1. If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction activities.

4.3.5.2.2. Inclement or adverse weather shall not be a prima facie reason for the granting of an extension of time, and the Contractor shall make every effort to continue work under prevailing conditions. The Owner may grant an extension of time if an unavoidable delay occurs as a result of inclement/severe/adverse weather and such shall then be classified as a "Delay Day". Any and all delay days granted by the Owner are and shall be non-compensable in any manner or form. The Contractor shall comply with the notice requirements concerning instances of inclement/severe/adverse weather before the Owner will consider a time extension. Each day of inclement/severe/adverse weather shall be considered a separate instance or event and as such, shall be subject to the notice requirements.

4.3.5.2.3. An "inclement", "severe", or "adverse" weather delay day is defined as a day on which the Contractor is prevented by weather or conditions caused by weather resulting immediately there from, which directly impact the current controlling critical-path operation or operations, and which prevent the Contractor from proceeding with at least 75% of the normal labor and equipment force engaged on such critical path operation or operations for at least 60% of the total daily time being currently spent on the controlling operation or operations.

4.3.5.2.4. The Contractor shall consider normal/typical/seasonal weather days and conditions caused by normal/typical/seasonal weather days for the location of the Work in the planning and scheduling of the Work to ensure completion within the Contract Time. No time extensions will be granted for the Contractor's failure to consider and account for such weather days and conditions caused by such weather for the Contract Time in which the Work is to be accomplished.

4.3.5.2.5. A "normal", "typical", or "seasonal" weather day shall be defined as weather that can be reasonably anticipated to occur at the location of the Work for each particular month involved in the Contract Time. Each month involved shall not be

considered individually as it relates to claims for additional time due to inclement/adverse/severe weather but shall consider the entire Contract Time as it compares to normal/typical/seasonal weather that is reasonably anticipated to occur. Normal/typical/seasonal weather days shall be based upon U.S. National Weather Service climatic data for the location of the Work or the nearest location where such data is available.

4.3.5.2.6. The Contractor is solely responsible to document, prepare and present all data and justification for claiming a weather delay day. Any and all claims for weather delay days shall be tied directly to the current critical-path operation or operations on the day of the instance or event which shall be delineated and described on the Critical-Path Schedule and shall be provided with any and all claims. The Contractor is solely responsible to indicate and document why the weather delay day(s) claimed are beyond those weather days which are reasonably anticipated to occur for the Contract Time. Incomplete or inaccurate claims, as determined by the Architect/Engineer or Owner, may be returned without consideration or comment.

4.3.5.3. Where the Contractor is prevented from completing any part of the Work with specified durations or phases due to delay beyond the control of both the Owner and the Contractor, an extension of the contract time or phase duration in an equal amount to the time lost due to such delay shall be the Contractor's sole and exclusive remedy for such delay.

4.3.5.4. Delays attributable to and/or within the control of subcontractors and suppliers are deemed to be within the control of the Contractor.

4.3.5.5. In no event shall the Owner be liable to the Contractor, any subcontractor, any supplier, Contractor's surety, or any other person or organization, for damages or costs arising out of or resulting from: (1) delays caused by or within the control of the Contractor which include but are not limited to labor issues or labor strikes on the Project, federal, state, or local jurisdiction enforcement actions related directly to the Contractor's Work (e.g. safety or code violations, etc.); or, (2) delays beyond the control of both parties including but not limited to fires, floods, earthquakes, abnormal weather conditions, acts of God, nationwide material shortages, actions or inaction by utility owners, emergency declarations by federal, state, or local officials enacted in the immediate vicinity of the project, or other contractors performing work for the Owner.

4.3.6. Claims for Consequential Damages

4.3.6.1. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

4.3.6.1.1. damages incurred by the Owner for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and,

4.3.6.1.2. damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, income, and for loss of profit.

4.3.6.2. This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this waiver of consequential damages shall be deemed to preclude an award of liquidated or actual damages, when applicable, in accordance with the requirements of the Contract Documents.

4.4. RESOLUTION OF CLAIMS, DISPUTES, AND CONTROVERSIES

4.4.1. Decision of Architect/Engineer. Claims, including those alleging an error or omission by the Architect/Engineer, shall be referred initially to the Architect/Engineer for decision. A decision by the Architect/Engineer shall be required as a condition precedent to mediation, arbitration or litigation of all Claims between the Contractor and Owner arising prior to the date of Final Acceptance, unless 30 days have passed after the Claim has been referred to the Architect/Engineer with no decision having been rendered by the Architect/Engineer. The Architect/Engineer will not decide disputes between the

Contractor and persons or entities other than the Owner. Any Claim arising out of or related to the Contract, except those already waived in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5 shall, pending compliance with Subparagraph 4.4.5, be subject to mediation, arbitration, or the institution of legal or equitable proceedings. Claims waived in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4, and 9.10.5 are deemed settled, resolved, and completed.

4.4.2. The Architect/Engineer will review Claims and within ten (10) days of the receipt of the Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party; (2) reject the Claim in whole or in part; (3) approve the Claim; (4) suggest a compromise; or (5) advise the parties that the Architect/Engineer is unable to resolve the Claim if the Architect/Engineer lacks sufficient information to evaluate the merits of the Claim or if the Architect/Engineer concludes that, in the Architect/Engineer's sole discretion, it would be inappropriate for the Architect/Engineer to resolve the Claim.

4.4.3. If the Architect/Engineer requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond within ten (10) days after receipt of such request and shall either provide a response on the requested supporting data, advise the Architect/Engineer when the response or supporting data will be furnished, or advise the Architect/Engineer that no supporting data will be furnished. Upon either no response or receipt of the response or supporting data, the Architect/Engineer will either reject or approve the Claim in whole or in part.

4.4.4. The Architect/Engineer will approve or reject Claims by written decision, which shall state the reasons therefore and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect/Engineer shall be final and binding on the parties but subject to mediation and arbitration.

4.4.5. When 30 days have passed upon submission of a Claim without decision or action by the Architect/Engineer, or the Architect/Engineer has rendered a decision or taken any of the actions identified in Subparagraph 4.4.2, a demand for arbitration of a Claim covered by such decision or action must be made within 30 days after the date of expiration of Subparagraph 4.4.1 or within 30 days of the Architect/Engineer’s decision or action. Failure to demand arbitration within said 30 day period shall result in the Architect/Engineer's decision becoming final and binding upon the Owner and Contractor whenever such decision is rendered.

4.4.6. If the Architect/Engineer renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

4.4.7. Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect/Engineer or the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Architect/Engineer or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

4.4.8. A Claim subject to or related to liens or bonds shall be governed by applicable law regarding notices, filing deadlines, and resolution of such Claim prior to any resolution of such Claim by the Architect/Engineer, by mediation, or by arbitration, except for claims made by the Owner against the Contractor’s bonds.

4.5. **MEDIATION**

4.5.1. Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5 shall, after initial decision by the Architect/Engineer or 30 days after submission of the Claim to the Architect/Engineer, be subject to mediation as a condition precedent to arbitration or the institution of legal or equitable proceedings by either party.

4.5.2. The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect and/or those rules specified in the contract documents or separately agreed upon between the parties. Construction Industry Mediation Rule M-2 (filing with AAA)

is void. The parties shall mutually agree upon a mediator who shall then take the place of AAA in the Construction Industry Mediation Rules. The parties must mutually agree to use AAA and no filing of a request for mediation shall be made to AAA by either party until such mutual agreement has been made. Request for mediation shall be filed in writing with the other party to the Contract and with the American Arbitration Association. The request may be made concurrently with the filing of a demand for arbitration but, in such event, mediation shall proceed in advance of arbitration or legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

4.5.3. The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

4.6. **ARBITRATION**

4.6.1. Any controversy or Claim arising out of or related to this Contract or the breach thereof shall be settled by arbitration in accordance with the Montana Uniform Arbitration Act (MUAA). To the extent it does not conflict with the MUAA, the Construction Industry Arbitration Rules of the American Arbitration Association shall apply except as modified herein. The parties to the arbitration shall bear their own costs and expenses for participating in the arbitration. Costs of the Arbitration panel shall be borne equally between the parties except those costs awarded by the Arbitration panel (including costs for the arbitration itself).

4.6.2. Prior to the arbitration hearing all parties to the arbitration may conduct discovery subject to the provisions of Montana Rules of Civil Procedure. The arbitration panel may award actual damages incurred if a party fails to provide full disclosure under any discovery request. If a party claims a right of information privilege protected by law, the party must submit that claim to the arbitration panel for a ruling, before failing to provide information requested under discovery or the arbitration panel may award actual damages.

4.6.3. The venue for all arbitration proceedings required by this Contract shall be the seat of the county in which the work occurs or the First Judicial District, Lewis & Clack County, as determined solely by the Owner. Arbitration shall be conducted by a panel comprised of three members with one selected by the Contractor, one selected by the Owner, and one selected by mutual agreement of the Owner and the Contractor.

4.6.4. Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Subparagraphs 4.3.6, 7.2.6, 7.3.8, 9.10.4 and 9.10.5, shall, after decision or action by the Architect/Engineer or 30 days after submission of the Claim to the Architect/Engineer, be subject to arbitration provided a demand for arbitration is made within the time frame provided in Subparagraph 4.4.5. If such demand is not made with the specified time frame, the Architect/Engineer's decision or action is final. Prior to arbitration, the parties shall endeavor to resolve disputes by mediation in accordance with the provisions of Paragraph 4.5.

4.6.5. Claims not resolved by mediation shall be decided by arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect and/or those rules specified in the Contract Documents or separately agreed upon between the parties. Construction Industry Arbitration Rule R-3 (filing with AAA) is void. The parties shall mutually agree upon an arbitrator or arbitrators who shall then take the place of AAA in the Construction Industry Arbitration Rules. The parties must mutually agree to use AAA and no filing of a demand for arbitration shall be made to AAA by either party until such mutual agreement has been made. The demand for arbitration shall be filed in writing with the other party to the Contract and a copy shall be filed with the Architect/Engineer.

4.6.6. A demand for arbitration shall be made within the time limits specified in Subparagraphs 4.4.5 and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Paragraph 13.7.

4.6.7. Pending final resolution of a Claim including arbitration, unless otherwise mutually agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract on Work or amounts not in dispute.

4.6.8. **Limitation on Consolidation or Joinder**. Arbitration arising out of or relating to the Contract may include by consolidation or joinder the Architect/Engineer, the Architect/Engineer's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect/Engineer, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Architect/Engineer, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Architect/Engineer, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

4.6.9. **Claims and Timely Assertion of Claims**. The party filing a demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

4.6.10. **Judgment on Final Award**. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. The parties agree that the costs of the arbitrator(s') compensation and expenses shall be borne equally. The parties further agree that the arbitrator(s) shall have authority to award to either party some or all of the costs and expenses involved, including attorney's fees.

ARTICLE 5 – SUBCONTRACTORS

5.1. DEFINITIONS

5.1.1. A Subcontractor is a person or entity who has a direct or indirect contract at any tier or level with the Contractor or any Subcontractor to the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

5.2. AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1. Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract and in no instance later than (30) days after award of the Contract, shall furnish in writing to the Owner through the Architect/Engineer the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect/Engineer will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect/Engineer, after due investigation, has reasonable objection to any such proposed person or entity.

5.2.2. The Contractor shall not contract with a proposed person or entity to which the Owner or Architect/Engineer has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3. If the Owner or Architect/Engineer has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect/Engineer has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner or Architect/Engineer makes reasonable objection to such substitute. The Contractor shall not change or

substitute for a Subcontractor who was required to be listed on the bid without first getting the approval of the Owner.

5.2.5. Buy-Safe Montana Provision: Before commencement of each subcontractor's portion of the Work, the Contractor shall obtain each subcontractor's incidence rate, experience modification rate, and loss ratio. The Contractor shall endeavor--but is not required--to use subcontractors whose incidence rate is less than the latest average for non-residential building construction for Montana as established by the Federal Bureau of Labor Statistics for the prior year; whose experience modification rating (EMR) is less than 1.0; and whose loss ratio is less than 100%. Contractor shall require any of its subcontractors who, based on the safety information that the Contractor obtains, have greater-than-average incidence rate, an EMR greater than 1.0, and a loss ratio of more than 100%, to schedule and obtain a Comprehensive Safety Consultation from the Montana Department of Labor & Industry, Employment Relations Division, Safety Bureau before substantial completion of each such subcontractor's portion of the Work. For assistance in obtaining the Comprehensive Safety Consultation, visit http://erd.dli.mt.gov/safety-health/onsite-consultation.

5.3. SUBCONTRACTUAL RELATIONS

5.3.1. By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect/Engineer. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect/Engineer under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.3.2. Upon written request by the Owner, the Contractor shall require its subcontractors to provide to it performance and payment securities for their portion of the Work in the types and form defined in statute (18-2-201 and 18-2-203 MCA) for all sub-contractual agreements.

5.3.3. The Contractor shall prepare a Subcontractors' and Suppliers' chart in CSI division format acceptable to the Owner which lists by name, all contact information, job category, and responsibility the Contractor's Subcontractors (at all tiers or levels) and Suppliers with a pecuniary interest in the Project of greater than $5,000.00. The Contractor shall not enter into any agreement with any subcontractor or supplier to which the Owner raises a timely objection. The Contractor shall promptly inform the Owner in writing of any proposed replacements, the reasons therefore, and the name and qualifications of any proposed replacements. The Owner shall have the right to reject any proposed replacements without cost or claim being made by the Contractor. The chart shall be provided to the Owner at the time of the pre-construction conference but no less than 30 days after award of the Contract.

5.3.4. All Contractors and Subcontractors to this contract must comply with all Montana Department of Labor and Industry requirements, regulations, rules, and statutes.

5.3.5. In accordance with 39-51-1104 MCA, any Contractor who is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, who contracts with any Subcontractor who also is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, shall withhold sufficient money on the contract to guarantee that all taxes, penalties, and interest are paid upon completion of the contract.

5.3.5.1. It is the duty of any Subcontractor who is or becomes an employer under the provisions of Title 39, Chapter 51 of Montana Code Annotated, to furnish the Contractor with a certification issued by the Montana Department of Labor and Industry, prior to final payment stating that said Subcontractor is current and in full compliance with the provisions of Montana Department of Labor and Industry.

5.3.5.2. Failure to comply shall render the Contractor directly liable for all taxes, penalties, and interest due from the Subcontractor, and the Montana Department of Labor and Industry has all of the remedies of collection against the Contractor under the provisions of Title 39, Chapter 51 of Montana Code Annotated, as though the services in question were performed directly for the Contractor.

5.3.6. In compliance with state statutes (15-50-206 MCA), the Contractor will have the 1% Gross Receipts Tax withheld from all payments. Each "Public Contractor" includes all Subcontractors with contracts greater than $80,000 each. The Contractor and all Subcontractors will withhold said 1% from payments made to all Subcontractors with contracts greater than $80,000.00 and make it payable to the Montana Department of Revenue. The Contractor and all Subcontractors shall also submit documentation of all contracts greater than $80,000.00 to the Montana Department of Revenue on the Department's prescribed form.

5.3.7. Construction Contractor Registration: All Subcontractors at any tier or level are required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. Subcontractors shall demonstrate to the Contractor that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work.

5.4. CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1. Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

5.4.1.1. assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor and Contractor in writing; and,

5.4.1.2. assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2. Upon such assignment, if the Work has been suspended for more than 30 days as a result of the Contractor's default, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension. Such adjustment shall be at the expense of the Contractor.

5.4.3. The Contractor shall engage each of its subcontractors and suppliers with written contracts that preserve and protect the rights of the Owner and include the acknowledgement and agreement of each subcontractor and supplier that the Owner is a third-party beneficiary of their sub-contractual and supplier agreements. The Contractor's agreements shall require that in the event of default by the Contractor or termination of the Contractor, and upon request of the Owner, the Contractor's subcontractors and suppliers will perform services for the Owner.

5.4.4. Construction Contractor Registration: All Subcontractors at any tier or level are required to be registered with the Department of Labor and Industry under 39-9-201 and 39-9-204 MCA prior to the Contract being executed by the Owner. Subcontractors shall demonstrate to the Contractor that it has registered or promises that it will register immediately upon notice of award and prior to the commencement of any work.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1. OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Paragraph 4.3.

6.1.2. When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3. The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.1.4. Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

6.2. MUTUAL RESPONSIBILITY

6.2.1. The Contractor shall afford the Owner and separate contractors reasonable opportunity' for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect/Engineer apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3. The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

6.2.4. The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Paragraph 12.2.

6.2.5. The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Subparagraph 3.14.

6.3. OWNER'S RIGHT TO CLEAN UP

6.3.1. If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect/Engineer will determine the responsibility of those involved and allocate the cost accordingly.

ARTICLE 7 – CHANGES IN THE WORK

7.1. GENERAL

7.1.1. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive, or order for a minor change in the Work subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. Minor changes as ordered by the Architect/Engineer has the definition provided in Paragraph 7.4

7.1.2. A Change Order shall be based upon agreement among the Owner, Contractor, and Architect/Engineer; a Construction Change Directive requires agreement by the Owner and Architect/Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect/Engineer alone.

7.1.3. Changes in the Work shall be performed under applicable provisions of the Contract Documents and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

7.1.4. No act, omission, or course of dealing, shall alter the requirement that Change Orders or Construction Change Directives shall be in writing and signed by the Owner, and that Change Orders and Construction Change Directives are the exclusive method for effecting any adjustment to the Contract. The Contractor understands and agrees that neither the Contract Sum nor the Contract Time can be changed by implication, oral agreement, verbal directive, or unsigned Change Order.

7.2. CHANGE ORDERS

7.2.1. A Change Order is a written instrument prepared by the Architect/Engineer and signed by the Owner, Contractor and Architect/Engineer, stating their agreement upon all of the following:

7.2.1.1. change in the Work;

7.2.1.2. the amount of the adjustment, if any, in the Contract Sum; and,

7.2.1.3. the extent of the adjustment, if any, in the Contract Time.

7.2.2. The cost or credit to the Owner resulting from a change in the Work shall be determined as follows:

7.2.2.1. Per the limitations of this Subparagraph, plus a 5% allowance for overhead and a 10% allowance for profit. The allowances for overhead and for profit are limited to the percentages as specified herein unless they are determined to be unreasonable by the Architect/Engineer (not the Contractor) per Subparagraph 7.3.9 for each Change Order or Construction Change Directive; or,

7.2.2.2. By one of the methods in Subparagraph 7.3.4, or as determined by the Architect/Engineer per Subparagraph 7.3.9, plus a 5% allowance for overhead and a 10% allowance for profit. The allowances for overhead and for profit are limited to the percentages as specified herein unless they are determined to be unreasonable by the Architect/Engineer (not the Contractor) per Subparagraph 7.3.9 for each Change Order or Construction Change Directive.

7.2.2.3. The Contractor's proposed increase or decrease in cost shall be limited to costs listed in Subparagraph 7.3.9.1 through 7.3.9.5.

7.2.3. The Contractor shall not submit any Change Order, response to requested cost proposals, or requested changes which are incomplete and do not contain full breakdown and supporting documentation in the following three areas:

7.2.3.1. Direct costs (only those listed in Subparagraph 7.3.9.1 through 7.3.9.5 are allowable);

7.2.3.2. Indirect costs (limited as a percentage on each Change Order per Paragraph 7.2.2); and

7.2.3.3. Consequential items (e.g. time extensions, credits, logic, reasonableness, impacts, disruptions, dilution).

7.2.4. Any Change Order, responses to requested proposals, or requested changes submitted by the Contractor which, in the opinion of the Architect/Engineer, are incomplete, may be rejected and returned to the Contractor without comment. It is the responsibility of and incumbent upon the Contractor to ensure and confirm that all Change Orders, responses to requested proposals, or requested changes are complete prior to submission.

7.2.5. Overhead, applicable to all areas and sections of the Contract Documents, means "Indirect Costs" as referenced in Subparagraph 7.2.3.2. Indirect costs are inclusive of, but not limited to, the following: home office overhead; off-site supervision; home office project management; change order and/or proposal preparation, design, research, negotiation and associated travel; effects of disruption and dilution of management and supervision off-site; time delays; coordination of trades; postage and shipping; and, effective increase in guarantee and warranty durations. Indirect costs applicable to any and all changes in the work, either through Change Order or Construction Change Directive, are limited to the percentage allowance for overhead in Subparagraph 7.2.2.

7.2.6. By signature on any Change Order, the Contractor certifies that the signed Change Order is complete and includes all direct costs, indirect costs and consequential items (including additional time, if any) and is free and clear of all claims or disputes (including, but not limited to, claims for additional costs, additional time, disruptions, and/or impacts) in favor of the Contractor, subcontractors, material suppliers, or other persons or entities concerning the signed change order and on all previously contracted Work and does release the Owner from such claims or demands.

7.2.7. Any and all changes or adjustments to the Contract Time requested or claimed by the Contractor as a result of a Change Order shall require documentation and justification for the adjustment by a Critical Path Method analysis of the Contractor's most recent Critical Path Schedule in use prior to the change. Changes which affect or concern activities containing float or slack time (i.e. not on the critical path) and which can be accomplished within such float or slack time, shall not result in an increase in the Contract Time.

7.2.8. Supervision means on-site, field supervision and not home office overhead, off-site management or off-site supervision.

7.2.9. Labor means those persons engaged in construction occupations as defined in Montana Prevailing Wage Rates for Building Construction or Heavy/Highway as bound in the Contract Documents and does not include design, engineering, superintendence, management, on-site field supervision, home office or other off-site management, off-site supervision, office or clerical work.

7.3. CONSTRUCTION CHANGE DIRECTIVES

7.3.1. A Construction Change Directive is a written order prepared by the Architect/Engineer directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

7.3.2. Any and all changes or adjustments to the Contract Time requested or claimed by the Contractor as a result of a Construction Change Directive, shall require documentation and justification for the adjustment by a Critical Path Method analysis of the Contractor's most recent Critical Path Schedule in use prior to the change. Changes that affect or concern activities containing float or slack time (i.e. not on the critical path) and which can be accomplished within such float or slack time shall not result in an increase in the Contract Time.

7.3.3. A Construction Change Directive shall be used in the absence of agreement on the terms of a Change Order.

7.3.4. If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

7.3.4.1. mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

7.3.4.2. unit prices stated in the Contract Documents or subsequently agreed upon;

7.3.4.3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee;

7.3.4.4. By actual cost as shown by the Contractor's and Subcontractor's itemized invoices; or

7.3.4.5. as provided in Subparagraph 7.3.9.

7.3.5. Costs shall be limited to the following: cost of materials, including cost of delivery; cost of labor, including social security, old age and unemployment insurance and fringe benefits under collective bargaining agreements; workers' compensation insurance; bond premiums; and rental value of power tools and equipment.

7.3.6. Overhead and profit allowances shall be limited on all Construction Change Directives to those identified in 7.2.2.

7.3.7. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect/Engineer of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

7.3.8. A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

7.3.9. If the Contractor does not respond or disagrees with the method for adjustment in the Contract Sum in writing within seven (7) calendar days, the method and the adjustment made shall be determined by the Architect/Engineer on the basis of reasonable expenditures and/or savings of those performing the Work directly attributable to the change including, in the case of an increase in the Contract Sum, plus an allowance for overhead and profit as listed under Subparagraph 7.2.2. In such case, and also under Clause 7.3.4.3, the Contractor shall keep and present, in such form as the Architect/Engineer may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.9 shall be limited to the following:

7.3.9.1. costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance as determined by the Prevailing Wage Schedules referenced in the Contract Documents;

7.3.9.2. costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

7.3.9.3. rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

7.3.9.4. costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

7.3.9.5. additional costs of field supervision and field office personnel directly attributable to the change.

7.3.10. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect/Engineer plus markups in subparagraph 7.2.2. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net change, if any, with respect to that change.

7.3.11. Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect/Engineer will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with Article 4.

7.3.12. When the Owner and Contractor agree with the determination made by the Architect/Engineer concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

7.4. **MINOR CHANGES IN THE WORK**

7.4.1. The Architect/Engineer will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 – TIME

8.1. **DEFINITIONS**

8.1.1. Time is of the essence in performance, coordination, and completion of the Work contemplated herein. The Owner may suffer damages if the Work is not completed as specified herein. When any duration or time period is referred to in the Contract Documents by days, the first day shall be determined as the day following the current day of any event or notice starting a specified duration.

8.1.2. Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

8.1.3. The date of commencement of the Work is the date established in the ARTICLE 2 OF THE CONTRACT AS ISSUED BY THE OWNER.

8.1.4. The date the Contractor reaches Substantial Completion is the date certified by the Architect/Engineer in accordance with Paragraph 9.8.

8.1.5. The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.1.6. Liquidated Damages. The Owner may suffer loss if the project is not substantially complete on the date set forth in the contract documents. The Contractor and his surety shall be liable for and shall pay to the Owner the sums hereinafter stipulated as liquidated damages for each calendar day of delay until the work is substantially complete: **As indicated in the instructions to bidders.**

8.1.7. The Contractor shall not be charged liquidated or actual damages when delay in completion of the Work is due to:

8.1.7.1. Any preference, priority or allocation order issued by the government;

8.1.7.2. Unforeseeable cause beyond the control and without the fault or negligence of the Contractor, such as acts of God or of the public enemy, fires, floods, epidemics, quarantine restrictions, freight embargoes, and unusually severe weather. All such occurrences resulting in delay must be documented and approved by Change Order; or,

8.1.7.3. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in 8.1.7.1 and 8.1.7.2 of this article.

8.1.8. The Contractor is completely obligated and responsible to provide written notice of each day of delay as provided for in Paragraph 4.3.

8.1.9. Contract Time. All work shall reach Substantial Completion within: Dates provided in Instructions to bidders and Invitation to bid documents. The Owner will issue a Contract for Construction with the specified dates of commencement and completion.

8.2. **PROGRESS AND COMPLETION**

8.2.1. Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Contract, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the date in the Contract and in no case prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance.

8.2.3. The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

8.2.4. If the Contractor falls behind the latest construction schedule by more than 14 calendar days through its own actions or inaction, neglect, inexperience, lack of oversight and management of the Work including that of any Subcontractors, written notice to the Owner and Architect/Engineer shall be provided within three (3) days with explanation of how the Contractor intends to get back on schedule. Response to getting back on schedule consists of providing a sufficient number of qualified workers and/or proper materials or an acceptably reorganized schedule to regain the lost time in a manner acceptable to the Owner.

8.3. **DELAYS AND EXTENSIONS OF TIME**

8.3.1. If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect/Engineer, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending mediation and arbitration, or by other causes which the Architect/Engineer determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect/Engineer may determine.

8.3.2. Claims relating to time shall be made in accordance with applicable provisions of Paragraph 4.3.

8.3.3. This Paragraph 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

PAYMENTS AND COMPLETION

9.1. **CONTRACT SUM**

9.1.1. The Contract Sum is stated in the Contract and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

9.2. **SCHEDULE OF VALUES**

9.2.1. Before the first Application for Payment, the Contractor shall submit to the Architect/Engineer a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect/Engineer may require. This schedule, unless objected to by the Architect/Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

9.3. **APPLICATIONS FOR PAYMENT**

9.3.1. The Contractor shall submit to the Architect/Engineer an itemized Application for Payment for operations completed in accordance with the Schedule of Values. Such application shall be signed and supported by such data substantiating the Contractor's right to payment as the Owner or Architect/Engineer may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

9.3.2. NOTICE OF APPROVAL OF PAYMENT REQUEST PROVISION. Per Title 28, Chapter 2, Part 21, this contract allows the Owner to change the number of days to approve a Contractor's payment request. This contract allows the Owner to approve the Contractor's payment request within thirty-five (35) calendar days after it is received by the Owner without being subject to the accrual of interest.

9.3.3. As provided in Subparagraph 7.3.11, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives, or by interim determinations of the Architect/Engineer, but not yet included in Change Orders.

9.3.4. Applications for payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or material supplier.

9.3.5. Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

9.3.6. The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

9.3.7. Until the work is complete, the Owner will pay 95% of the amount due the Contractor on account of progress payments.

9.3.7.1. If the Work and its progress are not in accordance with all or any part, piece, or portion of the Contract Documents, the Owner may, at its sole discretion and without claim by the Contractor, increase the amount held as retainage to whatever level deemed necessary to effectuate performance and progress of the Work, for anticipated repairs, warranties or completion of the Work by the Contractor or through the letting of other contracts. The Contractor will not be entitled to additional costs, expenses, fees, time, and such like, in the event the Owner increases the amount held as retainage due to non-compliance and/or non-performance with all or any part, piece, or portion of the Contract Documents.

9.3.7.2. Prior to the first application for payment, the Contractor shall submit the following information on the appropriate forms:

9.3.7.2.1. Schedule of Amounts for Contract Payment (Form 100): This form shall contain a breakdown of the labor, material and other costs associated with the various portions of the work and shall be the basis for the progress payments to the Contractor. The use of electronic method shall be in the Owner's format.

9.3.7.2.2. Project/Progress Schedule: If no Schedule (or revised Schedule) is provided with each and every Periodic Estimates for Partial Payment, the Architect/Engineer and/or Owner may return the pay request, or hold it, and may choose not pay for any portion of the Work until the appropriate Schedule, indicating all changes, revisions and updates, is provided. No claim for additional costs or interests will

be made by the Contractor or any subcontractor on account of holding or non-payment of the Periodic Estimate for Partial Payment request.

9.3.7.3. Progress Payments

9.3.7.3.1. Periodic Estimates for Partial Payment shall be on a form provided by the Owner (Form 101) and submitted to the Architect/Engineer for payment by the Owner. Payment shall be requested for the labor and material incorporated in the work to date and for materials suitably stored, less the aggregate of previous payments, the retainage, and the 1% gross receipts tax.

9.3.7.3.2. The Contractor, by submission of any partial pay request, certifies that every request for partial payment is correct, true and just in all respects and that payment or credit had not previously been received. The Contractor further warrants and certifies, by submission of any partial pay request, that all previous work for which payment has been received is free and clear of all liens, disputes, claims, security interests, encumbrances, or causes of action of any type or kind in favor of the Contractor, subcontractors, material suppliers or other persons or entities and does release the Owner from such.

9.3.7.3.3. Progress payments do not constitute official acceptance of any portion of the work or materials whether stored on or off-site.

9.3.7.3.4. In compliance with 15-50-206 MCA, the Contractor will have 1% of his gross receipts withheld by the Owner from all payments due. Each subcontractor who performs work greater than $80,000 shall have 1% of its gross receipts withheld by the Contractor. The Contractor shall notify the Department of Revenue on the department's prescribed forms.

9.3.7.4. The Contractor may submit obligations/securities in a form specified in 18-1-301 Montana Code Annotated (MCA) to be held by a Financial Institution in lieu of retainage by the Owner. The Owner will establish the amount that would otherwise be held as retainage. Should the Contractor choose to submit obligations/securities in lieu of retainage, the Owner will require the Financial Institution to execute the Owner's "Account Agreement for Deposit of Obligations Other Than Retainage" (Form 120) prior to submission of any obligations/securities in accordance with 18-1-302 MCA. The Contractor must extend the opportunity to participate in all obligations/securities in lieu of retainage on a pro rata basis to all subcontractors involved in the project and shall be solely responsible for the management and administration of same. The Owner assumes no liability or responsibility from or to the Contractor or Subcontractors regarding the latter's participation.

9.3.7.5. The Contractor shall maintain a monthly billing cycle.

9.4. CERTIFICATES FOR PAYMENT

9.4.1. The Architect/Engineer will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect/Engineer determines is properly due, or notify the Contractor and Owner in writing of the Architect/Engineer's reasons for withholding certification in whole or in part as provided in Subparagraph 9.5.1. For the purposes of this paragraph regarding certification of payment, electronic mail and/or notes provided through the use of an electronic approval system shall constitute written notice.

9.4.2. The issuance of a Certificate for Payment will constitute a representation by the Architect/Engineer to the Owner, based on the Architect/Engineer's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect/Engineer's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect/Engineer. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect/Engineer has: (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work;

(2) reviewed construction means, methods, techniques, sequences or procedures; (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or, (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

9.5. **DECISIONS TO WITHHOLD CERTIFICATION**

9.5.1. The Architect/Engineer may withhold or reject a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect/Engineer's opinion the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Architect/Engineer is unable to certify payment in the amount of the Application, the Architect/Engineer will notify the Contractor and Owner as provided in Subparagraph 9.4.1. If the Contractor and Architect/Engineer cannot agree on a revised amount, the Architect/Engineer will promptly issue a Certificate for Payment for the amount for which the Architect/Engineer is able to make such representations to the Owner. The Architect/Engineer may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect/Engineer's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Subparagraph 3.3.4, because of:

9.5.1.1. defective Work not remedied;

9.5.1.2. third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

9.5.1.3. failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

9.5.1.4. reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

9.5.1.5. damage to the Owner or another contractor;

9.5.1.6. reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or,

9.5.1.7. persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2. When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.5.3. Owner’s Right to Refuse Payment: The Architect/Engineer’s approval, or partial approval, of the Contractor’s request for payment shall not preclude or prevent the Owner from exercising any of its remedies under this Contract. The Owner shall have right to refuse to make payment(s) to the Contractor due to:

9.5.3.1. the Contractor’s failure to perform the Work in compliance with the Contract Documents;

9.5.3.2. the Contractor’s failure to correct any defective or damaged Work;

9.5.3.3. the Contractor’s failure to accurately represent the Work performed in the pay request;

9.5.3.4. the Contractor’s performance of its Work at a rate or in a manner that, in the Owner’s opinion, is likely to result in the Work, or any portion thereof, to be delayed;

9.5.3.5. the Contractor’s failure to use funds previously paid to it by the Owner to pay for the Contractor’s Work-related obligations including, but not limited to, subcontractors and suppliers on this Project;

9.5.3.6. claims made, or anticipated by the Owner to be made, against the Owner or its property;

9.5.3.7. inclusion in the pay request of any amounts in dispute or part of a claim;

9.5.3.8. Damage or loss caused by the Contractor, including its subcontractors and suppliers; or,

9.5.3.9. The Contractor's failure or refusal to perform its obligations to the Owner.

9.6. PROGRESS PAYMENTS

9.6.1. After the Architect/Engineer has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents or the Owner may take any action the Owner deems necessary under Subparagraph 9.5.3.

9.6.2. The Contractor shall promptly pay each Subcontractor in accordance with Title 28, Chapter 2, Part 21, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

9.6.3. The Contractor is prohibited from holding higher amounts in retainage on any Subcontractor than the Owner is holding from the Contractor.

9.6.4. The Architect/Engineer will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect/Engineer and Owner on account of portions of the Work done by such Subcontractor.

9.6.5. Neither the Owner nor Architect/Engineer shall have an obligation to pay, or to see to the payment of, money to a Subcontractor except as may otherwise be required by law.

9.6.6. Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.6.2, 9.6.3, 9.6.4, and 9.6.5.

9.6.7. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

9.6.8. Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

9.7. FAILURE OF PAYMENT

9.7.1. If the Owner does not approve payment to the Contractor within thirty-five (35) calendar days after the receipt of a certified Application for Payment, then the Contractor may, upon seven additional days' written notice to the Owner and Architect/Engineer, suspend the Work until payment of the amount owing has been received. Nothing in the Subparagraph shall limit the Owner's rights and options as provided in Subparagraph 9.5.3. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

9.8. SUBSTANTIAL COMPLETION

9.8.1. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

9.8.2. When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect/Engineer a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.8.3. Upon receipt of the Contractor's list, the Architect/Engineer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect/Engineer's Inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect/Engineer. In such case, the Contractor shall then submit a request for another inspection by the Architect/Engineer to determine Substantial Completion.

9.8.4. The Contractor shall ensure the project is substantially complete prior to requesting any inspection by the Architect/Engineer so that no more than one (1) inspection is necessary to determine Substantial Completion for all or any portion of the Work. If the Contractor does not perform adequate inspections to develop a comprehensive list as required in Subparagraph 9.8.2 and does not complete or correct such items upon discovery or notification, the Contractor shall be responsible and pay for the costs of the Architect/Engineer's additional inspections to determine Substantial Completion.

9.8.5. When the Work or designated portion thereof is substantially complete, the Architect/Engineer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion and which shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance. After issuance of the Certificate of Substantial Completion, the Contractor shall finish and complete all remaining items within thirty (30) calendar days of the date on the Certificate. The Architect/Engineer shall identify and fix the time for completion of specific items which may be excluded from the thirty (30) calendar day time limit. Failure to complete any items within the specified time frames may be deemed by the Owner as default of the contract on the part of the Contractor.

9.8.6. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety if there are claims or past payment issues, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

9.9. PARTIAL OCCUPANCY OR USE

9.9.1. The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect/Engineer as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect/Engineer.

9.9.2. Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect/Engineer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.9.3. Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10. FINAL COMPLETION AND FINAL PAYMENT

9.10.1. Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect/Engineer will promptly make such inspection and, when the Architect/Engineer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect/Engineer will approve the Contractor's final Certificate for Payment stating that to the best of the Architect/Engineer's knowledge, information and belief, and on the basis of the Architect/Engineer's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect/Engineer's signature on the Contractor's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.2. Neither final payment nor any remaining retainage shall become due until the Contractor submits to the Architect/Engineer:

9.10.2.1. completed Contractor's Affidavit of Completion, Payment of Debts and Claims, and Release of Liens (Form 106) that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied;

9.10.2.2. a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner;

9.10.2.3. a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents

9.10.2.4. Consent of Surety Company to Final Payment (Form 103); and,

9.10.2.5. if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

9.10.3. The Contractor and his surety accepts and assumes responsibility, liability, and costs for and agrees to defend and hold harmless the Owner for and against any and all actions as a result of the Owner making final payment.

9.10.4. By submitting any Application for Payment to the Architect/Engineer the Contractor and his surety certify and declare that all bills for materials, supplies, utilities and for all other things furnished or caused to be furnished by the Contractor and all Subcontractors and used in the execution of the Contract will be fully paid upon receipt of Final Payment and that there are no unpaid obligations, liens, claims, security interests, encumbrances, liabilities and/or demands of State Agencies, subcontractors, suppliers, mechanics, laborers or any others resulting from or arising out of any work done, caused to be done or ordered to be done by the Contractor under the contract.

9.10.5. In consideration of the prior payments and the final payment made and all payments made for authorized changes, the Contractor releases and forever discharges the Owner from any and all obligations, liens, claims, security interests, encumbrances and/or liabilities arising by virtue of the contract and authorized changes between the parties, either verbal or in writing, and any and all claims and demands of every kind and character whatsoever against the Owner, arising out of or in any way relating to the contract and authorized changes.

9.10.6. The date of Final Payment by the Owner shall constitute Final Acceptance of the Work. The determining date for the expiration of the warranty period shall be as specified in Paragraphs 3.5 and 12.2.2.

9.10.7. If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect/Engineer so confirms, the Owner shall, upon application by the Contractor and certification by the Architect/Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect/Engineer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

9.10.8. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

9.10.8.1. liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

9.10.8.2. failure of the Work to comply with the requirements of the Contract Documents; or,

9.10.8.3. terms of special warranties required by the Contract Documents.

9.10.9. Acceptance of final payment by the Contractor, a Subcontractor, or material supplier, shall constitute a waiver of any and all obligations, liens, claims, security interests, encumbrances and/or liabilities against the Owner except those previously made in writing per the requirements of Paragraph 4.3 and as yet unsettled at the time of submission of the final Application for Payment.

9.10.10. The Owner's issuance of Final Payment does not constitute a waiver or release of any kind regarding any past, current, or future claim the Owner may have against the Contractor and/or the surety.

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.1. SAFETY

10.1.1. **Importance of Safety**. The Contractor and all Subcontractors (at any tier or level) recognize that safety is paramount at all times. The Contractor shall perform the work in a safe manner with the highest regard for safety of its employees and all other individuals and property at the work site. Contractor shall maintain its tools, equipment, and vehicles in a safe operating condition and take all other actions necessary to provide a safe working environment for performance of work required under this Contract. The Contractor is solely responsible for the means, methods, techniques, sequences and procedures for coordinating and constructing the Work, including all site safety, safety precautions, safety programs, and safety compliance with OSHA and all other governing bodies.

10.1.2. **Particular Safeguards**. (a). The Contractor shall erect and maintain, as required by Paragraphs 10.1.1 and 10.1.3, safeguards for safety and protection, including posting danger signs and other warnings against hazards, installing suitable barriers and lighting, promulgating safety regulations, and providing notification to all parties who may be impacted by the Contractor's operations. (b) When use or storage of explosives or other Hazardous Materials/Substances (defined below) or equipment are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. (c) The Contractor shall not encumber or load or permit any part of the construction site to be encumbered or loaded so as to endanger the safety of any person(s).

10.1.3. **Compliance with Safety Laws**. Contractor represents and warrants to Owner that it knows and understands all federal, state and local safety statutes, rules, and regulations (Laws) related to the work under this Contract. Contractor shall comply with these Laws. Contractor shall keep all material data safety sheets on site and available at all times.

10.1.4. **Remedy property damage**. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor of any tier or level, or anyone employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.

10.1.5. **Designation of Safety Representative.** Unless the Contractor designates, in writing to the Owner and the Architect/Engineer, another responsible member of the Contractor's organization as the Safety Representative, the Contractor's superintendent is the Safety Representative. The Safety Representative is defined as that member of the Contractor's organization responsible for all safety under this Contract.

10.1.6. **Release/Indemnity of Owner and Architect/Engineer**. The Contractor agrees that the Owner and Architect/Engineer are not responsible for safety at the work site and releases them from all obligations and liability regarding safety at the work site The Contractor shall indemnify and defend the Owner and the Architect/Engineer against and from all claims, liabilities, fines, penalties, orders, causes of action, judgments, losses, costs and expenses (including but not limited to court costs and reasonable attorney fees), arising from injuries and death to any persons and damage to real and personal property arising from, in connection with, or incidental to Contractor's safety responsibilities under this Contract.

10.2. **HAZARDOUS MATERIALS/SUBSTANCES**

10.2.1. "Hazardous Materials/Substances" means any substance: (a) the presence of which requires investigation, or remediation under any federal, state or local statute, rule, regulation, ordinance, order, policy or common law; (b) that is or becomes defined as "hazardous waste," "hazardous substance," pollutant, or contaminant under any federal, state or local statute, rule, regulation, or ordinance or amendments thereto; (c) that is toxic, explosive, corrosive flammable, or otherwise hazardous and is or becomes regulated by any government authority, agency, board, commission or instrumentality of the United States, the state of Montana or any political subdivision thereof; (d) gasoline, diesel fuel or other petroleum hydrocarbons; (e) containing contains polychlorinated biphenyls (PCBs) or asbestos; or (f) the presence of which causes or threatens to cause a nuisance or trespass on the work site or adjacent property.

10.2.2. The Contractor is solely responsible for all compliance with all regulations, requirements, and procedures governing Hazardous Materials/Substances at the Work Site or that Contractor brings on the site. The Contractor is solely responsible for remediation, costs, damages, loss, and/or expenses for all Hazardous Materials/Substances brought to the site. The Contractor shall not and is strictly prohibited from purchasing and/or installing any asbestos-containing materials or products as part of the Work. Should the Contractor do so, the Contractor shall be solely responsible for the immediate remediation and all costs, damages, loss, and/or expenses per Paragraphs 10.1.6, 10.2.2, 10.2.3, and 10.2.4.

10.2.3. If the Contractor encounters Hazardous Materials/Substances during the course of the Work, whether or not identified in the Contract Documents, Work, the Contractor agrees that:

10.2.3.1. Encountering any Hazardous Materials/Substances during performance of the Work does not necessarily mean a change in conditions has occurred, nor is it evidence that the Contractor is due additional Contract Time or an increase in the Contract Sum. If encountering Hazardous Materials/Substances is determined to be a change in conditions to the Contract Documents, Paragraph 4.3 and Article 7 apply in determining any additional compensation or extension of time claimed by the Contractor.

10.2.3.2. The Contractor is solely responsible for securing the Work in accordance with this Article 10 involving any Hazardous Materials/Substances against unlawful, unregulated, or improper intrusion, disturbance, or removal. The Contractor shall implement protections and take protective actions throughout the performance of the Work to prevent exposure to workers, occupants, and contamination of the site or area.

10.2.3.3. If the Contractor is unable to or fails to properly secure the Work against unlawful, unregulated, or improper intrusion, disturbance, or removal of Hazardous Materials/Substances, the Contractor shall immediately implement protections and take protective actions, up to and including stopping Work in the area or on the item affected, to prevent exposure to workers, occupants, and contamination of the site or area. The Contractor shall immediately notify the Owner and Architect in writing giving details of the failure and the corrective actions taken. If the condition is an emergency and notice cannot be provided in writing, then Contractor shall orally and immediately notify the Owner and Architect/Engineer of the condition followed by a full written explanation. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss.

10.2.3.4. If the Contractor notifies the Owner and takes precautions in accordance with this Article 10 upon encountering materials/substances suspected of containing asbestos or polychlorinated biphenyls that are unidentified in the Contract Documents, the Owner shall verify if the unidentified material or substance contains asbestos or polychlorinated biphenyls and shall arrange for the removal or other measures as necessary to allow the Contractor to proceed with the Work. The Contract Time may be extended as appropriate if the Work affected is on the critical path and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs as provided in Article 7. Should the Contractor fail to notify the Owner upon encountering asbestos, polychlorinated biphenyls, or materials/substances suspected of containing asbestos or polychlorinated biphenyls, that are unidentified in the Contract Documents, the Contractor is solely responsible for all mitigation in accordance with Paragraphs 10.1.6, 10.2.2, 10.2.3, and 10.2.4.

10.2.4. The Contractor shall indemnify, hold harmless, and defend the Owner from and against all claims, liabilities, fines, penalties, orders, causes of action, judgments, losses, costs and expenses, including but not limited to court costs and reasonable attorneys' fees, arising from, in connection with, or incidental to the Contractor's handling, disposal, encountering, or release of Hazardous Materials/Substances.

10.3. **UTILITIES**

10.3.1. Underground Utilities: Buried utilities, including, but not limited to, electricity, gas, steam, air, water, telephone, sewer, irrigation, broadband coaxial computer cable, and fiber optic cables are very vulnerable and damage could result in loss of service. The telephone, broadband and fiber optic cables are especially sensitive and the slightest damage to these components will result in disruption of the operations of the campus.

10.3.2. "One Call" must be notified by phone and in writing at least 72 hours (3 business days) prior to digging to arrange and assist in the location of buried utilities in the field. (Dial 811). The Contractor shall mark the boundary of the work area. The boundary area shall be indicated with white paint and white flags. In winter, pink paint and flags will be accepted.

10.3.3. After buried utilities have been located, the Contractor shall be responsible for any utilities damaged while digging. Such responsibility shall include all necessary care including hand digging. Contractor's responsibility shall also include maintaining markings after initial locate. The area for such responsibility, unless otherwise indicated, shall extend 24 inches to either side of the marked center line of a buried utility line.

10.3.4. The Contractor's responsibility shall include repair or replacement of damaged utilities. The Contractor will also be responsible for all costs associated with reterminations and recertification.

10.3.5. Any buried utilities exposed by the operations of the Contractor shall be marked on the plans and adequately protected by the Contractor. If any buried utilities not located are exposed, the Contractor shall immediately contact the Owner and the Architect/Engineer. If, after exposing an unlocated buried utility, the Contractor continues digging without notifying Owner and Architect/Engineer and further damages the utility, the Contractor will be fully and solely responsible.

10.3.6. Damage to irrigation systems during seasons of no irrigation that are not immediately and adequately repaired and tested will require the Contractor to return when the system is in service to complete the repair.

10.3.7. In the event of a planned interruption of any existing utility service, the Contractor shall make arrangements with Owner at least 72 hours (3 business days) in advance. Shutdowns of the broadband or fiber optic cables will normally require 5 working days' notice to the Owner. The Contractor shall bear all costs associated with the interruptions and restorations of service.

ARTICLE 11 - INSURANCE AND BONDS

11.1. **CONTRACTOR'S LIABILITY INSURANCE**

11.1.1. The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the State of Montana with a rating no less than “A-“, such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

11.1.1.1. claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

11.1.1.2. claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

11.1.1.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

11.1.1.4. claims for damages insured by usual personal injury liability coverage;

11.1.1.5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting there from;

11.1.1.6. claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

11.1.1.7. claims for bodily injury or property damage arising out of completed operations; and,

11.1.1.8. claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

11.1.2. The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until termination of any coverage required to be maintained after final payment.

11.1.3. Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies except Workers Compensation required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire at any time prior to Final Acceptance and then not until at least 30 days' prior written notice has been given to the Owner. The Workers Compensation policy will not be canceled or allowed to expire at any time prior to Final Acceptance and then not until at least 30 days' prior written notice has been given to the Owner by the Contractor. If any of the foregoing insurance coverages are required to remain in force after final payment, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.1.4. At the request of the Owner, the Contractor shall provide copies of all insurance policies to the Owner.

11.2. **INSURANCE, GENERAL REQUIREMENTS**

11.2.1. The Contractor shall maintain for the duration of the contract, at its cost and expense, insurance against claims for injuries to persons or damages to property, including contractual liability, which may arise from or in connection with the performance of the Work by the Contractor, its agents, employees, representatives, assigns, or subcontractors. The Contractor is responsible for all deductibles regardless of policy or level of coverage. The Owner reserves the right to demand, and the Contractor agrees to provide, copies of any and all policies at any time.

11.2.2. Hold Harmless and Indemnification: The Contractor shall protect, defend, and save the state, its elected and appointed officials, agents, and employees, while acting within the scope of their duties as such, harmless from and against all claims, liabilities, demands, causes of action, and judgments whatsoever (including the cost of defense and reasonable attorney fees): 1) arising in favor of or asserted by third parties on account of damage to property, personal injury, or death which injury, death, or damage; or, 2) arising out of or resulting from performance or failure to perform, or omissions of services, or in any way results from the negligent acts or omissions of the Contractor, its agents, agents, or subcontractors.

11.2.3. Contractor's Insurance: insurance required under all sections herein shall be in effect for the duration of the contract that extends through the warranty period. Insurance required herein shall be provided by insurance policies issued only by insurance companies currently authorized to do business in the state of Montana. No Contractor or Sub-contractor shall commence any Work under this contract until all required insurance has been obtained. During the term of this contract, the Contractor shall, not less than thirty days prior to the expiration date of any policy for which a certificate of insurance is required, deliver to the Owner a certificate of insurance with respect to the renewal insurance policy. The Contractor shall furnish one copy of insurance certificates of insurance herein required, which shall specifically set forth evidence of all coverage required by these contract documents and which shall be signed by authorized representatives of the insurance company or companies evidencing that insurance as required herein is in force with the exception of Workers Compensation and will not be canceled, limited or restricted without thirty days' written notice by certified mail to the contractor and the Owner. The Workers Compensation policy will not be canceled or allowed to expire at any time prior to Final Acceptance and then not until at least 30 days' prior written notice has been given to the Owner by the Contractor. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits. Additionally, all certificates shall include the project name and A/E project number.

11.2.4. Certificates of Insurance and Endorsements. All certificates of insurance and the additional insured endorsements are to be received by the state prior to issuance of the Contract for Construction. The contractor is responsible to ensure that all policies and coverages contain the necessary endorsements for the State being listed as an additional insured. The state reserves the right to require complete copies of all insurance policies at any time to verify coverage. The contractor shall notify the state within 30 days of any material change in coverage.

11.3. **WORKERS' COMPENSATION INSURANCE**

11.3.1. The Contractor shall carry **Workers' Compensation Insurance**. Such Workers' Compensation Insurance shall protect the Contractor from claims made by his own employees, the employees of any Sub-contractor, and also claims made by anyone directly or indirectly employed by the Contractor or Sub-contractor. The Contractor shall require each Sub-contractor similarly to provide Workers' Compensation Insurance.

11.4. **COMMERCIAL GENERAL LIABILITY INSURANCE**

11.4.1. Each Contractor shall carry per occurrence coverage **Commercial General Liability Insurance** including coverage for premises; operations; independent contractor's protective; products and completed operations; products and materials stored off-site; broad form property damage and comprehensive automobile liability insurance with not less than the following limits of liability:

11.4.1.1. **$1,000,000 per occurrence; aggregate limit of $2,000,000**;

11.4.2. The **Commercial General and Automobile Liability Insurance** shall provide coverage for both bodily injury, including accidental death, sickness, disease, occupational sickness or disease, personal injury liability coverage and property damage which may arise out of the work under this contract, or operations incidental thereto, whether such work and operations be by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by the Contractor or by Sub-contractor, or by anyone for whose acts any of them may be liable. The Contractor shall maintain the liability insurance required herein for a period of not less than one year after final payment or anytime the Contractor goes on to the location of the project.

11.4.3. The Contractor's liability insurance policies shall list the STATE OF MONTANA as an additional insured. **AN ADDITIONAL INSURED ENDORSEMENT DOCUMENT SHALL BE SUBMITTED WITH THE CERTIFICATES OF INSURANCE**. The STATE OF MONTANA includes its officers, elected and appointed officials, employees and volunteers and political subdivisions thereof. Should the Contractor not be able to list the state as an additional insured, the Contractor shall purchase a per occurrence Owner's/Contractor's Protective Policy (OCP) with the STATE OF MONTANA as the insured party in the same occurrence and aggregate limits as that indicated above for the Contractor's Commercial General Liability Policy.

11.4.4. Property damage liability insurance shall be written without any exclusion for injury to or destruction of any building, structure, wires, conduits, pipes, or other property above or below the surface of the ground arising out of the blasting, explosion, pile driving, excavation, filling, grading or from the moving, shoring, underpinning, raising, or demolition of any building or structure or structural support thereof.

11.4.5. The Contractor's insurance coverage shall be PRIMARY insurance as respects the State, its officers, elected and appointed officials, employees and volunteers. Any insurance or self-insurance maintained by the state, its officers, elected and appointed officials, employees and volunteers shall be excess of the Contractor's insurance and shall not contribute to it. NO WAIVERS OF SUBROGATION OR ENDORSEMENTS LIMITING, TRANSFERRING, OR OTHERWISE INDEMNIFYING LIABLE OR RESPONSIBLE PARTIES OF THE CONTRACTOR OR ANY SUBCONTRACTOR WILL BE ACCEPTED.

11.5. **PROPERTY INSURANCE (ALL RISK)**

11.5.1. New Construction (for projects involving new construction): At its sole cost and expense, the contractor shall keep the building and all other improvements on the premises insured throughout the term of the agreement against the following hazards:

11.5.1.1. Loss or damage by fire and such other risks (including earthquake damage for those areas with a shaking level at 10g or above as indicated on the seismic map, NEHRP.pdf (mt.gov).pdf in an amount sufficient to permit such insurance to be written at all times on a replacement cost basis. This may be insured against by attachment of standard form extended coverage endorsement to fire insurance policies. Certificates of Insurance MUST indicate earthquake coverage if coverage is required per the above referenced map.

11.5.1.2. Loss or damage from leakage or sprinkler systems now or hereafter installed in any building on the premises.

11.5.1.3. Loss or damage by explosion of steam boilers, pressure vessels, and oil or gasoline storage tanks, or similar apparatus now or hereafter installed in a building or buildings on the premises.

11.5.2. Building Renovation (for projects involving building renovation or remodeling):

11.5.2.1. The contractor shall purchase and maintain Builder's Risk/Installation insurance on a "special causes of loss" form (so called "all risk") for the cost of the work and any subsequent modifications and change orders. The contractor is not responsible for insuring the existing structure for Builder's Risk/Installation insurance.

11.5.2.2. At its sole cost and expense, the contractor shall insure all property construction on the premises throughout the term of the agreement against the following hazards:

11.5.2.2.1. Loss or damage by fire and such other risks (including earthquake damage for those areas with a shaking level at 10g or above as indicated on the seismic map at http://rmtd.mt.gov/Portal/62/aboutus/publications/files/NEHRP.pdf in an amount sufficient to permit such insurance to be written at all times on a replacement cost basis. This may be insured against by attachment of standard form extended coverage endorsement to fire policies. Certificates of Insurance MUST indicate earthquake coverage if coverage is required per the above referenced map.

11.5.2.2.2. Loss or damage from leakage or sprinkler systems now or hereafter installed in any building on the premises.

11.5.2.2.3. Loss or damage by explosion of steam boilers, pressure vessels, oil or gasoline storage tanks, or similar apparatus now or hereafter installed in a building or buildings on the premises.

11.6. ASBESTOS ABATEMENT INSURANCE

11.6.1. If Asbestos Abatement is identified as part of the Work under this contract, the Contractor or any subcontractor involved in asbestos abatement shall purchase and maintain **Asbestos Liability Insurance** for coverage of bodily injury, sickness, disease, death, damages, claims, errors or omissions regarding the asbestos portion of the work ***in addition to*** the CGL Insurance by reason of any negligence in part or in whole, error or omission committed or alleged to have been committed by the Contractor or anyone for whom the Contractor is legally liable.

11.6.2. Such insurance shall be in "per occurrence" form and shall clearly state on the certificate that asbestos work is included in the following limits:

11.6.2.1. **$1,000,000 per occurrence; aggregate limit of $2,000,000.**

11.6.3. Asbestos Liability Insurance as carried by the asbestos abatement subcontractor in these limits in lieu of the Contractor's coverage is acceptable provided the Contractor and the State of Montana are named as additional insureds and that the abatement subcontractor's insurance is PRIMARY as respects both the Owner and the Contractor. If the Contractor or any other subcontractor encounters asbestos, all operations shall be suspended until abatement with the associated air monitoring clearances are accomplished. The certificate of coverage shall be provided by the asbestos abatement subcontractor to both the Contractor and the Owner.

11.7. PERFORMANCE BOND AND LABOR & MATERIAL PAYMENT BOND (BOTH ARE REQUIRED ON PROJECTS EXCEEDING $150,000.00 IN VALUE)

11.7.1. The Contract shall furnish a Performance Bond in the amount of 100% of the contract price as security for the faithful performance of his contract (18-2-201 MCA). The Contractor shall also furnish a Labor and Material Payment Bond in the amount of 100% of the contract price as security for the payment of all persons performing labor and furnishing materials in connection therewith (18-2-201MCA). The bonds shall be executed on forms furnished by the Owner and no other forms or endorsements will be acceptable. The bonds shall be signed in compliance with state statutes (33-17-1111 MCA). Bonds shall be secured from a state licensed bonding company. Power of Attorney is required with each bond. Attorneys-in-fact who sign contract bonds must file with each bond a certified and effectively dated copy of their power of attorney:

11.7.1.1. one original copy shall be furnished with each set of bonds.

11.7.1.2. Others furnished with a set of bonds may be copies of that original.

11.7.2. The Owner reserves the right at any time during the performance of Work to require bonding of Subcontractors provided by the General Contractor. Should this occur, the Owner will cover the direct cost. This shall not be construed as to in any way affect the relationship between the General Contractor and his Subcontractors.

11.7.3. Surety must have an endorsement stating that their guarantee of Contractor's performance automatically covers the additional contract time added to a Contractor's contract by Change Order.

11.7.4. A change in the Contractor's organization shall not constitute grounds for Surety to claim a discharge of their liability and requires an endorsement from Surety so stating.

11.7.5. Except as noted below, the Contractor is required to notify Surety of any increase in the contract amount resulting from a Change Order within 48 hours of signing and submitting a Change Order and shall submit a copy of Surety's written acknowledgment and consent to Owner before a Change Order can be approved. The Surety's written acknowledgment and consent on the Change Order form shall also satisfy this consent requirement.

11.7.5.1. Surety consent shall not be required on Change Order(s) which, in the aggregate total amount of all Changes Orders, increase the original contract amount by less than 10%. However, the Contractor is still required to notify Surety of any increase in contract amount resulting from a Change Order(s) within 48 hours of signing and submitting every Change Order.

11.7.5.2. Surety is fully obligated to the Owner for the full contract amount, inclusive of all Change Orders, regardless of whether or not written acknowledgement and consent is received and regardless of whether or not the aggregate total of all Change Orders is more or less than 10% of the original contract amount.

11.7.5.3. A fax with hard copy to follow of Surety's written acknowledgment and consent is acceptable. If hard copy is not received by Owner before Application for Payment on any portion or all of said Change Order, it will not be accepted by Owner for payment.

11.7.6. The Surety must take action within 30 days of notice of default on the part of the Contractor or of any claim on bonds made by the Owner or any Subcontractor or supplier.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.1. UNCOVERING OF WORK

12.1.1. If a portion of the Work is covered contrary to the Architect/Engineer's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Architect/Engineer, be uncovered for the Architect/Engineer's examination and be replaced at the Contractor's expense without change in the Contract Time.

12.1.2. If a portion of the Work has been covered which the Architect/Engineer has not specifically requested to examine prior to it being covered, the Architect/Engineer may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

12.2. CORRECTION OF WORK

12.2.1. BEFORE OR AFTER SUBSTANTIAL COMPLETION

12.2.1.1. The Contractor shall promptly correct Work that fails to conform to the requirements of the Contract Documents or that is rejected by the Architect/Engineer, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections and compensation for the Architect/Engineer’s services and expenses made necessary thereby, shall be at the Contractor's expense. The Contractor is responsible to discover and correct all defective work and shall not rely upon the Architect/Engineer’s or Owner’s observations.

12.2.1.2. Rejection and Correction of Work in Progress. During the course of the Work, the Contractor shall inspect and promptly reject any Work that:

12.2.1.2.1. does not conform to the Construction Documents; or,
12.2.1.2.2. does not comply with any applicable law, statute, building code, rule or regulation of any governmental, public and quasi-public authorities, and agencies having jurisdiction over the Project.

12.2.1.3. The Contractor shall promptly correct or require the correction of all rejected Work, whether observed before or after Substantial Completion. The Contractor shall bear all costs of correcting such Work, including additional testing, inspections, and compensation for all services and expenses necessitated by such corrective action.

12.2.2. **AFTER SUBSTANTIAL COMPLETION AND AFTER FINAL ACCEPTANCE**

12.2.2.1. In addition to the Contractor's obligations under Paragraph 3.5, if, within one year after the date of Final Acceptance of the Work or designated portion thereof or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect/Engineer, the Owner may correct it in accordance with Paragraph 2.3.

12.2.2.1.1. The Contractor shall remedy any and all deficiencies due to faulty materials or workmanship and pay for any damage to other work resulting there from, which shall appear within the period of Substantial Completion through one (1) year from the date of Final Acceptance in accordance with the terms and conditions of the Contract and with any special guarantees or warranties provided in the Contract Documents. The Owner shall give notice of observed deficiencies with reasonable promptness. All questions, claims or disputes arising under this Article shall be decided by the Architect/Engineer. All manufacturer, product and supplier warranties are in addition to this Contractor warranty.

12.2.2.1.2. The Contractor shall respond within seven (7) days after notice of observed deficiencies has been given and he shall proceed to immediately remedy these deficiencies.

12.2.2.1.3. Should the Contractor fail to respond to the notice or not remedy those deficiencies; the Owner shall have this work corrected at the expense of the Contractor.

12.2.2.1.4. Latent defects shall be in addition to those identified above and shall be the responsibility of the Contractor per the statute of limitations for a written contract (27-2-208 MCA) starting from the date of Final Acceptance.

12.2.2.2. The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work.

12.2.2.3. The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Paragraph 12.2.

12.2.3. The Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

12.2.4. The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

12.2.5. Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the one-year period for correction of Work as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

12.3. **ACCEPTANCE OF NONCONFORMING WORK**

12.3.1. If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1. GOVERNING LAW

13.1.1. The Contract shall be governed by the laws of the State of Montana and venue for all legal proceedings shall be the First Judicial District, Lewis & Clark County.

13.2. SUCCESSORS AND ASSIGNS

13.2.1. The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempt to make such assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

13.3. WRITTEN NOTICE

13.3.1. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

13.4. RIGHTS AND REMEDIES

13.4.1. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

13.4.2. No action or failure to act by the Owner, Architect/Engineer or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

13.5. TESTS AND INSPECTIONS

13.5.1. Quality Control (i.e. ensuring compliance with the Contract Documents) and Quality Assurance (i.e. confirming compliance with the Contract Documents) are the responsibility of the Contractor. Testing, observations, and/or inspections performed or provided by the Owner are solely for the Owner's own purposes and are for the benefit of the Owner. The Owner is not liable or responsible in any form or fashion to the Contractor regarding quality control or assurance or extent of such assurances. The Contractor shall not, under any circumstances, rely upon the Owner's testing or inspections as a substitute or in lieu of its own Quality Control or Assurance programs.

13.5.2. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect/Engineer timely notice of when and where tests and inspections are to be made so that the Architect/Engineer may be present for such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.3. If the Architect/Engineer, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.2, the Architect/Engineer will, upon written authorization from the Owner, instruct the Contractor to make

arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect/Engineer of when and where tests and inspections are to be made so that the Architect/Engineer may be present for such procedures. Such costs, except as provided in Subparagraph 13.5.4 shall be at the Owner's expense.

13.5.4. If such procedures for testing, inspection or approval under Subparagraphs 13.5.2 and 13.5.3 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect/Engineer's services and expenses shall be at the Contractor's expense.

13.5.5. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect/Engineer.

13.5.6. If the Architect/Engineer is to observe tests, inspections or approvals required by the Contract Documents, the Architect/Engineer will do so promptly and, where practicable, at the normal place of testing.

13.5.7. Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

13.6. **INTEREST**

13.6.1. Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

13.7. **COMMENCEMENT OF STATUTORY LIMITATION PERIOD**

13.7.1. As between the Owner and Contractor:

13.7.1.1. **Before Substantial Completion.** As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

13.7.1.2. **Between Substantial Completion and Final Certificate for Payment.** As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and,

13.7.1.3. **After Final Payment.** As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Paragraph 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

13.8. **PAYROLL AND BASIC RECORDS**

13.8.1. Payrolls and basic records pertaining to the project shall be kept on a generally recognized accounting basis and shall be available to the Owner, Legislative Auditor, the Legislative Fiscal Analyst or his authorized representative at mutually convenient times. Accounting records shall be kept by the Contractor for a period of three years after the date of the Owner's Final Acceptance of the Project.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.1. **TERMINATION BY THE CONTRACTOR**

14.1.1. The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

14.1.1.1. issuance of an order of a court or other public authority having jurisdiction which requires all Work to be stopped; or,

14.1.1.2. an act of government, such as a declaration of national emergency which requires all Work to be stopped.

14.1.2. The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Paragraph 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

14.1.3. If one of the reasons described in Subparagraph 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect/Engineer, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit but not damages.

14.1.4. If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect/Engineer, terminate the Contract and recover from the Owner as provided in Subparagraph 14.1.3.

14.2. **TERMINATION BY THE OWNER FOR CAUSE**

14.2.1. The Owner may terminate the Contract if the Contractor:

14.2.1.1. persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

14.2.1.2. fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

14.2.1.3. persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or,

14.2.1.4. otherwise is guilty of any breach of a provision of the Contract Documents.

14.2.2. When any of the above reasons exist, the Owner, upon certification by the Architect/Engineer that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

14.2.2.1. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

14.2.2.2. accept assignment of subcontracts pursuant to Paragraph 5.4; and,

14.2.2.3. finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

14.2.3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

14.2.4. If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect/Engineer's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect/Engineer, upon application, and this obligation for payment shall survive termination of the Contract.

14.3. **SUSPENSION BY THE OWNER FOR CONVENIENCE**

14.3.1. The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

14.3.2. The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

14.3.2.1. that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or,

14.3.2.2. that an equitable adjustment is made or denied under another provision of the Contract.

14.4. **TERMINATION BY THE OWNER FOR CONVENIENCE**

14.4.1. The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2. Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

14.4.2.1. cease operations as directed by the Owner in the notice;

14.4.2.2. take actions necessary, or that the Owner may direct, for the protection and preservation of the Work, and;

14.4.2.3. except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.4.3. In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination. The Contractor shall provide a full and complete itemized accounting of all costs.

ARTICLE 15 – EQUAL OPPORTUNITY

15.1. The Contractor and all Sub-contractors shall not discriminate against any employee or applicant for employment because of race, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability and shall comply with all Federal and State laws concerning fair labor standards and hiring practices. The Contractor shall ensure that applicants are employed, and that employees are treated during employment, without regard to race, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability.

15.2. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and

selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

15.3. The Contractor and all Sub-contractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, color, sex, pregnancy, childbirth or medical conditions related to pregnancy or childbirth, political or religious affiliation or ideas, culture, creed, social origin or condition, genetic information, sexual orientation, gender identity or expression, national origin, ancestry, age, disability, military service or veteran status, or marital status, or physical or mental disability.

15.4. The contractor shall not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, and the Contractor shall not discriminate during the term of the contract against a firearm entity or firearm trade association. This section shall be construed in accordance with 30-20-301, MCA.

15.4.1. The provisions of 30-20-301, MCA apply only to a contract that:

15.4.1.1. is between a governmental entity and a company with at least 10 full-time employees; and

15.4.1.2. has a value of at least $100,000 that is paid wholly or partly from public funds of the governmental entity.

15.4.2. By the signing the contract, the Contractor certifies and affirms:

15.4.2.1. Contractor does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association during the term of this contract; and

15.4.2.2. Contractor will not discriminate against a firearm entity or firearm trade association during the term of this contract.

15.4.3. The contractor's certification is made in compliance with and in reference to 30-20-301, MCA, and the terms defined therein. If the contractor determines the provisions of 30-20-301, MCA don't apply to the contract, the Contractor shall submit a statement set forth in details the basis for such determination.

[END OF GENERAL CONDITIONS]

MONTANA STATE UNIVERSITY

UNIVERSITY FACILITIES MANAGEMENT
Sixth Avenue and Grant Street • P.O. Box 172760 • Bozeman, Montana 59717-2760
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SUPPLEMENTAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

(REVISED FEBRUARY 2025)

FOR STATE OF MONTANA GENERAL CONDITIONS

ARTICLE 1 – GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.3 SPECIFICATIONS

1.1.3.1 ADD: "Approved": When used to convey Architect's/Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's/Engineer's duties and responsibilities as stated in the Conditions of the Contract.

1.1.3.2 ADD: "Directed": A command or instruction by Architect/Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

1.1.3.3 ADD: "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

1.1.3.4 ADD: "Regulations": Laws ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

1.1.3.5 ADD: "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

1.1.3.6 ADD: "Install": Operations at Project site including unloading, temporarily shoring, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

1.1.3.7 ADD: "Provide": Furnish and install, complete and ready for the intended use.

1.1.3.8 ADD: "Project site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land or portion of the building on which the Project is to be built.

1.6.1 Insert in the sixth line: "All documents which constitute the instruments of service are the property of the Owner." In lieu of the phrase "Unless otherwise indicated, the Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors of them… except as defined in the Owner's Contract with the Architect/Engineer."

ARTICLE 2 – THE OWNER

2.1 THE STATE OF MONTANA

2.1.1.1 ADD: The State of Montana includes its officers, elected and approved officials, employees and volunteers, and political subdivisions thereof. The State of Montana and Montana State University are synonymous throughout the contract documents.

ARTICLE 3 – THE CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.6 ADD: PRODUCT DELIVERY, STORAGE AND HANDLING

3.3.6.1 ADD: Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

3.3.6.2 ADD: DELIVERY AND HANDLING:

3.3.6.2.1 ADD: Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

3.3.6.2.2 ADD: Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3.3.6.2.3 ADD: Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

3.3.6.2.4 ADD: Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and property protected.

3.3.6.3 ADD: STORAGE

3.3.6.3.1 ADD: Store products to allow for inspection and measurement of quantity or counting of units

3.3.6.3.2 ADD: Store materials in a manner that will not endanger Project structure.

3.3.6.3.3 ADD: Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

3.3.6.3.4 ADD: Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

3.3.6.3.5 ADD: Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

3.3.6.3.6 ADD: Protect stored products from damage and liquids from freezing.

3.10 CONSTRUCTION SCHEDULES

3.10.1.1 ADD: A pre-construction meeting will be held at a time mutually agreed upon by the Owner, Architect/Engineer and Contractor at Campus Planning, Design and Construction, Montana State University, Bozeman, Montana. The contractor shall confirm the Contractor's Construction Schedule for the Work. Coordination of operating requirements of the affected buildings, and surrounds, schedule of activities and Owner requirements will be discussed, as well as the order in which the Contractor intends to pursue the work. This schedule will be reviewed and must be mutually agreed upon by the Architect, Contractor and Owner.

3.11 DOCUMENTATION AND AS-BUILT CONDITIONS AT THE SITE

3.11.4 ADD: The contractor shall maintain at the site two (2) construction reference sets of all specifications, drawings, approved shop drawings, change orders and other modifications, addenda, schedules and instructions, in good order.

3.11.4.1 ADD: The record drawings shall be two (2) sets of black (or blue) and white prints of the drawings on which the contractor must record all "red line" changes during the course of construction and will include references to change order numbers, field directives, etc., and their dates. This record set shall be maintained separate and apart from documents used for construction reference. This set will be available for review by the project consultant, architect, engineer and MSU project manager at all times.

3.11.4.2 ADD: All as-built conditions shall be kept current and the contractor shall not permanently conceal or cover any work until all required information has been recorded.

3.11.4.3 ADD: All survey and exterior underground utilities shall be recorded using the spatial reference, Montana State Plane, NAD 83, CORS 96, Lambert Conformal Conic. The National Geodetic Survey publishes NAD 83

coordinates in the metric system (i.e., meters). The conversion factor that should be used to convert between English and metric systems is the international conversion factor of 1 ft. = 0.3048 m. coordinate system.

3.11.4.4 ADD: In marking any as-built conditions, the contractor shall ensure that such drawings indicate by measured dimension to building corners or other permanent monuments the exact locations of all piping, conduit or utilities concealed in concrete slabs, behind walls or ceilings or underground. Record drawings shall be made to scale and shall also include exact locations of valves, pull boxes and similar items as required for maintenance or repair service.

3.11.4.5 ADD: The contractor shall prepare and maintain a binder with all project warranty information. This will be provided to the project consultant, architect or engineer at final acceptance.

3.12.1 DEFINITIONS:

3.12.1.4 ADD: Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

3.12.1.5 ADD: Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

3.12.1.6 ADD: New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

3.12.1.7 ADD: Comparable Products: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

3.12.1.8 ADD: Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specifications.

3.13. <u>USE OF SITE</u>

3.13.3 ADD: MSU BOZEMAN Vehicle Regulations state:

"All students, faculty, staff, and visitors must register any motor vehicle they park on the University campus, for any reason. A visitor is anyone not defined as student, staff or faculty."

All Contractor and Contractor employees shall comply with Montana State University parking regulations. MSU parking permits can be purchased at the Huffman Building at Seventh Avenue and Kagy Boulevard. Contractor should call University Police at 994-2121 for permit information. Violators of MSU Bozeman Vehicle Regulations may be ticketed and towed.

Unless otherwise indicated on the drawings, all Contractor and Contractor employee vehicles on campus shall be parked in designated parking lots. If allowed on the drawings, vehicles to a maximum number stated, may be parked in project site areas designated and shall only be Contractor vehicles with company signs clearly visible. No personal vehicles shall be parked at the project site in any case. If a driver of a vehicle not allowed to be parked at the project site must unload equipment, tools, or materials, the vehicle must be immediately thereafter moved to a designated lot or leave campus. Vehicles parked in the project site, other than those allowed on the drawings, may be ticketed and towed.

Access to the project site shall be only by the route designated on the drawings. In cases where a different route must be used for a specific purpose, permission must be obtained from MSU Facilities Services. In no case will vehicles be used on the Centennial Mall paving. Access routes are for delivery of equipment, tools, and not for parking.

Site staging areas for materials and equipment if permitted, will be designated on the drawings if permitted. If not designated, staging is intended to be in the construction area boundaries. Staged materials and equipment must be secured on the ground surface or in trailers. Site staging areas shall be fenced.

3.13.4 ADD: The Contractor shall coordinate his operations with the Owner in order that the Owner will have maximum use of existing facilities surrounding the area of the Work, as agreed upon, at all times during normal working hours. Contractor further agrees to coordinate his operations so as to avoid interference with the Owner's normal operations to as great an extent as possible.

3.13.5 ADD: By acceptance of MSU Building Keys the Contractor agrees with the following: University keys are the property of Montana State University. Fabricating, duplicating or modifying University keys is prohibited. Doors must remain locked at all times. The use of these keys to allow unauthorized persons to enter the above areas is prohibited. Loss of any key must be reported immediately to the Director, Office of Facilities Services and University Police, if the loss of keys results in re-keying costs, these costs will be charged to the Contractor. **See attached Estimated Re-Keying Costs.**

3.13.6 ADD: The Montana Legislature decreed that the "right to breath smoke-free air has priority over the desire to smoke" (MCA 20-40-102). It is the policy of MSU to promote the health, wellness and safety of all employees, students, guests, visitors, and contractors while on campus. Therefore, the campus will be free of tobacco-use effective August 1, 2012. The use of tobacco (including cigarettes, cigars, pipes, smokeless tobacco and all other tobacco products) by students, faculty, staff, guests, visitors, and contractors is prohibited on all properties owned or leased by MSU.

Littering any university property, whether owned or leased, with the remains of tobacco products is prohibited.

All university employees, students, visitors, guests, and contractors are required to comply with this policy, which shall remain in effect at all times. Refusal to comply with this policy may be cause for disciplinary action in accordance with employee and student conduct policies. Refusal to comply with the policy by visitors, guests and contractors may be grounds for removal from campus. (http://www2montana.edu/policy/smoking_facilities/)

3.13.7 ADD: The Contractor may use the University's toilet facilities only as directed by the Owner.

ARTICLE 4 – ADMINISTRATION OF THE CONSTRUCTION CONTRACT

4.6. ARBITRATION

4.6.3 Insert in the second line "the Eighteenth Judicial District, Gallatin County" in lieu of "First Judicial District, Lewis & Clark County."

4.6.11 ADD: In responding to a claim brought by a Contractor, the Owner shall have a minimum of forty-five (45) days in which to respond to a revised claim prior to the arbitration hearing.

ARTICLE 7 – CHANGES IN WORK

7.2 CHANGE ORDERS

7.2.2.1 Insert the word "maximum" before "5%" and insert the word "maximum" before "10%".

7.2.2.4 ADD: Total Change Order markup shall not exceed (cost of the work) x 1.15.

7.2.3.1 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.2 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.3 Insert at the beginning of the first sentence the word "Itemized".

7.2.3.4 ADD: The Contractor shall provide a complete description summarizing all work involved.

ARTICLE 8 - TIME

8.1. DEFINITIONS

8.1.8.1 ADD: Work commenced before receipt and signature by all parties of the Contract for Construction will be entirely at the Contractor's risk.

8.2. PROGRESS AND COMPLETION

8.2.5 ADD: Completion of the work within the stated time and/or by the date stated in the executed Contract for Construction is of the essence of this Contract and failure to complete, without approved time extension, may be considered default of the Contract. At the time for completion as stated in the executed Contract or as extended by approved change order, if the work is not substantially complete, the Owner may notify the Contractor and the Contractor's surety company in writing of the recourse the Owner intends to take, within the Contract, to assess liquidated damages and /or cause the work to be completed.

8.3. DELAYS AND EXTENSIONS OF TIME

8.3.4 ADD: By the act of signing the Contract, the Contractor signifies that he/she and all subcontractors can perform the work within the stated schedule and that subcontractors, manufacturers, suppliers, and deliverers are known to be able to support the schedule. Time extension may be granted for unforeseen conditions or events out of the Contractor's control causing delay in delivery of materials or causing delay in the Contractor's ability to perform the work within the Contract Documents. The Contractor is expected to take all possible measures and bear all reasonable costs in order to anticipate, control, counteract, and expedite such delay-causing conditions, including finding alternative sources of materials, equipment, shipping, and labor. Notification of any claim for schedule delay must be made in writing to the Owner within one week of the causing event or of first knowledge of a known delay causing condition with supporting documentation as required by the Owner. The Owner will respond in writing within one week to claims of delay. No claims of delay will be entertained after the date of completion as stated in the executed Contract or as extended by previously approved delay claims.

ARTICLE 9 – PAYMENTS AND COMPLETION

9.3. APPLICATIONS FOR PAYMENT

9.3.7.2.1. Insert in the first line "Schedule of Values" in lieu of "Schedule of Amounts for Contract Payment".

9.3.7.2.3 ADD: Subcontractor's List: The Contractor shall list all subcontractors doing work in excess of $5,000.

9.8. SUBSTANTIAL COMPLETION

9.8.4.1 ADD: Prior to the inspection, the Contractor shall complete the final clean-up of the project site which, unless otherwise stated in the Contract Documents, shall consist of:

9.8.4.1.1 Removal of all debris and waste. All construction debris and waste shall be removed from the campus grounds. Use of the University trash containers will not be permitted.

9.8.4.1.2 Removal of all stains, smears, marks of any kind from surfaces including existing surfaces if said damage is the result of the work.

9.8.4.1.3 Removal of all temporary structures and barricades.

9.10. FINAL COMPLETION AND FINAL PAYMENT

9.10.2.4 Insert in the first line after the word "(Form 103)": "for contracts greater than or equal to $150,000"

ARTICLE 10 – PROTECTIONS OF PERSONS AND PROPERTY

10.1. SAFETY

10.1.2 Insert in the second line before the word "safeguards": "and as approved by Owner,"

10.1.2.1 ADD: The Contractor recognizes that the Work will be conducted in and around buildings and areas that are occupied and will continue to function for the purposes of the University. The Contractor shall conduct a project safety meeting prior to the start of the Work, with the Owner's representative and all others that the Owner's representative deems necessary. The purpose of the meeting shall be to produce project specific rules and guidelines pertaining to but not restricted to: safety of persons in and around the area of the Work including type and location of fencing, guards, signage, etc.; closing of existing campus circulation routes and designation of alternate routes,

including creation of temporary routes of access as required; creation and location of temporary signage as required to maintain accessible routes for handicapped access to and around the site of the Work. The Contractor shall be solely responsible for implementing all required means and methods for site safety and security that may be agreed upon in this meeting.

10.1.2.2 ADD: Contractor shall notify Owner any time his operations will disrupt use of and access to existing accessible routes. Contractor is solely responsible for maintaining existing accessible routes in the area of the project with the exception of temporary interruptions lasting one day or less. Contractor is responsible for erecting signage identifying temporary re-routing of accessible routes. Such re-routing shall be coordinated with Owner in advance.

10.3. UTILITIES

10.3.1 ADD: Underground Utilities: Buried utilities, including, but not limited to, electricity, gas, steam, air, water, telephone, sewer, irrigation, broadband coaxial computer cable, and fiber optic cables are very vulnerable and damage could result in loss of service. The telephone, broadband and fiber optic cables are especially sensitive and the slightest damage to these components will result in disruption of the operations of the campus.

10.3.2 ADD: "One Call" must be notified by phone and in writing at least 72 hours (3 business days) prior to digging to arrange and assist in the location of buried utilities in the field. (Dial 811). The Contractor shall mark the boundary of the work area. The boundary area shall be indicated with white paint and white flags. In winter, pink paint and flags will be accepted.

10.3.3 ADD: After buried utilities have been located, the Contractor shall be responsible for any utilities damaged while digging. Such responsibility shall include all necessary care including hand digging. Contractor's responsibility shall also include maintaining markings after initial locate. The area for such responsibility, unless otherwise indicated, shall extend 24 inches to either side of the marked center line of a buried utility line. In cases of multiple or overlapping utilities or inconclusive electronic locating signals, MSU Project Manager may specifically indicate a wider area for Contractor's responsibility.

10.3.4 ADD: The Contractor's responsibility shall include repair or replacement of damaged utilities. In the event of damage to the 15 KV electrical distribution system, the broadband or fiber optic cables, repair will consist of replacement from termination to termination. Facilities Services and the MSU Information Technology Center will verify repair and recertification. The Contractor will also be responsible for all costs associated with re-terminations and recertification.

10.3.5 ADD: Any buried utilities exposed by the operations of the Contractor shall be marked on the plans and adequately protected by the Contractor. If any buried utilities not located are exposed, the Contractor shall immediately contact Facilities Services at the numbers above. If, after exposing an unlocated buried utility, the Contractor continues digging without notifying Facilities Services and further damages the utility, the Contractor will be responsible.

10.3.6 ADD: Damage to irrigation systems during seasons of no irrigation that are not immediately and adequately repaired and tested will require the Contractor to return when the system is in service to complete the repair.

10.3.7 ADD: In the event of a planned interruption of any existing utility service, the Contractor shall make arrangements with Facilities Services at least 72 hours (3 business days) in advance. Shutdowns of the broadband or fiber optic cables will normally require 5 working days notice to Facilities Services and the Information Technology Center. The Contractor shall bear all costs associated with the interruptions and restorations of service.

10.3.8 ADD: The Owner allows the contractor to use the Owner's utilities (water, heat, electricity) services without charge for procedures necessary for the completion of the work.

ARTICLE 11 - INSURANCE AND BONDS

11.4. COMMERCIAL GENERAL LIABILITY INSURANCE

11.4.1.3. Insert in the first line after "State of Montana": ", Montana State University".

11.7. PERFORMANCE BOND AND LABOR & MATERIAL PAYMENT BOND (BOTH ARE REQUIRED ON THIS PROJECT)

11.7.1. Insert in the first line at the beginning of the sentence "For contracts equal to or greater than $150,000".

11.8. CANCELLATION

11.8 ADD All Certificates shall contain a provision that coverage provided by the policies will not be cancelled without at least thirty (30) days prior notice to the Owner.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.1. GOVERNING LAW

13.1.1. Insert in the second line "The Eighteenth Judicial District, Gallatin County" in lieu of "First Judicial District, Lewis and Clark County".

13.9 EMERGENCY AND PUBLIC SAFETY

Montana State University has an Emergency and Public Safety Alert System that warns the campus community in the event of an emergency or public safety event. Because contractors, consultants, and vendors are considered members of the campus community when working on campus, they must be familiar with the alert system and understand when the system is used. Montana State University requires all contractors, consultants, vendors, and their employees working on or entering the MSU-Bozeman campus to register for the Emergency and Public Safety Alert System. The link to register is: http://www.montana.edu/msualert/.

END OF SUPPLEMENTARY GENERAL CONDITIONS

MONTANA
STATE UNIVERSITY

FACILITIES SERVICES
PO BOX 172760, BOZEMAN, MONTANA 59717-2760
406/994-5413 FAX 406/994-5665

Cost Estimate to Re-key Buildings

Access to campus buildings is controlled for safety and security reasons. As a key holder the contractor is responsible for following processes associated with maintaining the integrity of our access control program. If a key is lost the contractor is liable for costs associated with ensuring access control is maintained. In some cases that requires re-keying an entire building or key sequence. Cost can range from $2,000 to over $200,000 depending on building and key hierarchy.

SECTION 011000
SUMMARY

1.1 PART 1 - GENERAL

A. Related Documents
1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Project Description
1. The project involves replacing approximately 215 feet of 8-inch cast iron water main, removal and replacement of a fire hydrant, and installation of a new meter pit.

C. Site Information

Scope of work includes, but is not necessarily limited to,
1. Contractor material submittals and attend pre-construction meeting.
2. Street cut permit as required by the City of Bozeman.
3. Saw-cut, remove, and replace existing curb and gutter, pavement, and other site features.
4. Remove existing 8-inch water main as shown on the plans.
5. Install new 8-inch ductile iron water main and associated components.
6. Install a new meter vault and associated components.
7. Disinfection and testing for the new water main.
8. Coordination with Engineer and MSU Facilities for control of water, timing of improvements and control of water, site access and other related work.
9. Provide as-built drawings of constructed improvements.

D. Contracts
1. Contracts shall be under one General Contract and shall include, but not be limited to, all labor, materials, and supervision necessary to furnish and install the Work.

E. Work Sequence

1. The work will be conducted in one (1) phase to provide the least possible interference to the activities of the Owner's personnel and activities.
2. The Contractor will have access to the full extent of the site improvements from the date of receipt of the contract.
3. Coordinate with MSU Facilities for timing of the work to be completed. The Contractor shall submit a proposed schedule and sequence of work addressing main shut-downs, temporary water if needed, and impacts to parking and site access.

F. Contractor Use of Premises

1. Work on this contract is expected to be done during regular working hours Monday through Friday. Any variation from this will require prior approval of the Consultant and Owner.

2. All work must be coordinated with MSU at all times and MSU must be informed about any work impacting campus operations 72 hours or 3 working days in advance of work being conducted and shall require MSU approval.
3. General: Limit use of the premises to construction activities in areas indicated; allow for Owner/MSU occupancy and use by the public. Confine operations to areas within contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
4. Contractor shall conduct all his work in such a manner as to minimize the inconvenience and disruption of MSU's daily schedule.
5. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction.
6. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials to the areas designated on the drawings. If additional storage is necessary, obtain and pay for such storage off-site.
7. Contractor shall establish a staging area for storage of materials and equipment.
8. The Contractor is to coordinate with MSU for the location of the job site trailer office.
9. Keep driveways and entrances serving the premises clear and available to MSU and MSU's employees, staff and visitors at all times, unless otherwise agreed by MSU. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

G. Parking and Site Access
*(**See also Supplemental Conditions of the Contract for Construction.)***

1. MSU Bozeman Vehicle Regulations state: "All students, faculty, staff, and visitors must register any motor vehicle they park on the University campus, for any reason. A visitor is anyone not defined as student, staff or faculty."
2. All Contractor and Contractor employees shall comply with Montana State University parking regulations. MSU parking permits can be purchased at the University Police Office located in the Huffman Building at Seventh Avenue and Kagy Boulevard. Violators of MSU Bozeman Vehicle Regulations may be ticketed and towed.
3. A maximum of three (3) Contractor Permits (or as agreed with MSU) will be made available to the Contractor for parking of essential vehicles within the designated parking lot (as designated on the Cover Sheet of the Contract Documents). Essential vehicles are vehicles used for delivery of equipment and tools required to be parked in close proximity to the construction area. All allowed vehicles only to be parked on hard surfaced areas within the Staging Area. All other Contractor and Contractor employee vehicles on campus shall be parked in designated parking lots to be agreed with MSU. No personal vehicles shall be parked at the project site in any event. If a driver of a vehicle not allowed to be parked at the project site must unload equipment, tools, or materials, the vehicle must be immediately thereafter move to a designated lot or leave campus.

4. Access and egress to and from the project site shall be coordinated with the owner. In cases where a different route must be used for a specific purpose, permission must be obtained from MSU. Access routes are for delivery of equipment, tools, and materials and not for parking.
5. The site Staging Areas for materials and equipment are designated on the Cover Sheet of the Contract Documents. Staged materials and equipment must be secured on the ground surface or in trailers. Site staging areas shall be fenced in accordance with the Contract Documents. Vehicles in addition to those allowed to be parked may not be used for staging of equipment, tools, or materials.

H. Owner Occupancy

1. Full Owner/MSU Occupancy: The Owner/MSU will occupy the site during the entire construction period. Cooperate with MSU during construction operations to minimize conflicts and facilitate MSU usage. Perform the work so as not to interfere with MSU's operations.

I. Safety Requirements

1. General: The safety measures required by the Contract Documents are not meant to be inclusive. The Contractor shall be solely responsible for safety on a 24-hours-per-day, 7 days-per-week basis and shall take whatever additional measures are necessary to insure the health and safety of the buildings' occupants, or pedestrians at or near the construction site and access routes and of all other persons in all areas affected by the Contractor's activities. Prior to the start of construction, the Contractor is to submit to the Consultant, a detailed written plan specifying the safety procedures that will be followed. Include (but not by way of limitation) the following: Verbiage, size and locations of warning signs; construction sequence as related to safety; use of barricades (type and location); employee policies as related to safety; and delivery of materials as related to safety. Revise the safety plan as required during construction and resubmit to the Owner.
2. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
3. Comply with Federal, State, local, and the Owner's fire, health and safety requirements.
4. Advise MSU whenever work is expected to be hazardous or inconvenient (including objectionable odors) to MSU's employees, students, visitors or the building occupants.
5. Construction materials or equipment shall be placed so as not to endanger the work or prevent free access to all emergency devices or utility disconnects.
6. Maintain the proper rated fire extinguishers within easy access where power tools, sanding or other equipment is being used.
7. The Contractor shall erect and maintain, as required by law, conditions and progress of the work, warning signs, barricades and other reasonable safeguards for safety and protection.
8. **Emergency and Public Safety Alert System:**
   Montana State University has an Emergency and Public Safety Alert System that warns the campus community in the event of an emergency or public safety

event. Because contractors, consultants, and vendors are considered members of the campus community when working on campus, they must be familiar with the alert system and understand when the system is used. Montana State University requires all contractors, consultants, vendors, and their employees working on or entering the MSU-Bozeman campus to register for the Emergency and Public Safety Alert System. The link to register is: http://www.montana.edu/msualert/

J. Existing Premises Condition

1. The Contractor is responsible for adequately documenting in photos the existing condition of the premises, to include external road surfaces, curbing and landscaped areas, specifically the cleanliness of areas. Any damage to the premises which is found after construction and is not so documented will be the responsibility of the Contractor to repair or replace.

K. Discrepancies in the Documents

1. The Contractor shall bring any discrepancies between any portions of the drawings and specifications to the attention of the Owner and the Consultant in writing. The Owner and Consultant shall review the discrepancy and clarify the intent desired in the Contract Documents. Unless specifically directed otherwise, the Contractor shall be obligated to provide the greater quantity or quality without any change in contract sum or time.

END OF SECTION 011000

SECTION 012000
PRICE AND PAYMENT
PROCEDURES

1.1 GENERAL

A. Related Documents
1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Summary

1. This Section specified administrative and procedural requirements governing the Contractor's Applications for Payment.
2. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

C. Schedule of Values

1. Coordinate preparation of the Schedule of Values, Form 100, with preparation of the Contractor's Construction Schedule.
2. Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the work with preparation of the Contractor's Construction Schedule.
3. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's construction schedule
b. Application for Payment form
c. List of subcontractors
d. Schedule of allowances
e. Schedule of alternates
f. List of products
g. List of principal suppliers and fabricators
h. Schedule of submittals
i. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than seven (7) days before the date scheduled for submittal of the initial Application for Payment.
j. Sub-Schedules: Where the work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

4. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

a. Identification: Include the following project identification on the Schedule of Values:

1) Project name
2) Name of the Architect
3) Project number (PPA No.)
4) Contractor's name and address
5) Date of submittal

b. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

1) Generic name
2) Related specification section
3) Name of subcontractor
4) Name of manufacturer or fabricator
5) Name of supplier
6) Change Orders (numbers) that have affected value
7) Dollar value

a) Percentage of Contract Sum in the nearest one-hundredth percent, adjusted to total 100%

c. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

d. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

e. For each part of the work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that art of the work.

5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

6. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

D. Applications for Payment

1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
2. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
3. Payment Application Forms: Use Montana Form 101 as the form for Application for Payment.
4. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

a. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
b. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

5. Transmittal: Submit one (1) executed copy of each Application for Payment to the Architect by means ensuring receipt within 24 hours, including waivers of lien and similar attachments, when required.

   a. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

6. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

   a. List of subcontractors
   b. Schedule of Values

      1) Contractor's Construction Schedule (preliminary if not final)

   c. Copies of building permits

      1) Copies of authorizations and licenses from governing authorities for performance of the work

   d. Certificates of insurance and insurance policies (submitted with Contract)
   e. Performance and payment bonds (submitted with Contract if required)

7. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.
8. Administrative actions and submittals that shall proceed or coincide with this application include:

   a. Occupancy permits and similar approvals
   b. Warranties (guarantees) and maintenance agreements
   c. Test/adjust/balance records
   d. Maintenance instructions
   e. Meter readings
   f. Start-up performance reports

      1) Change-over information related to Owner's occupancy, use, operation and maintenance.

   g. Final cleaning

      1) Application for reduction of retainage, and consent of surety

9. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final Application for Payment include the following:

   a. Completion of project closeout requirements

      1) Completion of items specified for completion after Substantial Completion

   b. Assurance that unsettled claims will be settled

      1) Assurance that work not complete and accepted will be completed without undue delay
      2) Transmittal of required project construction records to Owner

END OF SECTION 01200

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

A. Related Documents
   1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and *Instructions to Bidders*.

B. Substitution Procedures
   1. Substitutions include changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by the Contractor.
   2. Substitution Requests: Submit three copies of each request on MSU Substitution Request Form 099 for each consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

      a. Submit requests in accordance with *Instructions to Bidders*.
      b. Identify product to be replaced and show compliance with requirements for substitutions. Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.

C. Architect will review proposed substitutions and notify Contractor of their acceptance or rejection. If necessary, Architect will request additional information or documentation of evaluation.

   1. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

D. Do not submit unapproved substitutions on Shop Drawings or other submittals.

END OF SECTION 012500

SECTION 013000

SUBMITTALS

1.1 GENERAL

A. Related Documents

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

B. Summary

1. This Section specifies administrative and procedural requirements for submittals required for performance of the work, including:

   a. Contractor's construction schedule
   b. Submittal schedule
   c. Daily construction reports
   d. Shop Drawings
   e. Product data
   f. Samples

   Note: All Submittals are to be both print and electronic.

2. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

   a. Permits
   b. Applications for Payment
   c. Performance and payment bonds
   d. Insurance certificates
   e. List of Subcontractors

3. The Schedule of Values submitted is included in Section "Applications for Payment".
4. Inspection and test reports are included in Section "Quality Requirements".
5. Unless otherwise instructed by the Owner all submittals shall be directed to Architect/Engineer Consultant of Record. The Contractor’s construction schedule, submittal schedule and daily construction reports shall be directed to the Consultant’s representative, the State of Montana’s representative and MSU’s representative. Shop drawings, product data and samples shall be directed to the Consultant’s representative.

C. Submittal Procedures

1. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

   a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

b. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.

1) The Consultant reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

c. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1) Allow two (2) weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Consultant will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
2) If an intermediate submittal is necessary, process the same as the initial submittal.
3) Allow two (2) weeks for reprocessing each submittal.
4) No extension of contract time will be authorized because of failure to transmit submittals to the Consultant sufficiently in advance of the work to permit processing.

2. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

a. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
b. Include the following information on the label for processing and recording action taken.

1) Project name and PPA Number
2) Date
3) Name and address of Consultant
4) Name and address of Contractor
5) Name and address of Subcontractor
6) Name and address of supplier
7) Name of manufacturer

a) Number and title of appropriate Specification Section
b) Drawing number and detail references, as appropriate

3. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Consultant using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

a. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include

Contractor's certification that information complies with Contract Documents requirements.

b. Transmittal Form: Contractor's standard form.

D. Contractor's Construction Schedule

1. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit both in print and electronically within thirty (30) days of the date established for "Commencement of the Work".

   a. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the "Schedule of Values".
   b. Within each time bar indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion.
   c. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
   d. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
   e. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.
   f. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Consultant's procedures necessary for certification of Substantial Completion.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
3. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
4. Cost Correlation: At the head of the schedule, provide a two (2) item cost correlation line, indicating "pre-calculated" and "actual" costs. On the line show dollar-volume of work performed as of the dates used for preparation of payment requests.

   a. Refer to Section "Price and Payment Procedures" for cost reporting and payment procedures.

5. Distribution: Following response to the initial submittal, print and distribute copies to the Consultant, Owner, subcontractors, and other parties required to comply with scheduled dates. Transmit electronically and post copies in the project meeting room and temporary field office.

   a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have

completed their assigned portion of the work and are no longer involved in construction activities.

6. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule electronically and in print concurrently with report of each meeting.

E. Submittal Schedule

1. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within ten (10) days of the date required for establishment of the Contractor's construction schedule.

   a. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products, as well as the Contractor's construction schedule.
   b. Prepare the schedule in chronological order; include submittals required during the first thirty (30) or sixty (60) days of construction. Provide the following information:

      1) Scheduled date for the first submittal
      2) Related section number
      3) Submittal category
      4) Name of subcontractor
      5) Description of the part of the work covered
      6) Scheduled date for resubmittal
         a) Scheduled date the Consultant's final release or approval

2. Distribution: Following response to initial submittal, print and distribute copies to the Consultant, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

   a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

3. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

F. Daily Construction Reports

1. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Consultant at weekly intervals:

   a. List of subcontractors at the site
   b. Approximate count of personnel at the site
   c. High and low temperatures, general weather conditions
   d. Accidents and unusual events
   e. Meetings and significant decisions

f. Stoppages, delays, shortages, losses
g. Meter readings and similar recordings
h. Emergency procedures
i. Orders and requests of governing authorities
j. Change Orders received, implemented
k. Services connected, disconnected
l. Equipment or system tests and start-ups
m. Partial completions, occupancies
n. Substantial Completions authorized

G. Shop Drawings

1. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the project is not considered Shop Drawings.
2. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

a. Dimensions
b. Identification of products and materials included
c. Compliance with specified standards
d. Notation of coordination requirements
e. Notation of dimensions established by field measurement
f. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2" x 11", but no larger than 36" x 48".
g. Submittal: Submit electronically and in print for the Consultant's review; Consultant’s comments will be returned electronically.

1) One (1) of the prints returned shall be marked-up and maintained as a "Record Document".

h. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

3. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

a. Preparation of coordination drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
b. Submit coordination drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

H. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's

installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings".

a. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

1) Manufacturer's printed recommendations
   a) Compliance with recognized trade association standards
   b) Compliance with recognized testing agency standards

2) Application of testing agency labels and seals
   a) Notation of dimensions verified by field measurement
3) Notation of coordination requirements

b. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

c. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

d. Submittals: Submit two (2) copies of each required submittal; submit four (4) copies where required for maintenance manuals. The Consultant will retain one (1), and will return the other marked with action taken and corrections or modifications required.

1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

e. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

1) Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.
2) Do not permit use of unmarked copies of Product Data in connection with construction.

I. Samples

1. Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

a. Mount, display, or package samples in the manner specified to facilitate review of qualities indicated. Prepare samples to match the Consultant's sample. Include the following:

1) Generic description of the sample
2) Sample source
3) Product name or name of manufacturer

4) Compliance with recognized standards
5) Availability and delivery time

2. Submit samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

a. Where variation in color, pattern, texture, or other characteristics are inherent in the material or product represented, submit multiple units (not less than three (3), that show approximate limits of the variations.
b. Refer to other specification sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
c. Refer to other sections for samples to be returned to the Contractor for incorporation in the work. Such samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of sample submittals.

3. Preliminary Submittals: Where samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

a. Preliminary submittals will be reviewed and returned with the Consultant's mark indicating selection and other action.

4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit three (3) sets; one (1) will be returned marked with the action taken.

a. Maintain sets of samples, as returned, at the project site, for quality comparisons throughout the course of construction.

1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
2) Sample sets may be used to obtain final acceptance of the construction associated with each set.

5. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the work. Show distribution on transmittal forms.

a. Field samples specified in individual sections are special types of samples. Field samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.

1) Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

J. Consultant's Action

1. Except for submittals for record, information, or similar purposes, where action and return is required or requested, the Consultant will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.
2. Action Stamp: The Consultant will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

    a. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted", that part of the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
    b. Returned for Resubmittal: When submittal is marked "Revise and Resubmit", do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

        1) Do not permit submittals marked "Revise and Resubmit" to be used at the project site, or elsewhere where work is in progress.

    c. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action not Required".

END OF SECTION 013000

SECTION 013100
PROJECT COORDINATION

1.1 GENERAL

A. Related Documents
1. Drawings and general provisions of Contract, including General Conditions and Supplemental Conditions and other Division1 Specification Sections, apply to this Section.

B. Summary
1. This section specifies administrative and supervisor requirements necessary for project coordination including, but not necessarily limited to:
   a. Coordination
   b. Administrative and supervisory personnel
   c. General installation provisions
   d. Cleaning and protection
2. Field Engineering is included in Section "Field Engineering".
3. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
4. Requirements for Contractor's Construction Schedule are included in Section "Submittals".

C. Coordination
1. Coordination: Coordinate construction activities included under various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operation.
   a. Provide access to work at all times for inspections by Owner and authorized representatives.
   b. Provide safe working conditions and protection of completed work.
   c. Provide barricades and signs.
   d. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   e. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   f. Make adequate provisions to accommodate items scheduled for later installation.
   g. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
      1) Prepare similar memoranda for the Owner and separate Contractors where coordination of their work is required.
2. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

a. Notify Facilities Services or Campus Planning, Design and Construction of any expected disruptions in service or changes in construction schedule at least 72 hours (3 working days) in advance.
b. Preparation of schedules.
c. Installation and removal of temporary facilities.
d. Delivery and processing of submittals.
e. Progress meetings.
f. Project close-out activities.

3. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
a. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

D. Submittals
1. Coordinated Drawings: Prepare and submit coordination drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
a. Show the interrelationship of components shown on separate shop drawings.
b. Indicate required installation sequences.
c. Comply with requirements contained in Section "Submittals".
d. Section "Basic Electrical Requirements" for specific coordination drawing requirements for mechanical and electrical installations.

2. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

1.2 PROJECT MEETINGS

A. Related Documents
1. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

B. Summary
1. This section specifies administrative and procedural requirements for project meetings including but not limited to:
a. Pre-construction conference
b. Pre-installment conferences
c. Coordination meetings
d. Progress meetings

C. Pre-construction Conference
1. Schedule a pre-construction conference and organizational meeting.
a. Hold meeting at the project site or other convenient location and prior to commencement of construction activities, including the moving of

equipment on to the site. Conduct the meeting to review responsibilities and personnel assignments.

2. Attendees: The Owner, Consultant and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work. Both the Contractor and the Contractor's job foremen shall attend the meeting, along with all subcontractors.
3. Agenda: Discuss items of significance that could affect progress including such topics as:
    a. Tentative construction schedule
    b. Critical work sequencing
    c. Designation of responsible personnel
    d. Procedures for processing field decisions and Change Orders
    e. Procedures for processing Applications for Payment
    f. Distribution of Contract Documents
    g. Submittal of Shop Drawings, Product Data and Samples
    h. Preparation of record documents
    i. Use of the premises
    j. Office, work and storage areas
    k. Equipment deliveries and priorities
    l. Safety procedures
    m. First aid
    n. Security
    o. Housekeeping
    p. Working hours

D. Pre-Installation Conferences
1. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Consultant of scheduled meeting dates.
2. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
    a. Contract Documents
    b. Options
    c. Related Change Orders
    d. Purchases
    e. Deliveries
    f. Shop Drawings, Product Data and quality control samples
    g. Possible conflicts
    h. Compatibility problems
    i. Time schedules
    j. Weather limitations
    k. Manufacturer's recommendations
    l. Compatibility of materials
    m. Acceptability of substrates
    n. Temporary facilities
    o. Space and access limitations
    p. Governing regulations

q. Safety
r. Inspection and testing requirements
s. Required performance results
t. Recording requirements
u. Protection

3. The Consultant will record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Consultant.
4. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

E. Coordination Meeting
1. Conduct project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
2. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
3. The Consultant will record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

F. Progress Meetings
1. Conduct progress meetings at the project site at regularly scheduled intervals. Coordinate with the Owner and Consultant of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
2. Attendees: In addition to representatives of the Owner and Consultant, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.
3. Agenda: Visit job site to raise specific pending issues prior to meeting. Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time.
   b. Review the present and future needs of each entity present, including such items as:
      1) Interface requirements
      2) Time
      3) Sequences
      4) Deliveries
      5) Off-site fabrication problems
      6) Access
      7) Site utilization

8) Temporary facilities and services
9) Hours of work
10) Hazards and risks
11) Housekeeping
12) Quality and work standards
13) Change Orders
14) Documentation of information for payment requests

4. Reporting: The Consultant shall distribute printed and electronic copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   a. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.3 PRODUCTS (NOT APPLICABLE)

1.4 EXECUTION

A. General Installation Provisions
1. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
3. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
4. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
5. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Consultant for final decision.
6. Recheck measurements, quantities and dimensions, before starting each installation.
7. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
8. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
9. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated and in compliance with accessibility requirements. Refer questionable mounting height decisions to the Consultant for final decision.

B. Cleaning and Protection
1. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

2. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
3. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
    a. Excessive static or dynamic loading
    b. Excessive internal or external pressures
    c. Excessively high or low temperatures
    d. Thermal shock
    e. Excessively high or low humidity
    f. Air contamination or pollution
    g. Water or ice
    h. Solvents
    i. Chemicals
    j. Light
    k. Radiation
    l. Puncture
    m. Abrasion
    n. Heavy traffic
    o. Soiling, staining and corrosion
    p. Bacteria
    q. Rodent and insect infestation
    r. Combustion
    s. Electrical current
    t. High speed operation
    u. Improper lubrication
    v. Unusual wear or other misuse
    w. Contact between incompatible materials
    x. Destructive testing
    y. Misalignment
    z. Excessive weathering
        aa. Unprotected storage
        ab. Improper shipping or
        ac. handling Theft
        ad. Vandalism

END OF SECTION 013100

SECTION 014000 QUALITY REQUIREMENTS

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies administrative and procedural requirements for quality control services.
2. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
3. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
4. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

    a. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
    b. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
    c. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. RESPONSIBILITIES

1. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those

    a. Services specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
    b. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
    c. The Owner will engage and pay for the services of an independent agency

to perform inspections and tests specified as the Owner's responsibility. Payment for these services will be made by the Owner.

d. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services provide unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

   a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Associated services required include but are not limited to:

   a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
   b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
   c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
   d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
   e. Security and protection of samples and test equipment at the Project site.

4. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.

   a. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

5. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

   a. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

b. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
c. The agency shall not perform any duties of the Contractor.

6. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

D. SUBMITTALS

1. The independent testing agency shall submit a certified written report and electronic copy of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

a. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
b. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

1) Date of issue
2) Project title and number
3) Name, address and telephone number of testing agency
4) Dates and locations of samples and tests or inspections
5) Names of individuals making the inspection or test
6) Designation of the Work and test method
7) Identification of product and Specification Section
8) Complete inspection or test data
9) Test results and in interpretations of test results
10) Ambient conditions at the time of sample-taking and testing
11) Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements
12) Name and signature of laboratory inspector
13) Recommendations on retesting

DI. QUALITY ASSURANCE

1. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
2. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State of Montana.

1.2 PRODUCTS (NOT APPLICABLE)

1.3 EXECUTION

A. GENERAL

1. Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
2. Protect construction exposed by or for quality control service activities, and protect repaired construction.
3. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014000

SECTION 015000
TEMPORARY FACILITIES AND UTILITIES

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
2. Temporary utilities required may include but are not limited to:

   a. Telephone service
   b. Electric Service
   c. Water
   d. Natural gas
   e. Sewer

3. Temporary construction and support facilities required may include but are not limited to:

   a. Field offices and storage sheds.
   b. Sanitary facilities, including drinking water
   c. Temporary Project identification signs and bulletin boards
   d. Waste Disposal services
   e. Construction aids and miscellaneous services and facilities

4. Security and protection facilities required include but are not limited to:

   a. Temporary Security Fencing
   b. Temporary fire protection

   b. Barricades, warning signs, lights
   c. Environmental protection

C. QUALITY ASSURANCE

1. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

   a. Building Code requirements
   b. Health and safety regulations
   c. Utility company regulations
   d. Police, Fire Department and Rescue Squad rules
   e. Environmental protection regulations

2. Standards: Comply with NFPA Code 241, "Building Construction and

Demolition Operations" and ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".

D. PROJECT CONDITIONS

1. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

1.2 PRODUCTS

A. MATERIALS

1. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
2. Water: Provide potable water approved by local health authorities.
3. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1 1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

B. EQUIPMENT

1. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
2. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
3. Electrical Outlets: Provide properly configured NEA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
4. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
5. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
6. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
7. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

9. First Aid Supplies: Comply with governing regulations.
10. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

    a. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

1.3 EXECUTION

A. INSTALLATION

1. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work and Owner's operations. Relocate and modify facilities as required.
2. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

B. TEMPORARY UTILITIES

1. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Provide cellular telephone, operational and on site at all times.

C. TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

1. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access and minimal interruption to Owner's operations.

    a. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

2. Field Offices: The Contractor, at his option, shall provide insulated, weather tight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:

    a. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table and plan rack and a 6-shelf bookcase.
    b. Equip with a water cooler and private toilet complete with water closet, lavatory and mirror-medicine cabinet unit.

3. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved,

including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.

4. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

    a. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

5. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
6. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

    a. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.

7. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.

    a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).

8. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg. F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. Do not use University trash containers for any reason.

D. SECURITY AND PROTECTION FACILITIES INSTALLATION

1. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

    (a) Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
3. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel

pipe posts, 1 1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

4. Barricades, Warning Signs and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

5. Do not remove temporary security and protection facilities until Substantial Completion, or longer as requested by the Architect.

6. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

   a. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than on extinguisher on each floor at or near each usable stairwell.
   b. Store combustible materials in containers in fire-safe locations.
   c. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
   d. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

7. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

E. OPERATION, TERMINATION AND REMOVAL

1. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
2. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
3. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

   a. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to this section.

1.2 SECTION REQUIREMENTS

A. Provide products of same kind from a single source. The term "product" includes the terms "material," "equipment," "system," and similar terms.

B. Deliver, store, and handle products according to manufacturer's written instructions, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Inspect products at time of delivery for compliance with the Contract Documents and to ensure items are undamaged and properly protected.

C. Product Substitutions: Reasonable and timely requests for substitutions will be considered. Substitutions include products and methods of construction differing from that required by the Contract Documents and proposed by Contractor after award of Contract. Substitutions only al-lowed for products when more than one manufacturer is indicated.

1. Submit two (2) copies of each request for product substitution. Identify product to be re-placed and provide complete documentation showing compliance of proposed substitu-tion with applicable requirements. Include a full comparison with the specified product, a list of changes to other Work required to accommodate the substitution, and any pro-posed changes in Contract Sum or Contract Time should the substitution be accepted.
2. Submit requests for product substitution in time to permit processing of request and sub-sequent Submittals, if any, sufficiently in advance of when materials are required in the Work. Do not submit unapproved substitutions on Shop Drawings or other submittals.
3. Owner will review the proposed substitution and notify Contractor of its acceptance or rejection.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.

1. Provide products complete with accessories, trim, finish, and other devices and compo-nents needed for a complete installation and the intended use and effect.

B. Select products as follows:

1. Where only a single product or manufacturer is named, provide the item indicated. No substitutions will be permitted.
2. Where two or more products or manufacturers are named, provide one of the items indi-cated. No substitutions will be permitted.
3. Where products or manufacturers are specified by name, accompanied by the term "or equal," provide the named item or comply with provisions concerning "product substitu-tions" to obtain approval for use of an unnamed product or manufacturer.
4. Where a product is described with required characteristics, with or without naming a brand or trademark, provide a product that complies with those characteristics and other Contract requirements.
5. Where compliance with performance requirements is specified, provide products that comply and are recommended in writing by the manufacturer for the application.
6. Where compliance with codes, regulations, or standards, is specified, select a product that complies with the codes, regulations, or standards referenced.

C. Unless otherwise indicated, Owner will select color, pattern, and texture of each product from manufacturer's full range of options.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 016000

SECTION 173000 EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.

1.3 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Consultant of locations and details of cutting and await directions from Consultant before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or those results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Consultant's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Consultant for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a written and email request for information to Consultant.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, promptly notify Consultant by email and in writing.

1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
2. Inform installers of lines and levels to which they must comply.
3. Check the location, level and plumb, of every major element as the Work progresses.
4. Notify Consultant when deviations from required lines and levels exceed allowable tolerances.

B. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Consultant, and in compliance with accessibility requirements.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond- core drill.
4. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste.
4. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

1. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through

the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017400
WARRANTIES AND
BONDS

1.1 GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY

1. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

   a. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
   b. General closeout requirements are included in Section "Project Closeout."
   c. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
   d. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

2. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. DEFINITIONS

1. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
2. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

D. WARRANTY REQUIREMENTS

1. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with

requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

4. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

    a. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

E. SUBMITTALS

1. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

    a. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work.

2. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate items and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.

    a. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.

3. Forms of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

    a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a

typed description of the product or installation, including the name or the product, and the name, address and telephone number of the installer.

b. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.

2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 PRODUCTS (NOT APPLICABLE)

1.3 EXECUTION

A. SCHEDULE OF WARRANTIES

1. Schedule: Provide warranties and bonds on products and installations as specified in the appropriate Sections.

END OF SECTION 017400

SECTION 017419
WASTE MANAGEMENT

PART 1 - GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

Owner requires that this project generate the least amount of trash and waste possible. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills
or by incineration and shall be recycled:

Aluminum and plastic beverage containers.
Corrugated cardboard.
Wood pallets.
Clean dimensional wood: May be used as blocking or furring.
Land clearing debris, including brush, branches, logs, and stumps.
Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

Methods of trash/waste disposal that are **not** acceptable are:
Burning on the project site.
Burying on the project site.
Dumping or burying on other property, public or private. Other illegal dumping or burying.

Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 DEFINITIONS

Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
Non-hazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
Return: To give back reusable items or unused products to vendors for credit.

Reuse: To reuse a construction waste material in some manner on the project site.
Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
Toxic: Poisonous to humans either immediately or after a long period of exposure.
Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

1.3 WASTE MANAGEMENT PLAN IMPLEMENTATION

Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and the Architect.
Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
Meetings: Discuss trash/waste management goals and issues at project meetings, including the Pre-bid meeting, Pre-construction meeting and regular job-site meetings.
Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

As a minimum, provide:

Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
Separate dumpsters for each category of recyclable.
Recycling bins at worker lunch area.

Provide containers as required.
Provide adequate space for pick-up and delivery and convenience to subcontractors. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

SECTION 017700
PROJECT
CLOSEOUT

1.1 GENERAL

A. RELATED DOCUMENTS
1. Drawings and general provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

B. SUMMARY
1. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   a. Inspection procedures
   b. Project record document submittal
   c. Operating and maintenance manual submittal
   d. Submittal of warranties
   e. Final cleaning
   f. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions - 2 through - 33.

C. SUBSTANTIAL COMPLETION
1. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   a. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      1) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   b. Advise Owner of pending insurance change-over requirements.
   c. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
   d. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   e. See the *Supplemental Conditions of the Contract for Construction* 3.11 for Documentation and As-Built Conditions, and the *Project Closeout Checklist*: Contractor Requirements. Submit maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
   f. Deliver tools, spare parts, extra stock, and similar items.

   h. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
   i. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

2. Inspection Procedures: On receipt of a request for inspection, the Consultant will either proceed with inspection or advise the Contractor of unfilled requirements. The Consultant will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   a. The Consultant will repeat inspection when requested and assured that the Work has been substantially completed.
   b. Results of the completed inspection will form the basis of requirements for final inspection.

D. FINAL ACCEPTANCE
1. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   c. Submit a certified copy of the Consultant's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Consultant.
   e. Submit consent of surety to final payment.
   f. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
2. Re-inspection Procedure: The Consultant will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Consultant.
   a. Upon completion of re-inspection, the Consultant will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   b. If necessary, re-inspection will be repeated.

E. RECORD DOCUMENT SUBMITTALS
1. See also the *Supplemental Conditions of the Contract for Construction* 3.11 for Documentation and As-Built Conditions, and the *Project Closeout Checklist*: Contractor Requirements.
2. General: Do not use record documents (red-line markups) for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Consultant's reference during normal working hours.
3. Record Drawings (Red-lined): Maintain two clean, undamaged sets of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the sets to show the red-line changes during the course of construction with actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the

corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

a. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
b. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
c. Note related Change Order numbers where applicable.
d. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

4. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
   a. Upon completion of the Work, submit record Specifications to the Consultant for the Owner's records.
5. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark up of record drawings and Specifications.
   a. Upon completion of mark-up, submit (3) complete sets of record Product Data to the Consultant for the Owner's records.
6. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Consultant and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area
7. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Consultant for the Owner's records.
8. Maintenance Manuals: Provide one (1) draft copy for review. Provide **one (1)** final paper copy and one electronic pdf file prior to final completion. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-inch, 3 ring vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include the following types of information; and others as specified in other Divisions:
   a. Emergency instructions
   b. Spare parts list
   c. Copies of warranties
   d. Wiring diagrams

e. Recommended "turn around" cycles
f. Inspection procedures
g. Shop Drawings and Product Data
h. Fixture lamping schedule
i. List of final color and material selections

F. WARRANTIES AND BONDS

1. SUMMARY

a. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1) Refer to the General Conditions and Supplemental Conditions for terms of the Contractor's special warranty of workmanship and materials.
2) General closeout requirements are included in Section "Project Closeout."
3) Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
4) Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

b. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

c. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

2. DEFINITIONS

a. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

b. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

G. WARRANTY REQUIREMENTS

a. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

b. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

c. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is

responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

d. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1) Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

di. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

4. SUBMITTALS

a. Submit written warranties to the Consultant prior to the date certified for Substantial Completion. If the Consultant's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Consultant.
   1) When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Consultant within fifteen days of completion of that designated portion of the Work.

b. Forms of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

c. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1) Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name or the product, and the name, address and telephone number of the installer.
   2) Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.

d. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 EXECUTION

A. CLOSEOUT PROCEDURES

1. Functional Demonstration: Demonstrate proper operation of all systems to Consultants and Owners representative prior to request for substantial completion. Coordinate schedule with Consultant.
2. Operating and Maintenance Instructions: Provide two (2) duplicate training sessions for each MSU trade group responsible for systems installed under this project. Coordinate schedule with Owner. Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
    a. Maintenance manuals
    b. Record documents
    c. Spare parts and materials
    d. Tools
    e. Lubricants
    f. Fuels
    g. Identification systems
    h. Control sequences
    i. Hazards
    j. Cleaning
    k. Warranties and bonds
        1) Maintenance agreements and similar continuing commitments

END OF SECTION 017700

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 A.RELATED DOCUMENTS

A. General provisions of Contract, including General and Supplemental Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.
3. Product maintenance manuals.
4. Systems and equipment maintenance manuals.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. One paper copy and one electronic pdf. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will deliver copies to the Owner.

C. Manual Submittal: Submit each manual in DRAFT in PDF format form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments. PROVIDE PAPER AND PDF OF FINAL APPROVED MANUALS

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily

navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: These binders are sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and oversize sheets will need to be folded to 8x11.5.

a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Precautions against improper use.
9. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.

7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

CI. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

CII. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

PART 4 - MATERIAL AND FINISHES MAINTENANCE MANUAL

A. General: Incorporate as part of the O& M Manuals. Material and finishes to the Architect/Engineer for approval and distribution. Provide one section for architectural products, including applied materials and finishes, and a second section for products designed for moisture protection and products exposed to the water.

1. Refer to individual specification sections for additional requirements on the care and maintenance of materials and finishes

B. Architectural Products, Applied Materials and Finishes: Provide complete manufacturers data and instructions on the care and maintenance of architectural products, including applied materials and finishes.

C. Manufacturers Data: Provide complete information on architectural products, including but not limited to the following items, as applicable:
1. Manufacturer’s catalog number
2. Size
3. Material composition
4. Color texture reordering information for specially manufactured products
5. Manufacturer and supplier/installers contact information
6. Warranty terms

D. Care and Maintenance Instruction: Provide complete information on the care and maintenance of architectural products, including the manufacturer’s recommendations for the types of cleaning agents to be used and the methods of cleaning. In addition, provide information regarding cleaning agents and methods which could prove detrimental to the product. Include the manufacturer’s recommended schedule for cleaning and maintenance.

E. Manufacturer's Data: Provide complete manufacturer's data giving detailed information including, but not limited to the following, as applicable:
   1. Applicable standards
   2. Chemical composition
   3. Installation details
   4. Inspection procedures
   5. Maintenance information
   6. Repair procedures

F. Schedule: Provide complete information in the materials and finishes manual on products specified in the following sections: (To be determined with Owner)

G. Color Schedule: Provide complete information on MSU CPDC provided electronic spreadsheet form, to include manufacturer's name and number, location, item and surface of all painted, stained or treated material, surface or piece of equipment.

END OF SECTION 017823

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. See also General Conditions and Supplemental Conditions of the Contract for Construction.

B. **See the *Supplemental Conditions of the Contract for Construction* 3.11 for Documentation and As-Built Conditions, and the *Project Closeout Checklist*: Contractor Requirements**

C. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

D. Related Requirements:

1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings (Redline Markups): Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Draft Submittal:

1) Submit PDF electronic files of scanned record prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one set(s) of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.
c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name and PPA Number.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 024119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.5 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.6 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Before selective demolition, Owner will remove the following items:
      a. Text books and other loose classroom resources.
      b. Loose shelving units and storage cabinets.
      c. Loose furniture (tables and chairs).
      d. Loose equipment.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is included in the Contract Documents. Examine report to become aware of locations where hazardous materials are present. Do not proceed with selective demolition until all hazardous materials have been removed. Do not proceed with selective demo until all hazardous materials have been removed.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials
    i. except under procedures specified elsewhere in the Contract Documents.

DI. Storage or sale of removed items or materials on-site is not permitted.

DII. Utility Service: Maintain existing utilities and the protection facilities indicated to remain in and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit and email a written report to Architect and MSU Project Manager.

3.2 UTILITY SERVICES AND MECHANICAL/ ELECTRICAL SYSTEMS

A. Existing Services/ Systems to Remain: Maintain services/ systems indicated to remain and protect them against damage.

B. Comply with requirements for existing services/ systems interruptions specified in Section 011000 "Summary."

C. Existing Services/ Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/ electrical systems serving areas to be selectively demolished.

1. If services/ systems are required to be removed, relocated, or abandoned, provide temporary

services/ systems that bypass area of selective demolition and that maintain continuity of services/ systems to other parts of building.
2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
3. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
4. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material.
5. Equipment to be removed: Disconnect and cap services and remove equipment.
6. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
8. Ducts to be removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
9. Ducts to be abandoned in place: Cap or plug ducts with same or compatible ductwork material.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls".

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

B. . Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

C. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

D. Do not use cutting torches for selective demolition operations.

E. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

F. Dispose of demolished items and materials promptly.

G. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on campus as directed by Owner.
5. Protect items from damage during transport and storage.

H. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

I. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 Waste "Construction Management and Disposal".

B. Burning: Do not burn demolished materials.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

LANDSCAPE GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

A. The work in this section includes landscape construction, protection of existing site and landscape conditions and landscape maintenance during construction.

B. See drawings for extent of landscaping.

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01500 – Temporary Facilities and Controls

B. Section 02210 – Tree Protection

C. Section 02235 – Site Clearing

D. Section 02300 - Earthwork

E. Section 02810 - Irrigation System

F. Section 02935 – Lawns and Grass

1.3 QUALITY ASSURANCE

A. Comply with applicable Federal, state and local regulations governing landscape materials and work.

B. Owner’s representative reserves right to review and reject materials at growing site and as delivered to site.

C. Observation at growing site does not preclude right of rejection at job site. Remove rejected materials from site immediately.

D. Personnel: Employ only qualified personnel familiar with required work.

E. Contractor's Responsibilities: Landscape Contractor to coordinate activities with all other trades. Landscape Contractor to also secure utility locates prior to commencing work involving excavation or digging.

1.4 REFERENCED STANDARDS

A. *ANSI Z60.1: American Standard for Nursery Stock*, latest edition, American National Standards Institute.

B. *Hortus Third: A Concise Dictionary of Plants Cultivated in the United States & Canada*, Staff of the L.H. Bailey Hortorium, Cornell University, 1999.

C. *ASTM C33: Specification for Concrete Aggregate*, American Society of Testing Materials.

D. Alex Shigo, *Tree Pruning*, Shigo & Tree Associates, LLC, 1989.

E. *Guide for Plant Appraisal*, latest edition, Council of Tree and Landscape Appraisers.

F. *Species Ratings and Appraisal Factors Guide*, latest edition, International Society of Arboriculture, Rocky Mountain Chapter.

G. *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.

H. Tree Planting Specifications, Dr. Delmar Gilman, University of Florida, http://hort.ifas.ufl.edu/woody/summary-planting.shtml, Copyright 2011, University of Florida

I. Guideline Specifications for Nursery Tree Quality**,** Dr. Delmar Gilman, University of Florida, http://search.ufl.edu/web/#gsc.tab=0&gsc.q=Guideline%20Specifications%20for%20nursery%20stock%20%20site%3Ahort.ifas.ufl.edu , Copyright 2011, University of Florida.

J. International Society of Arboriculture (ISA) Best Management Practices publications

1.5 SUBMITTALS

A. File Certificates of Inspection of plant material by Federal, State and local authorities with Landscape Architect, if required.

B. Submit within 30 days after award of contract, complete list of materials to be furnished under this section and confirmed sources for materials.

C. Requests for substitutions shall be submitted in writing to the Landscape Architect prior to award of contract.

D. Provide and pay for material testing. Submit the following materials certification and text report.

1. Topsoil

a. pH factor

b. Mechanical analysis

c. Percentage of organic content

d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring topsoil to satisfactory level for planting.

e. Identify source location of topsoil proposed for use on the project if imported from off-site.

2. Organic Additives

a. Loss of weight by ignition

b. Moisture absorption capacity

c. Percentage of organic matter

d. pH factor

E. Submit the following material samples, in a size within reason to evaluate material thoroughly:

1. Mulch

2. Erosion control fabric

3. Edging

1.6 PRODUCT PREPARATION, DELIVERY, AND STORAGE

A. Preparation and Protection

1. Balled and Burlapped (B&B) Plants: Dig and prepare shipment in a manner that will not damage roots, branches, shape, and future development.

2. Container Grown Plants: Deliver plants in container sufficiently rigid to hold ball shape and protect root mass.

3. Use all means necessary to protect and maintain materials before, during and after installation and to protect the installed work and materials of all other trades.

4. All seed shall be delivered in the original bags certifying purity, germination, common, and botanical name for each species, and percent weed seed. Owner's representative shall inspect all seed prior to application. Untagged seed bags shall be rejected. Immediately make all replacements necessary to the approval of the Owner's representative and at no additional cost to the Owner.

5. Deliver all products, as specified, to site in original, sealed containers bearing manufacturer's guaranteed statement of analysis.

B. Delivery

1. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.

2. Deliver only plant materials that can be planted in one day unless adequate storage and watering facilities are available on job site.

3. Protect root balls by heeling in with mulch if not planted within 24 hours of delivery.

4. Protect during delivery to prevent damage to roots at all times. Cover all materials during transport.

5. Notify Land Owner's representative of delivery schedule 48 hours in advance so plant material may be observed upon arrival at job site and can be inspected immediately after being unloaded at site.

6. Remove rejected plant material immediately from site.

7. Do not lift, move, adjust to plumb, or otherwise manipulate plants by trunk or stems. Avoid damage or stress by proper handling. Plant material dropped

on the ground, rather than gently placed into the storage area or planting bed, will be rejected.

C. Storage

1. Plant material shall be stored in a shady and secure location, and shall be watered regularly prior to planting to prevent drying out of the rootball.

2. Seed, fertilizer, herbicide, hydromulch, and tackifier shall be kept in dry storage away from contaminants, at a weatherproof location.

1.7 JOB CONDITIONS

A. Site and Plant Protection

1. Care must be exercised to minimize disturbance or compaction of areas adjacent to any project. Trees shall be protected as specified in the project manual. (Section 02210 – Tree Protection)

2. In order to prevent excessive soil compaction and destruction of soil structure, no site work will be performed in cases where equipment or traffic must pass over wet soils or if wet soils must be handled or manipulated in order for the work to progress. Wet soil is defined as any soil within 90 percent of field capacity (saturation).

3. Do not move equipment over existing landscape or newly placed structures without approval of the Owner or Owner's Representative.

4. Provide board roading as required to protect paving. Protect other improvements from damage, with protection boards, ramps and protective sheeting.

B. Planting Restrictions

1. Perform actual planting per referenced standards.

2. Owner's representative must approve all bedding plants and ground covers.

4. Plant materials must be installed with spacings that allow, at maturity, a maximum of 30 percent canopy overlap or inter-fingering. This does not apply to species of widely disparate mature sizes, such as between a large tree and understory shrubs, because their canopies do not grow together.

5. Trees that are medium and small at maturity must be planted no closer than fifteen feet to any building, sidewalk or paved surface unless otherwise indicated on the drawings. Trees that are large at maturity cannot be placed closer than 20 feet to any building, sidewalk or paved surface unless otherwise indicated on the drawings. Owner must approve exceptions to these requirements.

C. Utilities

1. Utility locates are required prior to digging and any construction activities.

2. Coordinate work with Owner, including irrigation manager,in order to prevent damage to underground sprinkler system.

1.8 WARRANTY

A. Warranty plant material for one year after final acceptance. Replace dead or dying materials not in vigorous, thriving condition as soon as weather permits and on notification by Owner's representative. Replace plants, including trees, which in opinion of Owner's representative have partially died, thereby compromising shape, size or symmetry.

B. Replace plants with same kind and size as originally planted, at no cost to Owner. Provide one-year warranty on replacement plants. Trees should be replaced at start of next planting or digging season. In such cases, remove dead trees immediately. Protect irrigation system and other piping conduit or other work during replacement. Repair damage immediately.

C. Warranty excludes replacement of plants after final acceptance because of injury by storm, drought, drowning, hail, freeze, insects, or disease. Materials damaged by "Acts of God" prior to final acceptance are responsibility of Contractor.

D. At end of warranty period, remove staking and guying materials from the site.

1.9 MAINTENANCE

A. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.

B. Maintain plantings and trees by watering, cultivating, weeding, spraying, cleaning, and replacing as necessary to keep landscape in a vigorous, healthy condition.

C. Coordinate watering schedules with irrigation contractor or Owner's representative during installation and until final acceptance. Provide deep root watering to newly installed trees.

D. Mowing: Mow newly planted grass area weekly after initial growth reaches two and one-half inches.

E. Weeding: Remove weeds and foreign grasses in planted areas at least once per week. Herbicides may be used only when approved by the Owner's Representative.

F. Fencing: Provide four (4') foot tall orange plastic snow fencing and metal tee fence post spaced at a maximum of eight (8') feet apart around all walks at seeded areas. Maintain until lawn is accepted.

G. Tree Replacement

Trees removed during demolition or construction are to be replaced following consultation with Owner's Arborist or Owner's Representative. Appraised values of existing trees have been determined according to industry standards and will be provided by the Owner if applicable.

PART 2 – PRODUCTS

2.0 PLANTS

A. General

Plant quality must be equal to well formed No. 1 grade nursery stock. Listed plant heights are from tops of root balls to nominal tops of plants. Plants shall be specimen quality, typical of their species or variety.

B. Shrubs and Ground Covers

Plants shall be nursery grown, healthy and vigorous, of normal habit of growth for the species, free from disease, insect eggs, and larvae. Specified sizes are before pruning and measured with branches in normal position. Plants shall be well rooted and established in the container.

C. Ornamental and Shade Trees

Trees shall be healthy, vigorous, full-branched, well-shaped, trunk diameter, and height requirements as specified. Root balls shall be firm, neat and slightly tapered and well burlapped. Trees with loose or damaged root balls at time of planting shall be rejected. Root balls should meet the American Standard for Nursery Stock, Edition approved 1985 by American National Standards Institute, Inc. (Z6O.1) standard.

D. Special Requirements

Shade trees are to be procured a minimum of 30 days prior to scheduled installations. Trees to be shipped in enclosed truck or the branches/leaves protected by appropriate fabric during shipping. Trees are to be healed in at job site or at Contractor's holding facility and maintained until site is ready. Owner's representative will review trees at holding area prior to planting.

E. Collected Trees

Direct planting from the collection site is preferred. Coordinate with Owner for utility locates and scheduling of sidewalk closures or other logistical issues. If necessary, spray field grown trees immediately prior to digging with anti-desiccant. Insure adequate coverage to trunks, branches and foliage.

2.1 SOIL PREPARATION MATERIALS

A. Soil Amendments: Soil amendments are not to be used unless approved by Owner.

B. Topsoil

1. Friable, fertile, dark, loamy soil, free of clay lumps, stones and other extraneous material and reasonably free of weeds and foreign grasses, with a pH of 5.0 to 8.0.

2. Organic matter shall be four to 12 percent total dry weight.

3. Provide tests for certification.

C. Sharp Sand

Sharp sand shall be clean, washed and fine aggregate and shall meet ASTM C33 standards.

D. Peat Moss

Peat moss shall be commercially produced, sterilized, reed-sedge peat, equivalent to Martins Peat, Big Fork, Montana. Peat must have a pH between five and seven and organic matter content not less than 90 percent.

E. Fertilizer

1. Type A – as recommended by testing agency.

2. Type B – Scotts "Osmocote" at a 14-14-14 ratio, incorporated into the soil according to instructions on the bag.

2.2 MISCELLANEOUS MATERIALS

A. Edging

As indicated on drawings.

B. Mulch

1. Shredded, medium grade, Douglas fir bark with a chip size of one and one-half inch to two and one-half inch average, free of wood chips and sawdust, as manufactured by Model Log Homes, 75777 Gallatin Road, Gallatin Gateway, Montana, 59730 (or approved equal).

2. One and one-half inch round, native, washed, river rock.

3. Owner's representative approved equal.

C. Landscape Fabric

Heavy, professional grade, spun-bonded nylon landscape fabric with six-inch anchoring pins. Woven fabric is unacceptable.

D. Anti-Desiccant

1. Protective film emulsion for protection of plant surfaces during transport. Permeable to permit transpiration, as manufactured by Wilt Pruf, Inc., P.O. Box 4280, Greenwich, Connecticut, 06830. Mixed and applied in accordance with manufacturer's instructions.

2. Owner's representative approved equal.

E. Staking and Guying

1. Tie Wire: 12-gauge, galvanized wire

2. Metal posts: 8'-0" t-stakes

3. Nylon strap: three inches wide, 12 inches long white or black nylon strap with one ½" brass grommet in each end or Landscape Architect approved equivalent.

F. Drainage Fill

No drainage without Owner's written permission.

G. Native Topsoil

Refer to Montana Standard Specifications Subsections 203.80 Topsoil Salvaging and placing, 610.00 Topsoiling and 713.06 Topsoil Material.

H. Imported Topsoil

In the event sufficient quantities of native topsoil cannot be salvaged from the site, the Contractor shall provide imported topsoil to supplement the project requirements. The Contractor shall provide topsoil that meets or exceeds the quality of the native topsoil material available on site. Contractor shall provide source and analysis information to the Owner's Representative, for his approval, prior to delivery. The Contractor shall incorporate into the topsoil, amendments necessary to provide topsoil fertility and quality, equal to or exceeding the characteristics of the native topsoil.

PART 3 - EXECUTION

3.0 INSPECTION

Examine sub-grade and verify conditions under which work is to be performed. Notify General Contractor and Owner's representative of unsatisfactory conditions.

3.1 BED PREPARATION

A. Scarify all sub-grade of bed areas to six inches, all areas.

B. Contractor shall spread topsoil evenly throughout bed after thoroughly mixing soil, amendments and fertilizer together on site.

C. Remove any debris and rocks larger than one inch.

3.2 SHRUB AND GROUNDCOVER PLANTING

A. Provide one-foot deep top soil in all shrub beds.

B. Place plants in a position on bed areas before removal from containers. Obtain approval from Owner's representative of plant layout in the field. Owner's representative reserves the right to shift locations of plants prior to planting.

C. Remove all materials (burlap, twine, wire, etc.) from entire root ball on all B&B plants.

D. Plant all plants as located, setting plants with the root flare even with the tops of bed grades. Backfill with native soil and compact soil carefully around each plant ball. Water thoroughly to eliminate air pockets. Carefully prune plants to remove dead or broken branches and hand-rake bed areas to smooth even surfaces.

3.3 TREE PLANTING

A. Ornamental Trees and Shrubs

1. Stake locations for approval by Owner's representative.

2. Plant in pits two times wider than ball for trees and shrubs.

3. Fill material should be the native soil removed from the hole. No planting mix or soil amendments should be used.

4. Glazed sides of mechanically dug holes should be roughened or scarified to allow root penetration.

5. Remove all materials (burlap, twine, wire, etc) from entire root ball.

6. Carefully settle by watering to prevent pockets.

7. Root collar shall not be planted below finish grade level.

B. Root Balls

1. Root balls shall be properly located in relationship to adjacent soil as required by referenced standards.

2. Balls set too deep or too shallow shall be carefully removed and replanted as required by the Owner's representative.

3.4 TREE MOVING AND TRANSPLANTING

A. Tree moving and transplanting shall be done in accordance with standards outlined in *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.

B. All tree moving and/or transplanting operations shall be coordinated with the Owner prior to commencement of work.

C. All removal and receiving areas shall have a comprehensive utility locate done according to current standards prior to commencement of work.

3.5 PERENNIAL PLANTING

A. Prepare planting beds as indicated on drawings. Provide one foot of thoroughly mixed and prepared soil consisting of 50 percent sand loam topsoil; 25 percent coarse pumice, 3/8 inch size; and 25 percent peat moss. Thoroughly mix in 20 pounds of Scott, Ortho or Lilly-Miller nitrogen fertilizer per cubic yard with formulation of 10-20-10.

B. Replace existing soil with planting mix.

C. Space plants as indicated on drawings. Obtain approval of plant layout from Owner's representative before planting. Owner's representative reserves the right to change the location of plants prior to planting.

3.6 LANDSCAPE FABRIC

After planting has been completed and approved by the Owner's representative, install landscape fabric across planting beds. Sheets of fabric should have a minimum six-inch overlap. At the bed margins, fabric should be installed under the bottom of the edging. Fabric lapping outside the edging should be trimmed to below grade and buried when the edging is backfilled. Fabric should be well anchored with 6 inch staples pounded flush with the grade. Plant openings must be large enough to allow for future growth.

3.7 TOP DRESSING

After landscape fabric has been installed and accepted by the Owner's representative, top dress bed areas with mulch, as indicated on drawings, a minimum of three inches deep. Fabric must not be exposed or protrude above the mulch or edging. Mulch should be clean, whether organic or mineral mulch, and should be free of debris and soil.

3.8 TREE WRAPPING

Tree wrapping will not be accepted.

3.9 PRUNING OF NEW TREES

A. Follow referenced standards and prune material as directed by Owner's represenative.

B.Do not cut back terminal branches. Properly remove sucker growth from the base and badly broken or bruised branches. Thin native trees more heavily than nursery grown plants.

3.10 TREE SAUCERS

Form a four inch high saucer around each new tree for deep watering. Contractor is responsible for deep watering until final acceptance.

3.11 TREE GUYING AND STAKING

A. Stake and guy trees immediately following planting operation. Take precautions during guying operation to prevent damage or injury to branches and roots. Orient all stakes within each cluster or row of trees in the same direction or as directed by Owner's representative.

B. Trees of over one inch caliper must be staked with woven nylon straps and wire. Tension on ties should be adequate to support tree, but slack enough to permit movement and the development of reaction wood. Ties cannot be fastened tightly to trunks; free movement or slack equal to at least twice the caliper must be allowed.

3.12 PLANTING BED EDGING

Install edging per manufacturer's directions. Set edging as indicated in true lines as designed with top of edging one inch above finish grade.

3.13 CLEANUP

A. Keep premises neat and orderly including organization of storage areas. Remove trash and debris from excavated planting areas, preparing beds, or planting plants from site daily as work progresses. Keep paved areas clean by sweeping or hosing.

B. Repair all damage caused by landscape operations.

END

IRRIGATION SYSTEM GUIDELINES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of each Contract, including General Conditions and Supplementary Conditions, apply to work of this section.

1.02 DESCRIPTION

The work of this section consists of all items necessary to install the proposed irrigation system as indicated on the plans, and the protection and splicing required to maintain all parts of the existing irrigation system in operation, with the exception of those parts designated to be removed or abandoned. This includes required sleeves for pipe and wire, back-flow prevention devices, reconnections, and miscellaneous modifications to the existing irrigation distribution lines including, but not limited to:

A. Automatic controller and remote control valves.

B. Lawn and planting beds sprinkler system.

C. Connection to proposed irrigation water source and power supply.

1.03 RELATED WORK DESCRIBED ELSEWHERE

A. Site Clearing	Section 02230
B. Earthwork/Restoration	Section 02301
C. Landscaping	Section 02905
D. Lawns and Grass	Section 02935

1.04 QUALITY ASSURANCE

A. Qualifications of Installer

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials of installation and who shall direct all work performed under this section. All work of this section and related work listed above shall be performed by the same CONTRACTOR.

B. Codes and Standards

1. In addition to complying with all pertinent codes and regulations, comply with the latest rules of the National Electrical Code for all electrical work and materials.

2. Comply with National Plumbing code at all connections to potable water systems.

3. Where provisions of pertinent codes and standards conflict with the requirements of this section of these Specifications, the more stringent provisions shall govern.

1.05 SUBMITTALS

A. Material List

Before any irrigation system materials are delivered to the job site, submit to the ENGINEER a complete list of all irrigation system materials to be furnished and installed.

1. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation. Where materials proposed differ from those specified, furnish complete shop drawings and design calculations to demonstrate equivalent performance of the proposed installation.

2. Do not permit any irrigation system component to be brought onto the job site without prior approval by the ENGINEER. Provide one sample of each element of the system to the ENGINEER for approval (sprinkler heads, valves, couplings, etc.). These samples will be returned to the CONTRACTOR, and if approved, may be used in the project.

B. Shop Drawings

CONTRACTOR shall submit Five (5) copies of the proposed sprinkler layout in a schematic form to the ENGINEER for approval. Any modifications to these proposed drawings will be returned to the CONTRACTOR for the preparation of five (5) copies of the final revised layout. The material list will be coordinated with the final shop drawings by the CONTRACTOR. Show all sleeve locations.

C. Field Verification

CONTRACTOR shall field verify all dimensions, existing and proposed conditions, and as required to provide one complete and operable system. Proposed system shall be laid out above ground using locate flags to show location of all sprinkler heads, valves, and sleeve locations. This layout shall be signed off on by MSU Irrigation Manger before any excavation shall begin.

D. As-built Drawings

Provide a complete set of Mylar reproducible as-built shop drawings to the ENGINEER for approval prior to final payment.

1.06 PRODUCT HANDLING

A. Protection

Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

1.07 PERFORMANCE REQUIREMENTS

A. Minimum Requirements

The following shall be the minimum requirements of the system. They are not intended to limit the overall intent, which is to obtain a fully operational and completely automatic sprinkler system. Specific requirements of this project manual shall apply to all elements typically. Conflicts between the drawings and the project manual or between specific and general performance of material requirements shall be assumed to be the most expensive.

B. Project Zones

Refer to the drawings for the general zones to be served by this system.

1. Irrigation layout must be adaptable to the future modification of the system to smaller heads, more intense head arrays and minimal spraying over the sidewalks. This should be accomplished by running the laterals near sidewalk edges whenever possible, and by positioning the mains with this future intent.

2. CONTRACTOR will advise himself of all existing and proposed site conditions and related planting and grading as required to coordinate and schedule with the work of other contractors.

3. Heads shall be positioned to prevent damage from spraying on the building envelope and/or causing inside flooding in any and all cases.

4. Organize zones to allow walking across the area on dry sidewalk while the irrigation system is on.

PART 2 - MATERIALS

2.01 PIPE

A. Plastic Pipe

1. Plastic pipe 4” and under in diameter shall be rigid non-plasticized Schedule 40 PVC IPS solvent-welded conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. Plastic pipe 6” and larger in diameter shall be rigid non-plasticized Class 200 PVC IPS gasket fit conforming to ASTM D-1784 and D-2241 standard specifications for PVC plastic pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious material, wrinkles, and dents.

2. All pipes shall be continuously and permanently marked with the following information:

   Manufacturer’s name or trademark, size, schedule and type of pipe, working pressure at 73 deg. F and National Sanitation Foundation (N.S.F.) approval.

3. All main lines shall be a minimum of two inches (2”) in diameter, unless otherwise noted.

4. All lateral lines shall be a minimum of one and one-half inches (1-½”) in diameter, unless otherwise noted.

5. All plastic pipefittings to be installed shall be molded fittings manufactured of the same material as the pipe, rated as a pressure fitting (no DWV fittings shall be allowed) and shall be suitable for solvent weld, slip joint ring-tight seal, or screwed connections. All pipe six inches (6”) in diameter and above shall be Class 200 PVC IPS gasket end. All smaller pipes shall be Schedule 40 PVC IPS solvent-welded.

6. Slip fitting socket taper shall be so sized that a dry, unsoften pipe end, conforming to these specifications, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only schedule 80 pipe may be threaded.

7. When connection is plastic to metal, plastic male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape on Water Based Teflon Paste.

8. All mainline pipes shall be traceable via purple or blue-colored 14 gauge single strand direct burial wire attached to the pipe. The wire should be free from moving valve parts to prevent damage. The tracer wire shall surface at and be

secured to the controller. This is not necessary for lateral pipelines with irrigation heads attached.

B. Pipe Sleeves

Pipe sleeves shall be Schedule 40 PVC pipe, six-inch (6") diameter unless noted otherwise, or equal approved by ENGINEER.

1. Installation

Provide empty sleeves along all pathways as noted on the drawings or every 100 feet. Extend sleeves at least one foot (1') beyond pavement on both sides. Sleeves shall be installed 18 inches below finished grade. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected. Cap ends of empty sleeves with duct tape.

2. Sleeve Location Marking

a. New Pavement

The location of each sleeve must be marked along both of the extreme edges of any new pavement installed over the sleeve. This shall be accomplished by pressing the end section of a two-inch (2") pipe into the uncured pavement surface to make an imprint.

b. Existing Pavement

For sleeves pushed under existing pavement, sleeve locations shall be marked along the extreme edges of the pavement on both sides where the sleeve emerges from under the pavement. Markings shall consist of scoring the surface of the existing pavement with a 2" O.D. core drill just enough to make the impression of a circle in the pavement surface.

2.02 RISERS/SWING JOINTS

A. Flexible Risers

Stationary Pop-up and Surface Sprinkler Heads shall be installed using "funny pipe" or four-piece swing joints. Sprinkler Heads with one-half inch (1/2") and/or three-quarter inch (3/4") inlets shall connect with "funny pipe" exclusively, in lengths no longer than two feet (2'). Sprinkler Heads with one-inch (1") inlets shall connect with four-piece swing joints only.

1. Installation with "funny pipe", which is one-half inch (1/2") low density, polyethylene pipe, rated 80 PSI at 100 deg. F, must use Teflon-taped barbed street

ells. Use of flexible pipe such as “funny pipe” is limited to connecting laterals to irrigation heads.

2. Four-piece swing joints shall consist of an assembly using three (3) one inch (1”) Marlex street elbows, with a 1” SCH 80 Nipple of required length to set head at grade.

B. HDPE Pipe

1. All HDPE pipe must be SDR11 manufactured in accordance with AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714 and ANSI/NSF 14/16 listings.
2. All fusion welds must be done by a certified technician.
3. All fitting must be fusion welded using butt joints with mechanical fittings or electro fusion fittings designed for use with HDPE.
4. All HDPE pipe that is damaged to the point where 10% of the overall wall thickness is effected shall be repaired according to owners’ recommendation.

C. Rigid Risers

All risers for shrub spray heads, bubblers, etc., that are in shrub or flowerbed areas and planters, shall be schedule 80 PVC plastic pipe, unless otherwise specified or shown on the plans. The risers shall be of sufficient height so as not to cause any interruption of the stream from the sprinkler nozzle when the plant material has reached its optimum growth.

2.03 VALVES

A. Ball Valves

1. All manual ball valves, sizes 1-1/2” inches and smaller, shall be all bronze double with integral taper seats and with rising stem.

2. All valves 2” and larger shall be gate valves.
3. All ball valves shall be full port, with chromium or stainless ball with Teflon seats 150 PSI rated, Hammond, or approved equal.

B. Pressure Reducing Valves

Provide pressure-reducing valves on main lines only, Watts, Series U5, U5B ½” to 2” Standard Capacity, or approved equal.

C. Gate Valves

1. All manual gate valves, sizes four-inch (4”) and smaller, shall be made in the U.S.A., brass body, threaded, non-rising stem, full port, 200 PSI/13.8 bar non-

shock cold working pressure up to 180 deg. F./82 deg. C., NSF/ANSI 61-8 compliant: NIBCO model TI-8 or approved equal.

2. All gate valves of 6-inch (6") size or larger shall be at least 150 PSI rated, AWWA-C509 resilient wedge gate valve, made in the U.S.A., featuring non-rising stem, iron body, epoxy coated interior, mechanical joint with appropriate size gaskets for corresponding pipe as per drawing.

D. Quick-Coupler Valves

Provide Rain Bird #3 DNP Quick Coupler valves and one key per valve.

E. Automatic Remote Control Valves

Automatic control valves shall consist:

1. Rain Bird PESB Series, 24 volts, contamination resistant valve with a pressure operating range of 20-200 psi and a 0.25 to 200 g.p.m. flow range. Glass-filled nylon construction, one-piece solenoid with captured plunger, flow control handle adjusts, manual internal and external bleeds, nylon screen scrubber and purple flow control handles for easy identification of non-potable water systems or approved equal.

F. Back-Flow Preventers

Back-flow on potable systems only shall be Wilkins Model 720A or approved equal.

2.04 VALVE BOXES

All remote control valves, pressure regulating valves, manual control valves, zone shut-off valves, gate valves or globe valve filters and drains, unless otherwise indicated, shall be installed in a valve access box of proper size as required for easy access to the valve. Valve box to be Carson, with round, locking green cover ten inches (10") in diameter for quick coupler valves, and 10" x 15" standard for all others unless described otherwise in the contract drawings, or approved equal. All round valve boxes shall be supported underneath the bottom edges with two bricks (minimum). All rectangular valve boxes shall be supported underneath the bottom edges with three bricks (minimum). The base of the valve box should be at or below the body of the valve. The lid of the valve box should be flush or within 1" of turf grade.

2.05 AUTOMATIC IRRIGATION CONTROLLER

A. Controller Type

The automatic controller shall be 120 volt input, soft-wired, 26.5 volt output, with the

number of valve stations and in the type and model number indicated on the plans, and shall be a Rain Bird ESP SAT LS or ESP SAT LW. Wall or pedestal mount type must be pre-approved by the ENGINEER and OWNER for the site situation. Controller station size and quantity specified per drawing. Station wiring and timing schedule specified per drawing. All station wiring must be terminated in a Rain Bird ESPSATOB24 mounted in the pedestal or wall mounted wire trough. All controllers must be equipped with a Rain Bird RMK450NARR with a University licensed and authorized frequency, hooked to a Rain Bird Maxilink Ant 01 or Antenex Directional Yagi Model Y4503/Y4505 or University approved substitute. All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.

B. Electrical Power

Power for the controllers shall be the responsibility of the sprinkler installer. Meet all electrical specifications for installation of controllers and power to the controllers. The controllers must be wired to the power source in the pedestal or wall via an Isobar Ultra 4 surge protector and a two-receptacle Ground Fault Interrupter (GFI) outlet. A pigtail that can reach from the controller to the outlet is required. Power source must be pre-approved by Owner prior to connection.

C. Sleeves

1. Provide minimum six inch (6”) diameter sleeves under paved areas as necessary to run all control wiring and piping for sprinkler zones. Coordinate with concrete work prior to forms being set. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.

2. No sleeving shall be put in tunnel walls. All main lines fed from the tunnel shall be cored, and sized to fit link seals for that pipe size. Each mainline shall be sealed using 2 link seals, one on the inner wall and one on the outer wall. No fittings allowed within 3’-0” of outer tunnel wall.

D. Location

After pre-approval by the ENGINEER and OWNER, locate controllers on outside walls of buildings or on pedestals at locations that will maximize the view of the zones serviced by each controller. Verify locations with the ENGINEER to avoid compromising buildings systems and/or appearance concerns.

Pedestals controllers must be mounted to a concrete slab of dimensions 1.5' x 1.5' x 0.33'. Each pedestal slab shall have a minimum of 2 electrical sweep 90’s poured into it. First; one 1” sweep shall hold 120V direct bury power wires, second, one 2” sweep shall hold valve control and flow meter wires- additional or larger sweeps shall

be installed as needed to avoid wire damage. Two bollards consisting of three inch (3") steel pipe filled with concrete and anchored in concrete shall be installed against the edge of the slab in front and in back of the controller. The bollards shall be primed and painted with a black, epoxy-based paint. The concrete at the top of the pipe must be domed and finished to a smooth, even surface, without concrete residue on the outside surface of the pipe.

E. Flow Meter

A MaxiCom-compatible flow meter must be installed at every point of connection. This may be either a Rain Bird Brass Insert Sensor (FS350B) for pipe three inches or larger, or a Rain Bird PVC Tee Sensor of the appropriate size: FS150P for 1-1/2" pipe, FS200P for 2' pipe, and FS300P for 3" pipe. The flow meter must be directly connected to the controller using PE43 communication cable (the blue/blue white wire pair must be used for the flow meter/pulse transmitter connection) and a PT 322 pulse transmitter. All splices using this type of cable must meet Rain Bird MaxiCom standards. Programming and hook up of the PT322 shall be completed by MSU Irrigation Employee.

F. Certified Installation

All MaxiCom components must be ordered and installed by a MaxiCom-certified installer.

2.06 IRRIGATION HEADS

A. Rotary Sprinklers

All rotary sprinkler heads shall be Model I-20R Series, manufactured by Hunter Industries, San Marcos, California; Rain Bird 5004+PCSAMRNP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; Rain Bird 8005NP Series, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California; or owner approved equivalent.

B. Spray Heads

All spray head sprinklers shall be Rain Bird Model Nos. 1800 series SAM with variable arc nozzles (VAN) or MPR nozzles, manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora California or approved equal.

C. Bubblers

All bubbler zones must be controlled by a Rain Bird PESB Series Valve incorporating a Rain Bird PRS regulator. There must be a Rain Bird WYE Filter System installed directly downstream of the valve, located inside the valve box in a

manner that allows easy maintenance. The bubbler heads must be Rain Bird 1300A-F Series mounted on Rain Bird 1804 SAM Spray Bodies or approved equal.

D. Drip Irrigation

No drip irrigation systems are allowed at Montana State University.

2.07 CONTROL CABLE

A. Type

All electrical control and ground wire shall be Baron irrigation control cable or approved equal, 14-gauge unless otherwise indicated on the drawings. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 600 volt, solid copper, single conductor wire with PVC or polyethylene insulation and bear UL approval for direct underground burial feeder cable.

B. Insulation

Insulation shall be four-sixty-fourths inch (4/64") thick minimum covering of ICC-l00 compound for positive waterproofing protection. All control or "hot" wires shall be red and all common or "ground" wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed. All black extra wires shall be intact and usable from the controller to the end of each mainline run with slack wire available at each valve location.

C. Code Compliance

Verification of wire types and installation procedures shall be checked to conform to local codes.

D. Splices

All splices are to be completed within valve boxes using one-piece, jelly-filled, water-proof wire connectors with 20 expansion coils per splice, allowing work to be completed at ground level. All splices shall be located on as-built drawings.

E. Trench Installation

1. Tape and bundle all wiring at ten-foot (10') intervals.

2. Attach tracer wire to main line pipe only at ten-foot (10') intervals.

3. All 120 volt wiring shall be in conduit with marker tape installed in the ditch six inches (6") above the conduit.

4. All wiring under pavement and through sleeves shall be in conduit.

5. Tie a loose twenty-inch (20") loop in wiring at all changes in direction greater than 30 degrees. Untie all loops after making connections.

2.08 VAULTS

A. Water Service Connection

A vault shall be installed at domestic water service connection. Vault shall house domestic water back-flow preventers, blowout assembly and isolation valves. Vault must comply with applicable code(s).

B. Location

Review location of vault with ENGINEER prior to installation.

2.09 OTHER MATERIALS

A. Tools To Be Furnished

1. Supply as part of this contract the following tools:

   a. Two keys for each automatic controller

   b. Two quick-coupler keys, Rain Bird Model 33K with matching hose swivels.

2. The above equipment shall be turned over to the OWNER at the conclusion of the project. Before final inspection can occur, evidence that the OWNER has received materials must be shown to the ENGINEER.

B. Concrete

Provide and coordinate installation of all concrete thrust blocks. Refer to Division 3 for concrete requirements. Provide thrust blocks for all lines larger than 3-inch diameter, at all tees and ells.

C. Other Materials

All other materials not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to the approval of the ENGINEER.

PART 3-EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that such work is complete to the point where this installation may properly commence.

2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies

1. In the event of discrepancy, immediately notify the ENGINEER.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 FIELD MEASUREMENTS

Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design.

3.03 TRENCHING AND BACKFILLING

A. General

1. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these specifications.

2. Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.

3. The CONTRACTOR will be required to conduct his work so that trenches will remain open a minimum possible time.

B. Depth

1. Trench as required to provide the elevations shown on the Plans.

2. Trench to sufficient depth to give a minimum of eighteen inches (18") of fill above the top of the pipe measured from the adjacent finished grade under driveways and sidewalks.

3. All mainline and control cables shall have a minimum cover of eighteen inches (18") above the pipe or wire. All laterals shall have a minimum cover of twelve inches (12") above the pipe.

4. All sleeves shall be installed at a depth on line and grade with existing or proposed irrigation lines. Sleeves with excessive or shallow invert depth will be rejected.

C. Correction of Faulty Grades

Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the ENGINEER and then compact to provide a firm and unyielding sub grade to the approval of the ENGINEER and at no additional cost to the OWNER.

D. Trench Bracing

1. Properly support all trenches in strict accordance with all pertinent rules and regulations.

2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.

3. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

4. Arrange all bracing, sheeting, and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to proven, sufficient strength.

E. Removal of Trench Bracing

Exercise care in the driving and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

F. Grading and Stockpiling Trenched Material

1. Control the stockpiling of trenched material in a manner to prevent water from running into the excavation.

2. Do not obstruct surface drainage but provide means whereby storm and wastewater are diverted into existing gutters, other surface drains, or temporary drains.

G. Methods

1. All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. All material not required for backfill or not suitable for backfill shall be removed from the site by the CONTRACTOR. Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.

2. The CONTRACTOR shall provide, place, maintain, and remove all necessary barricades, warning signs, and other safety devices from the start to the finish f the project to prevent pedestrians from falling in open trenches.

3. Trench widths in paved streets or in areas where proximity to other structures requires vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.

4. The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth, and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.

5. Where rock occurs in trench excavation, the rock shall be removed to a depth of six inches (6") below the established grade line, and to a width of twelve inches (12") greater than the outside diameter of the pipe to be installed in the trench.

6. No water shall be permitted to rise or stand in trenches not yet backfilled until after the pipe has been placed, tested and covered with backfill for a depth of at least ten inches (10"). Any pipe having its alignment or grade changed as a result of a flooded trench shall be removed and re-laid after the trench is graded once again at no additional cost to the OWNER.

H. Pavement Removal

1. Where excavation of trenches requires the removal of pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bit air hammer, concrete saw or similar approved equipment to obtain straight, square and clean break. After backfilling and sub grade preparations are completed, the pavement section and surfacing shall be replaced.

2. Pavement replacement shall utilize the same materials and design as the original pavement.

3. Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and disposed of by the CONTRACTOR.

3.04 BORING

A. Locations

Boring shall be used to route pipe, wiring, or both under structures such as walks or curbs where trenching is impractical. Sleeves shall be installed in all bored holes.

B. Method

Boring shall be accomplished with a drill, auger, water jet, or any other instrument approved by the ENGINEER capable of producing a precise hole. Boring shall not disturb overlaying structures or cause settlement and damage to those structures.

3.05 SLEEVES

A. Locations

Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.

B. Methods

1. Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.

2. Sleeves installed in borings shall be forced through and shall have a snug fit throughout the length of the bored hole. Sleeves cracked or broken shall not be accepted.

3.06 BACKFILL

A. Material

Backfill material shall be free of clods, lumps of frozen material, or stones larger than one-inch (1”) in their maximum dimension. The bedding and select material under, around and six inches (6”) above the top of the pipe shall be placed by hand in maximum layers of six inches (6”) and carefully compacted in a manner which will not displace the pipe. Compaction of the select backfill shall be at least ninety percent (90%) of the maximum density as determined by AASHTO T-180. Water settling will not be allowed.

B. Inspection

The trenches shall not be backfilled until inspection has been completed and the pipe installation, including the grade, alignment and jointing has been found to be in compliance with the requirements of the plans and specifications.

C. Around and Over the Pipe

1. Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than three-quarters of an inch (¾") shall be used in backfilling around and over the installed pipe.

2. The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The CONTRACTOR may at his option and expense provide an acceptable imported material.

3. This backfill material shall be carefully deposited around and over the pipe in layers not more than six inches (6") thick, loose measurement, unless otherwise permitted by the ENGINEER, wetted to optimum moisture content and uniformly compacted to at least ninety-five percent (95%) of the maximum density obtainable at optimum moisture content as determined by ASTM D698 (latest revision), until the pipe has a cover depth of at least one foot (1').

D. Remainder of Trench Backfill

1. The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.

2. This material shall be carefully deposited in layers not to exceed six inches (6") in compacted thickness and compacted to at least ninety-five percent (95%) of the maximum density as determined by ASTM D698 (latest revision). The method of compaction selected by the CONTRACTOR shall not cause damage of any nature to the installed pipe. Replace topsoil on trench fill and compact to eighty-five percent (85%) of maximum density at optimum moisture.

3. The use of water settlement for this portion of the trench backfilling is permissible if the specified density can be obtained and the backfill material is suitable for this type of trench compaction.

3.07 INSTALLATION OF PIPING

A. General

1. Layout the piping system in strict accordance with the Plans.

2. Where piping is shown on the Plans to be under paved areas but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.

B. Line Clearance

1. All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades, except through pipe sleeves.

2. Parallel lines shall not be installed directly over one another.

C. Inspection of Pipe and Fittings

Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and butts and reaming as required; install all pipe with stamped markings oriented up to allow visual inspection and verification.

D. Plastic Pipe

1. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

2. All plastic pipe joints shall be solvent-weld joints or gasket fit joints. Only the solvent cement recommended by the pipe manufacturer shall be used and it must be a two-part system consisting of primer and cement. No single part cement system shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the CONTRACTOR's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The CONTRACTOR shall assume full responsibility for the correct installation.

3. All plastic (PVC) to metal joints shall be made with plastic threaded male adaptors into metal threaded female fittings.

4. The solvent-weld joints shall be made on dry pipe.

5. The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.

E. Copper Pipe

Direct buried copper pipe connections shall be made using silver solder.

F. Thrust Blocks

Provide concrete thrust blocks for all pipes as shown on the plans. All thrust blocks shall bear directly on undisturbed earth. Center the pipe in the middle of the thrust block.

3.08 INSTALLATION OF EQUIPMENT

A. General

1. All fittings, valves, etc., shall be carefully placed in the trenches with concrete thrust blocks, placed where required.

2. All sprinklers, having adjustable nozzles, shall be adjusted for proper and adequate distribution of the water over the coverage pattern of the sprinkler.

3. All nozzles on stationary pop-up sprinklers or stationary spray heads shall be tightened after installation. All sprinklers having an adjusting screw, adjusting stem or adjusting friction collars shall be adjusted as required for the proper arc of coverage, radius, diameter and/or discharge.

4. All control wires shall be clearly labeled by station, using weatherproof material, at the controller and at the valve ends. Mark the underside of all valve box covers, indicating the valve controller station number. All markings shall be made in a neat and legible manner using white enamel paint.

5. All control or “hot” wires shall be red and all common or “ground” wires shall be white. A minimum of one black extra wire shall be included in the wiring run for every four (4) wires installed.

B. Sprinkler Heads

1. Install lawn sprinkler heads where indicated on the plans and in strict accordance with the manufacturer s recommendations and as necessary to provide complete uniform coverage and precipitation.

2. Upon completion of installation, reset all lawn sprinkler heads flush with grade and firmly anchored with soil.

C. Master Automatic Control Valves

A master automatic control valve shall be installed at the point of connection to the main for any remotely controlled portion of the irrigation system. In cases where there are multiple points of connection, a master valve shall be installed for each, with

no more than three points of connection allowed. Each master valve will have its own separate yellow “hot” wire.

3.09 TESTING AND INSPECTION

A. Covering or Enclosing Work Prior to Inspection

Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the OWNER’s Representative.

B. Flushing

Before backfilling the mainline, and with all control valves in place, but before lateral pipes are connected, completely flush and test the mainline and repair for all leaks; flush out each section of lateral pipe before sprinkler heads are attached. Complications due to this not being done during install will result in charges to the contractor.

C. Testing

1. Make all necessary provisions for thoroughly bleeding the line of air and debris.

2. After valves have been installed, test all live water lines hydrostatically for leaks at a pressure of one hundred fifty (150) psi for a period of two (2) hours, with all couplings exposed and with all pipe sections center loaded.

3. Furnish all necessary testing equipment and personnel.

4. Correct all leaks and retest until acceptance by the ENGINEER.

D. Final Inspection

1. Thoroughly clean, adjust, and balance all systems.

2. Demonstrate the entire system to the ENGINEER and OWNER, proving that all remote control valves are opening and closing on command, that all heads are properly adjusted for radius and arc of coverage, that all emitters are functioning, and that the installed system is workable, clean, and efficient.

3. Existing irrigation system(s) or portions of systems which have had their performance altered by any of the work related to this project shall be repaired or adjusted using materials and installation methods in accordance with this specification and in a manner to restore head-to-head sprinkler coverage, uniform precipitation rates, control zone integrity, and elimination of the spraying of water on building walls and sidewalks.

3.10 CLEANUP

Upon completion of the work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. Cleanup shall be considered an incidental item, and no additional payment shall be made for any cleanup item. All improvements or other obstructions removed during construction shall be replaced in a condition at least equal to their existing condition.

3.11 MAINTENANCE

A. The CONTRACTOR shall, for a period of one (1) year after completion and final acceptance of the work, maintain and repair any trench or boring settlement which may occur, and shall make suitable repairs to any pavements, or other structures which may become damaged as a result of settlement. All such maintenance and repair shall be at the CONTRACTOR's expense.

B. The CONTRACTOR shall inform the OWNER of the location and the nature of all damage done to the existing irrigation system not slated for demolition within eight hours of the occurrence of the damage.

C. The CONTRACTOR shall maintain the existing and proposed irrigation system in operation during the construction period. Upon completion of the proposed irrigation work the CONTRACTOR shall balance and adjust the entire (new and existing) system.

3.12 AS-BUILT DRAWINGS, CHARTS AND EQUIPMENT MANUALS

A. Record Drawings

1. Accurately record on one set of black and white prints of the site plan all installed work including both pressure and non-pressure lines.

2. Upon completion of each increment of work, transfer all such information and dimensions to the print. The dimensions shall be recorded in a legible and workmanlike manner.

3. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day-to-day as the project is being installed. All dimensions noted on drawings shall be one-eighth-inch (1/8”) in size (minimum).

4. Show locations and depths of the following items:

   Point of connection
   Routing of pressure lines (max. dimension=one hundred feet {100'} along lines)
   Gate valves
   Sprinkler control valves
   Quick coupling valves
   Routing of control wires
   Sprinkler heads
   Other related equipment

5. Maintain as-built drawings on site at all times.

6. Make all notes on drawings in pencil (no ball point pen).

B. Controller Charts

1. ENGINEER must approve as-built drawings before charts are prepared.

2. Provide one controller chart for each controller supplied showing the area covered by automatic controller, of the maximum size controller door will allow.

3. The chart is to be a reduced drawing of the actual as-built system.

4. Chart shall be black line print and different colored shading used to show area of coverage for each station.

5. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic.

6. The chart shall be mounted using Velcro or equal type of semi-permanent fastening device.

7. These charts must be completed and approved prior to final acceptance of the irrigation system by the OWNER.

C. Operation and Maintenance Manuals

1. Prepare and deliver to the ENGINEER within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two (2) individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:

a. Index sheet stating CONTRACTOR's address and telephone number, duration of guarantees period, list of equipment with names and addresses of local manufacturer representatives.

b. Complete operating and maintenance instructions on all major equipment.

c. System start-up and shut down instructions.

2. In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the OWNER at the conclusion of the project that this service has been rendered.

3.13 GUARANTEE

A. Warranty

1. The entire irrigation and water system shall be guaranteed to give satisfactory service for a period of one year from the date of acceptance by the OWNER.

2. Should any trouble develop within the time specified above due to inferior or faulty materials or workmanship, the trouble shall be corrected at no expense to the OWNER.

3. Any and all damages resulting from faulty materials or workmanship shall be repaired by the CONTRACTOR to the satisfaction of the OWNER, at no cost to the OWNER.

End

TREE PROTECTION GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

The work in this section includes protection, trimming and maintenance of existing trees, shrubs and groundcover that are affected by execution of the Contract Documents, whether temporary or permanent construction.

A. The Contractor assumes responsibility for all coordination of work within the Critical Root Zone (CRZ) of protected trees.

B. Plant protection applies to all trees to remain within the Limit of Work as well as those, which are adjacent to the Limit of work and could be affected by new construction. Work to include:

1. Protection of existing trees and indicated vegetated areas.

2. Watering of existing trees and vegetated areas to be protected.

3. Maintenance of existing and newly installed tree and vegetation protection elements including but not limited to fencing, organic bark mulch, landscape fabric, cabling, and signage.

4. Pruning of existing trees to be protected

5. Removal of pruning debris and other excess material not used. On-site chipping and re-use of pruned material is encouraged.

C. Contractor shall perform all tree protection installation and removal, and any necessary pruning work required for construction under the supervision of the Owner.

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. Section 01500 – Temporary Facilities and Controls

B. Section 02235 – Site Clearing

C. Section 02300 - Earthwork

D. Section 02810 - Irrigation System

E. Section 02900 - Landscaping

F. Section 02935 – Lawns and Grass

1.3 DEFINITIONS

A. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

B. Drip Line: The areas encompassing the base of the tree as delineated by an imagined vertical line drawn from the farthest extent of the branches to the ground.

C. Diameter at Breast Height (DBH): Diameter at breast height as measured at four and one-half feet (4'-6") above the existing grade at the base of the tree.

D. Critical Root Zone (CRZ): An area up to one and one-half the radius of the drip line of the tree.

1.4 REFERENCED STANDARDS

A. *ANSI Z60.1: American Standard for Nursery Stock*, latest edition, American National Standards Institute.

B. *Hortus Third: A Concise Dictionary of Plants Cultivated in the United States & Canada*, Staff of the L.H. Bailey Hortorium, Cornell University, 1999.

C. *ASTM C33: Specification for Concrete Aggregate*, American Society of Testing Materials.

D. Alex Shigo, *Tree Pruning*, Shigo & Tree Associates, LLC, 1989.

E. *Guide for Plant Appraisal*, latest edition, Council of Tree and Landscape Appraisers.

F. *Species Ratings and Appraisal Factors Guide*, latest edition, International Society of Arboriculture, Rocky Mountain Chapter.

G. *ANSI A300: Standards for Tree Care Operations*, American National Standards Institute.

H. International Society of Arboriculture Best Management Practices publications

I. An Illustrated Guide to Pruning, 2nd Edition, Gilman, Delmar, 2002.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: An experienced tree service firm with a minimum of five years of experience that has successfully completed tree protection and trimming work similar to that required for this project.

B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where the project is located.

C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)."

1. Owner's representative shall be notified 24 hours in advance of all pruning, thinning and tree protection work.

D. Pre-Construction Conference: Conduct conference at project site to comply with requirements in ANSI A300 Division 1, Section "Project Management and Coordination."

1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner's Arborist, Landscape Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated below.

B. Product samples:

1. Tree protection area signage.

2. Cabling materials.

3. Landscape fabric.

4. Organic bark mulch.

C. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that are affected by construction.

D. Tree Protection Plan: Contractor shall submit a tree protection plan that confirms that use of the tree protection fencing plan provided in the Contract Documents. Contractor shall notify the Owner of all work activities within the CRZ of trees to be protected, anticipated work methods, proposed tree and root avoidance techniques, and Arborist's on-site confirmation of CRZ for each tree.

1.7 JOB CONDITIONS

A. Site Work Restrictions: In order to prevent excessive soil compaction and destruction of soil structure, no site work will be performed in cases where equipment or traffic must pass over wet soils or if wet soils must be handled or manipulated within the Tree Protection Zone in order for the work to progress. Wet soil is defined as any soil within 85 percent of field capacity (saturation).

B. Utilities

1. Utility locates are required prior to digging and any construction activities.

2. Coordinate work with Owner, including irrigation manager, in order to prevent damage to underground sprinkler system.

1.8 MAINTENANCE

A. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.

B. Maintain existing plantings and trees by watering, cultivating, weeding, and spraying as necessary to keep landscape in a vigorous, healthy condition.

C. Coordinate watering schedules with irrigation contractor during installation and until final acceptance. Provide deep root watering to newly installed trees.

PART 2 – PRODUCTS

2.0 MATERIALS

A. Topsoil Depth: Natural or cultivated surface-soil layer containing composted organic matter an sand, silt and clay particles; friable, pervious, and black or darker shade of brown, gray or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than two inches in diameter; and free of weeds, roots and toxic and other non-soil materials.

B. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

C. Chain-Link Fence:

1. Fencing shall be galvanized chain link as specified below, six feet minimum height. Plastic fencing and wood stakes, or snow fencing are not acceptable.

2. Includes posts, braces, supports and mesh that may be salvaged materials or other used material to form a minimum six foot high enclosure.

3. Posts shall be a minimum diameter of 1-1/2-inch steel pipe.

4. Mesh shall be two inches by two inches by 11 gauge minimum chain link fabric.

5. Use of concrete or metal post piers is permitted.

E. Signage: Provide weather resistant 8-1/2 inches by 11 inches fluorescent green or yellow signs that identify Tree Protection Zone and list restrictions.

F. Cabling: Cabling materials shall meet the ANSI A300 standards for cabling of trees.

G. Tree Tags: Rack track shaped aluminum engraved numbered tags.

H. Organic Mulch: Shall be free from weed seed, sawdust and splinters and shall not contain resin, tannin, wood fiber or other compounds detrimental to plant life. Bagged mulch shall have moisture content not in excess of 22%. Bulk mulch shall have a size range of ½ inch to 1-1/4 inch with a maximum of 20% passing a ½ inch screen. Re-use of organic debris generated during the project is encouraged.

I. Mycorrhizae Fungal Inoculants: "mycogrow gel" as manufactured by Fungi Perfecti, Olympia, WA, 1-800-780-9162, or approved alternate.

J. Slow Release Fertilizer: Osmocote Plus, 15-9-12, or approved alternate.

K. Anti-Desiccant: Protective film emulsion for protection of plant surfaces during transport. Permeable to permit transpiration, as manufactured by Wilt Pruf, Inc., P.O. Box 4280, Greenwich, Connecticut, 06830, or approved alternate. Mixed and applied in accordance with manufacturer's instructions.

L. Staking and Guying

1. Tie Wire: 12-gauge, galvanized wire

2. Metal posts: 8'-0" t-stakes

3. Nylon strap: three inches wide, 12 inches long white or black nylon strap with one ½" brass grommet in each end or Landscape Architect approved equivalent.

PART 3 - EXECUTION

3.0 INSTALLATION OF TREE PROTECTION FENCING

A. Prior to the start of any construction activity install temporary fencing at the designated tree protection zones to protect existing trees and vegetation to remain from construction damage. Maintain temporary fence and remove when construction (including irrigation and planting) is complete. Owner shall approve fence installation prior to mobilization of the site.

1. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions. All fencing to be locked securely and only entered with owner's permission and in consultation with the Owner's Arborist.

2. Place concrete or metal piers to minimize pedestrian and vehicle circulation and landscape impacts.

3. Provide diagonal bracing to vertical posts at corners of enclosures and wherever needed to ensure rigidity of the fencing.

4. If chain link fabric is used versus chain link panels the chain-link fabric shall be tight to grade at the bottom edge and stretched uniformly between posts. Top of fabric shall be a minimum of six feet above grade. Install fabric to form completely closed area around tree(s). Attach fabric to posts 12 inches on center with 11 gauge wire ties securely fastened, or with bolted ring clips and to top rail not over three feet on center.

B. Fencing shall be installed as follows: In the vicinity of coniferous trees, fenced area shall include an area of a radius from the trunk equal to one and one-half times the radius of the drip line of the tree. In the vicinity of deciduous trees, fenced area shall include an area of a radius from the trunk equal to one and one-half times the radius of the drip line of the tree. For areas with shrubs plants, fenced area shall include the entire edge of the planted area.

C. Area within tree protection fencing must be mulched with organic bark mulch to a depth of four inches.

D. Attach orange flag strips 12 inches long at three feet on center along the fence, five feet above grade.

E. Place tree protection signs at thirty-foot intervals along fence with a minimum of one sign if the fence is less than 30 feet in length.

3.1 FENCE MAINTENANCE AND REMOVAL

A. Maintain fence in specified location and in good condition until completion of site operations and of delivery of equipment and material, except where directed otherwise in writing by Owner's representative.

B. Fencing shall be immediately repaired when damaged.

C. Remove protection fencing at Substantial Completion.

3.2 USE OF AREA WITHIN FENCE

A. Do not use area within fence for operation, storage, vehicles, or foot traffic. Contractor shall notify Owner's representative 24 hours in advance of the need to move a tree protection fence or access inside of it.

B. Do not alter grades within the required protective fence line except as directed during the fine grading operations at the conclusion of site development.

C. Control soil moisture within the protected area. Prevent flooding, ponding, erosion, or excessive wetting of the soil and root systems caused by dewatering operations. Protect root areas from leachate, concrete, oil, fuel, lubricating oil, and from other contaminants.

3.3 USE OF AREA ADJACENT TO FENCE

A. Do not store materials potentially harmful to tree roots within 20 feet of protected areas. Potentially harmful materials include, but are not limited to petroleum products, cement and concrete materials, cement additives, lime, paints coating, waterproofing agents, from coatings, detergents, acids, and cleaning agents.

B. Notify owner's representative of all heavy equipment work to be performed within the CRZ.

1. Tie-back all flexible limbs and branches, which may be damaged during construction, under the direction of the Owner's representative.

2. Use compaction mitigation strategies such as planking, mulch, or plating as directed by the Owner's representative.

3.4 DAMAGES FOR LOSS OR INJURY TO TREES

A. Trees removed or damaged and deemed unviable, during demolition or construction, are to be replaced following consultation with Owner's Arborist or Owner's representative.

B. Trees removed during demolition or construction are to be replaced following consultation with Owner's Arborist or Owner's Representative. Appraised values of existing trees have been determined according to industry standards and will be provided by the Owner if applicable.

C. Contractor is to replace any and every tree lost or irreparably damaged as a result of failure of the Contractor to protect or to adequately maintain existing trees. Trees that fail to fully foliate in the spring following completion of construction operations may be presumed to have been lost due to construction operations.

D. In the event of injuries to the crown, trunk or root system of any tree to remain that are the result of the Contractor's failure to protect and/or maintain such tree, the Owner's Representative may elect to retain the tree and hold the Contractor liable for compensation.

E. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Owner's Arborist's written instructions. Work required by the Owner's Arborist shall be performed by the Contractor at no additional cost to the Owner.

F. Trees, which are removed without authorization, shall be replaced with a tree of the same size and species. If a tree of the same size and species is not available the Owner's Representative shall provide alternatives. If a tree cannot be replaced because the size exceeds the maximum which can be relocated using latest technology, the Contractor shall compensate the Owner at amount equal to the appraised value.

G. Should replacement work of large trees be required as a result of Contractor's failure to protect or maintain trees, a subcontractor specializing in relocating large trees shall conduct all replacement work. Submit qualifications of tree relocation Contractor to the Owner's Representative. The cost of the subcontractor will be at the Contractor's expense.

H. Completely remove and dispose of any tree killed or irreparably damaged as a result of Contractor's failure to protect or maintain trees. Remove those trees damaged or killed as a result of vandalism, natural acts or other causes. Removal and disposal shall include stumps and roots to a depth of two feet below finished grade.

3.5 PRUNING OF EXISTING TREES

A. Limbs and branches that have been broken shall be cut off cleanly above the nearest crotch in accordance with International Society of Arboriculture (ISA) standards. Cut limbs and branches greater than one-half inch in diameter. Sterilize equipment with alcohol prior and during trimming and pruning operation. All pruning of damaged trees shall be carried out to the complete satisfaction of the Owner's Representative.

B. The Contractor shall provide a ISA certified professional to assess and recommend treatment of any damage to trunks or major limbs three inches in diameter or over.

C. All existing trees to be saved shall be limbed and pruned by a ISA certified Arborist. Limbs shall be pruned to ensure safety and promote health of the tree. Inform the Owner's Representative prior to commencement of pruning.

3.6 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within Tree Protection Zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots. Work shall be performed under the supervision of the Owner's representative.

1. Redirect roots into backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately three inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with approved soil.

    a. Straw Mulch: Thoroughly wet excavated sub-grade where roots of existing trees to remain have been exposed. Apply four inches of wet organic bark mulch on horizontal area and wet burlap mats along exposed trench sides.

b. Watering and Maintenance: Thoroughly and evenly water protected areas at a rate not to exceed two inches per hour during dry periods. Coordinate water procedures and schedules with the Owner's Representative or the Project Manager. Maintain root protection procedures throughout the term of the Contract, as required.

D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut roots larger than 1" without notifying Owner's representative; Cut roots smaller than 1" in accordance with ISA standards.

3.7 POST CONSTRUCTION TREE MAINTENANCE

A. Ensure that existing trees remaining on the project site shall be in as good condition at completion of the work as at the commencement of the work. If such a condition does not exist at the completion of the work, assume responsibility to provide corrective actions or replacement with new material as directed by the Owner's Representative.

END

LAWNS AND GRASS GUIDELINES

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General conditions, Supplementary Conditions, apply to work of this section.

1.1 DESCRIPTION

A. Work in this section includes:
   1. Furnishing all plants, labor, equipment;
   2. Performing all operations to finish grade topsoil;
   3. Prepare seed and sod beds;
   4. Sod all lawn areas; and
   5. Maintenance and protection of all sodded and seeded areas.

B. All areas within the contract limits, except surfaces occupied by paving and areas indicated to be undisturbed shall be hydroseeded or sodded as shown on Plans. Areas repaired due to Contractor damage shall be hydroseeded.

1.2 RELATED WORK DESCRIBED ELSEWHERE

A. Section 02200 - Earthwork

B. Section 02215 - Earthwork for Surface Restoration

C. Section 02810 - Irrigation System

D. Section 02900 - Landscaping

The Montana Department of Transportation Standard Specification for road and bridge construction, 1987 Edition, Section 610, roadside development shall govern the work as if bound herein. Where provisions of this section and the referenced standard conflict, this section shall govern.

1.3 QUALITY ASSURANCE

A. Qualification of Workmen

Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

B. Contractor Qualifications

The Contractor shall have at least two (2) years of weed control spraying experience. Proof of experience will be required. The Contractor must have a valid Montana Commercial Herbicide Applicator's License.

C. Chemical Registration

All weed control chemicals must be registered with the Environmental Protection Agency and the State of Montana.

D. Equipment Requirements

The Contractor shall furnish, operate, and maintain suitable and adequate equipment necessary to perform the above operations in an approved and workman-like manner without delays. Spray nozzles shall be raindrop or similar drift control type.

E. Liability and Contractor's Responsibilities

Weather conditions must be such that no damage outside the sprayed area will occur and the Contractor will cease spraying whenever the application of spray could cause such damage.

The Contractor agrees to hold harmless the Owner and Landscape Architect and/or Engineer against any and all claims for damage arising from operations covered in this proposal.

F. Time of Application

Because of varied climatic conditions, it will be the Contractor's responsibility to coordinate spraying activities to achieve the best results. To avoid possible chemical exposure and general alarm among campus users, time of application must not coincide with other nearby outside campus activities. If nearby activity encroaches during spraying operations, spraying must cease immediately until people leave the area.

1.4 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect and maintain materials before, during, and after installation and to protect the installed work and materials of all other trades.

2. All seed shall be delivered in the original bags certifying purity, germination, common, and botanical name for each species, and percent weed seed. Owner shall inspect all seed prior to application. Untagged seed bags shall be rejected. Immediately make all replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

3. Deliver chemical fertilizers and herbicides, as specified, to site in original, sealed containers bearing manufacturer's guaranteed statement of analysis

B. Storage

Seed, fertilizer, herbicide, hydromulch, and tackifer shall be kept in dry storage away from contaminants, at a weatherproof location.

C. Notice to Proceed

The Contractor shall not proceed with seeding or sodding operations until the irrigation system has been tested and approved by the Owner's Representative.

D. Schedules

Install lawn seed mixes during the specified time periods. If special conditions exist that may warrant a variance in the specified plant dates or conditions, a written request shall be submitted to the Owner's Representative stating the special conditions and proposed variance.

The Contractor shall provide a weed control plan and schedule prior to bed preparation, for approval of the Owner's Representative.

E. Substitutions

Requests for substitutions shall be submitted in writing to the Owner's Representative prior to award of contract.

1.5 SPECIAL LANDSCAPE PROVISIONS

A. Water

Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.

B. Maintenance

Until final acceptance, and until as approved stand of grass is achieved, maintain plantings by watering, cultivating, mowing, weeding, spraying, cleaning and replacing as necessary to keep lawns in a vigorous, healthy condition.

Watering: Water as necessary to keep top two inches of soil moist. Coordinate with Irrigation Contractor.

Mowing: Mow newly planted grass area weekly after initial growth reaches 2-½ inches.

Weeding: Remove weeds and foreign grasses in planted areas at least once per week. Herbicides may be used only when approved by the Owner's Representative.

Fencing: Provide four (4') foot tall orange plastic snow fencing and metal tee fence post spaced at a maximum of eight (8') feet apart around all walks at seeded and sodded areas. Maintain until lawn is accepted.

1.6 CONDITION OF SURFACES

Lawn areas will be left at ± 0.1 feet of finish grade as shown on plans.

1.7 ACCEPTANCE

The work will be accepted when a completed stand of grass at the three-leaf stage or beyond is achieved and all provisions of Section 3.5.C, "Performance" have been met as approved by the Owner and Owner's Representative.

PART 2 - MATERIALS

2.1 GRASS SEED

A. General

1. Seed shall be used only in areas where an irrigation system is absent or has been removed.

2. All seed shall be:

a. Free from noxious weed seeds, and re-cleaned;

b. Grade A recent crop seed;

c. Treated with appropriate fungicide;

d. Delivered to the site in sealed containers with dealer's guaranteed analysis.

B. Irrigated Grass Seed Mixture: Seed at the minimum rate of three (3) pounds per one thousand (1000) square feet (130 lbs./acre).

Name of Grass	Proportion by Weight	Percent Purity	Percent Germination
'Midnight' Kentucky bluegrass	25%	95%	85%
'Rugby II' Kentucky bluegrass	25%	95%	85%
'Ram I' Kentucky bluegrass	25%	95%	85%
'Delaware' Dwarf Peren. Rye Grass	25%	95%	85%

C. Non-irrigated Grass Seed Mixture: must be 'Kitty Hawk' turf-type tall fescue seeded at three (3) pounds per thousand (1000) square feet (130 lbs./acre).

2.2 SOD

A. General

1. Sod all areas where site is substantially disturbed.

2. Sod shall be from a commercial sod farm located in the Gallatin Valley.

3. Sod type, condition and source shall be approved by the Owner's Representative.

B. Sod Characteristics

Sod shall be well-established lawn turf grasses similar to the seed mix described in 2.1 B.

Sod shall be vigorous, well-rooted, healthy turf, well hydrated and possessing excellent color.

Sod shall be free from disease, insect pests, weeds, other grasses, stones, and any other harmful or deleterious matter.

C. Sod Handling

Cut sod in uniformly wide strips, uniformly 1-1/2 inches thick with clean cut edges.

Sod shall be rolled or folded prior to lifting. Handling of sod shall be done in a manner that will prevent tearing, breaking, drying, or any other damage.

Sod shall be installed in place on the site not more than 24 hours after cutting.

2.3 FERTILIZER

A. Soil Testing

1. Verify fertilization needs by sampling and testing soil prior to purchasing fertilizer. The test sample shall be obtained by sampling six different locations at the project site. Soil from sampled locations shall be mixed in equal parts to provide a compiled sample for testing.

Testing by an approved laboratory shall include:

a. A test for soil pH,

b. A test for electrical conductivity (EC),

c. A test for the amount of nitrogen, phosphorus and potassium present (NPK),

d. A test to determine the amount of organic matter present (OM).

2. Results of tests shall be reviewed by the Owner and Engineer prior to purchase of fertilizer. If tests results are typical for the general campus area, fertilization operations may commence as specified. If test results are not typical for the general campus area, Owner will provide modified formulation and application rate specifications by Change Order.

B. Formulation

1. Fertilizer shall be manufactured by Anderson ProTurf, or equal approved by the Owner. Application rates shall be in accordance with manufacturer recommendations. Fertilizer shall be complete, uniform in composition, dry and free flowing. The fertilizer shall be delivered to the site in the original waterproof containers, each bearing the manufacturer's statement of analysis.

2. Fertilizer to be spread on areas to be seeded shall be commercially prepared by Anderson ProTurf or an equal product pre-approved by the Owner. Fertilizer shall be a slow release, Poly-S urea, and shall contain the following percentages by weight:

10% Nitrogen
20% Phosphorus
10% Potassium
12% Sulfur

3. Grow - in Fertilizer shall be a slow-release, Poly-S urea, and shall be formulated as 25-3-4-Fe-2% and commercially prepared by Anderson ProTurf or equal approved by the Owner.

C. Special Protection

If stored at the site, protect fertilizer from the elements at all times.

2.4 Mulch

Wood cellulose fiber for hydromulch – Weyerhauser, Conweb, or approved equal.

2.5 Mulch Tackifier

Mulch tackifier must be natural, non-asphaltic, vegetable gum with gelling and hardening agents, Terra Tack or approved equal.

2.6 Water

Water shall be clean irrigation quality water.

2.7 Pre-Planting Herbicide

Roundup, provide compatible surfactant and drift control agents as required.

2.8 Post-Emergent Herbicide

"TRIMEC" 2.4.D.M.C.P.P. DICAMBA (BANVIL) manufactured by P.B.I. Gordon 816-421-4070 distributed by Wilbur Ellis Company (406)-248-1176 or West Chemical Agricultural Chemicals, Inc., (406)-252-3834, or other appropriate control which best fits the weed problem and necessary applications.

2.9 Native Topsoil

Refer to Montana Standard Specifications Subsections 203.80 Topsoil Salvaging and placing, 610.00 Topsoiling and 713.06 Topsoil Material.

2.10 Imported Topsoil

In the event sufficient quantities of native topsoil cannot be salvaged from the site, the Contractor shall provide imported topsoil to supplement the project requirements. The Contractor shall provide topsoil that meets or exceeds the quality of the native topsoil material available on site. Contractor shall provide source and analysis information to the Owner's Representative, for his approval, prior to delivery. The Contractor shall incorporate into the topsoil, amendments necessary to provide topsoil fertility and quality, equal to or exceeding the characteristics of the native topsoil.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

Verify that seeding may be completed in accordance with the original design and the reference standards.

B. Discrepancies

1. In case of discrepancy, immediately notify the Owner's Representative.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FINISHING

A. Topsoil Spreading

Contractor shall provide a 6" minimum compacted, depth of topsoil on all lawn areas. Topsoil shall be graded smoothly and evenly. Lawn area sub grade particularly on slopes shall be roughed and scarified 6" minimum depth to except and bind with the finish layer of topsoil. Topsoil shall be spread in a non-muddy, unfrozen condition. Surface finish shall be +/- 0.1 foot. Compaction of the topsoil layer shall be ±85% maximum dry density. Refer to Montana Department of Highways Standard Specifications Subsections 610.00 Topsoiling.203.08 Topsoil Salvaging and Placing, 713.06 topsoil material.

B. Finish Grading

Grade lawn areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain minimum 2% slope. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, and elevations at steps or building). Loosen and fine rake areas to receive seed or sod to break up lumps and produce a smooth, even grade, free from unsightly variations, ridges, or depressions. Remove stones one inch or larger, sticks, roots or other debris exposed during this operation. All finish grades shall meet the approval of the Owner’s Representative before grass seed is sown or sod is placed.

C. Weed Control

1. Prior to application of seed or sod, the bed shall be roughed up to a depth of 1/8th inch.

2. Moisten the seedbed to a depth of 1" to promote germination of any seeds contained in the topsoil. If rhizomatous grasses, field bindweed (morning glory) or noxious weeds are evident, the Contractor shall be required to eliminate those undesirable plants prior to seeding or sodding, at the discretion and direction of the Owner’s Representative.

3. Spray areas showing weed growth with approved herbicides, mow, and remove clippings prior to final grading. Seeding and sodding shall be executed 72 hours following Roundup application.

3.3 PLANTING

A. Preparation

1. Hydroseed bed preparation shall pertain to the preparation of the surface of the ground to receive the seed. The ground shall be hand or machine raked to remove all debris, clods, rocks, and other material larger than 1 inch, to a depth of 4 inches. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property. Hydroseed bed preparation shall not commence until the moisture conditions make the ground area and soil friable.

2. If there has been a time lapse following the placement of the topsoil to allow it to become settled and compacted on the surface, the areas to be seeded shall be thoroughly worked to a depth of 3 to 4 inches so as to provide a surface of such condition that it will allow application of the seed in compliance with these specifications.

3. Hydroseed beds shall be permitted to settle or firmed by rolling before seeding.

4. Initial application of fertilizer shall be applied evenly at the rate of 600 lbs. of material per Acre prior to seeding and incorporate into the prepared seedbed ½" deep by light raking.

B. Sowing

1. Immediately prior to the application of the seed, the soil shall be loose to a depth of at least 1 inch and free from all material as specified. If soil is too loose or dry for good handling, it should be moistened and rolled lightly.

2. Hydroseed all irrigated areas as shown on the plans. Irrigated areas may be seeded any time between April 15 and June 1, and August 10 and September 10, provided the irrigation system is operational. Hydroseed all dry land areas as shown on the plans. Seed to overlap limits of irrigated lawn by one half the distance between sprinkler head and limits of coverage between April 1 and May 15, and September 20 and October 30.

3. Lawn grass shall be sown at 3 pounds per 1000 square feet, (130 lbs./acre) using approved methods that allow for the even precise hydroseeding and incorporation of the seed into the top ½-inch of the prepared seedbed. If seed can be drilled, reduce rate to 60 pounds per acre. A drill type seeder with spacing greater that 3½" is not acceptable. When seed is drilled and the surface is unduly loose, the seedbed shall be compacted by an agricultural roller, cultipacker, or compactor not more than 24 hours after seeding.

4. Apply tackifier on all slopes greater than 4 to 1 at a rate of 100 pounds per acre.

5. Seed and mulch shall be applied in separate and distinct operations except that a minimal amount of mulch may be added to the seed slurry as a visual aid during the seeding process. Mulch applied with seed shall not exceed of mulch for each five (5) gallons of water. This mulch shall be deducted from the total quantity to be applied. The application of the seed slurry shall be made with the equipment having a built-in agitation system and operating capacity sufficient to agitate, suspend, and homogeneously mix slurry containing water, seed, and mulch. The slurry shall be sprayed over the soil in a uniform coat. Wherever practical, the slurry shall be applied normal to the surface being treated to effectively drill the seed in to the seedbed. Hydromulch application shall follow seeding as soon as practical, with consideration for minimal soil erosion through washing. All seeded areas shall be mulched before work is terminated on any day.

C. Mulching

1. Mulch all hydroseeded areas. Topsoil or seed that washes out for reasons attributable to the Contractor's activities or failure to take proper precautions shall be replaced at the Contractor's expense.

2. All structures shall be protected from hydraulic application of mulch material. Any material deposited on walks, streets, inlets, or other structures, shall be removed.

1. Mulch shall not be applied in the presence of free surface water, but may be applied on damp ground.

2. Organic mulch shall be mixed with water at a rate of one pound of mulch (dry weight) to one gallon of water, hydraulically applied as per manufacturer's recommendations at a rate of 2000 pounds per acre.

D. Tackifier

Mulch tackifiers shall be mixed with water at a rate specifically by the manufacturer and shall be applied at a minimum rate of 40 pounds per acre.

3.4 SOD INSTALLATION

A. Preparation

Bed preparation shall be similar to that required for seedbed preparation.

B. Application

1. Sod may be placed at any time when the ground is not frozen.

2. A string or line of boards may be used as a guide for setting the first course of sod across the area. Each course is matched against the edge of this course, staggering successive courses. All work should be done on boards laid on top of the sod to avoid footprints or other injuries to the surface.

3. All sod is to be laid on topsoiled areas. The joints shall be butting.

4. Lay sod across slope.

5. Roll or lightly tamp, with suitable wooden or metal tamper, all new sod sufficiently to set or press sod into underlying soil.

6. Before sod is laid, apply fertilizer specified, at the rate of six (6) pounds per 1000 square feet.

7. After sod installation is completed, clean up and thoroughly moisten areas of newly laid sod.

3.5 STAKING AND FENCING

A. General

All newly sodded or seeded areas are to be fenced so as to prevent trampling by foot or vehicular traffic. Fencing shall be removed by Contractor when Owner has determined that the lawn area is successfully established, as dictated in this section.

B. Materials

1. Posts to be five-foot minimum, six foot maximum green steel t-posts.

2. Fencing to be four-foot Tenax in guardian orange, length variable. Color substitutions allowed only with the direction and approval of the Project Manager.

C. Performance

1. Staking shall not be performed without prior identification of underground utilities, including but not limited to irrigation.

2. Stakes shall be installed every 16 feet or less, using a t-post driver.

3. Fencing to be attached to posts with nylon fence ties, zip ties or flexible wire.

3.6 MAINTENANCE

A. General

Maintain original grades of all lawn areas after commencement of planting and during maintenance period until final acceptance of the job, but in no case less than forty-five (45) days.

B. Work Included

1. All irrigated areas shall be watered as required to establish a mature stand of grass.

2. All areas shall be watched closely so that they are not permitted to dry out or to form puddles of water, or to be washed by over-application.

3. Mow all seeded lawn at 2½" each time its height reaches 3½". Maintain through a minimum of three mowings to provide an even stand over the entire seeded area, until final inspection and acceptance.

4. Provide a "grow-in" fertilizer, as specified, for all irrigated lawns. Apply six weeks after seed germination. In the case of fall seeding, apply prior to May 1, the following year.

5. Apply post emergence herbicide per the manufacturer's recommendations and application rates, whenever and wherever weed growth jeopardizes or inhibits the development of a mature grass lawn. Apply herbicide in late spring or early summer. Apply only when mean high temperatures are between 60° and 85° F with wind velocities less than five (5) miles per hour. Prior to application, Contractor shall notify Owner, in writing, of the proposed schedule for applying herbicides. Written notice shall include the following items:

   a. Date of proposed application
   b. Specific area of proposed application
   c. Proposed herbicide for application
   d. Proposed concentration and application rate.

   The application area must be signed with Owner-approved signs informing the public of the application and duration of restricted use.

C. Performance

1. Establish a dense lawn of permanent grasses, free from lumps and depressions. Any part failing to show uniform cover and grades free from lumps and depressions shall be redone, and such replacement shall continue until a dense lawn is established. Scattered bare spots will not be allowed. Adequate germination shall equate to 11 to 15 seedlings per square foot over 95 percent of area seeded for native grass areas.

2. Finish grades at the edges of sidewalks, curbs or other hard surface boundaries must be at a level such that the established turf surface will be one (1) inch below the plane of the hard surface for a minimum distance of six (6) feet from the edge.

3. Maintain entire lawn area until the above performance is achieved throughout the project.

D. Replacements

1. Any area that fails to produce an adequate stand of grass shall be re-sodded or reseeded by the Contractor at no additional expense to the Owner.

2. Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract.

3. For acceptance, the established grass will be judged by the stand's fullness, health, maturity and number of weeds present. Determination and acceptance of grass areas shall be made by the Owner’s Representative.

E. Extension of Maintenance Period

Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

3.7 CLEAN-UP

Keep premises neat and orderly including organization of storage areas. Remove trash and debris resulting from lawn preparation from site daily as work progresses. Leave paved areas in a broom clean condition by sweeping or hosing.

END

MONTANA STATE UNIVERSITY – BOZEMAN
ASBESTOS ABATEMENT PROCEDURES
ASBESTOS HAZARD RISK MANAGEMENT

I. Scope

This plan provides a description of the minimum requirements for the removal (abatement) of asbestos containing building materials for Montana State University (MSU), Bozeman. This document provides general guidelines and regulatory references to be followed and fully complied with during work involving greater than 10-square feet of asbestos containing building material (ACBM) or 3-linear feet of thermal system insulation (TSI) material containing asbestos. ACBM is defined as a material containing greater than 1% asbestos mineral.

II. Purpose

The purpose of this document is to create and communicate a uniform expectation for the management of asbestos and its associated risks on the MSU Bozeman campus. It outlines the mechanisms to protect the occupants of our buildings, our staff and faculty, the general public, and the environment from asbestos fiber release as well as to ensure regulatory compliance.

The document is intended to communicate minimum expectations both to internal abatement staff as well as contractors who may perform abatement work on campus.

III. Definitions

Definitions related to asbestos work and asbestos hazard control are taken from the following references:

- 40 CFR 61 Subpart A & M;
- 29 CFR 1926.1101;
- 29 CFR 1910.1001; and
- MDEQ Asbestos Control Act (Current Regulation).

Note: In some cases, extra detail or clarification has been added to the regulatory definition. At all times the regulatory definition is the minimum standard and this document may prescribe best business practices that exceed requirements.

Asbestos Containing Building Material (ACBM): Any building component determined to contain 1% or greater of asbestos mineral as specified in 40 CFR 61 Subpart M (EPA) (MDEQ), 29 CFR 1926.1101 and 29 CFR 1910.1001 (OSHA).

Background: Pre-construction fiber results either by Phase Contrast Microscopy (PCM) or Transmission Electron Microscopy (TEM) collected in proximity to the work space and to be used for determination of existing conditions where concern exists that fiber concentrations are above the accepted industry clearance level of 0.010 f/cc (PCM) or 70 structures/mm^2 (TEM).

Friable ACBM: Any ACBM that can be crushed to powder by hand or that may be crushed to powder in the course of the construction activity. All materials mechanically disturbed and significantly crushed on campus are assumed to have the potential for friability and are to be handled as such.

Negative Pressure Enclosure: An enclosure of the work area constructed of wood or poly (plastic). . All enclosures are to be constructed with HEPA (High Efficiency Particulate Air) filtered ventilation to provide a negative pressure differential with adjacent areas equal to or greater than 0.020 inches of H_2O column as measured by a logging manometer. At a minimum, the HEPA filtered ventilation is to provide four (4) air changes per hour. In effect, a negative pressure enclosure ensures asbestos fibers do not escape during entry, work, or exit – fibers are captured in filters. All surfaces not to be impacted by the work are to be isolated from the work by the enclosure or have the ability to be cleaned within the enclosure to ensure they are free of dust and fibers related to the work.

Decontamination Unit: A two or three room attachment to the containment used for ensuring that the workers have a space to don Personal Protective Equipment on the entry and decontaminate clothing and tools prior to exit from work area. Decontamination rooms are separated by plastic flaps and are kept under negative pressure during the work. A shower is used during friable removal to ensure workers wash themselves prior to exit.

IV. Friable Asbestos Material Indoors and Outdoors

All abatement of friable material is to be performed inside a fully isolated negative pressure enclosure with a minimum of 0.020 inches of H_2O column negative pressure differential with the adjacent space and a minimum of four (4) air changes per hour maintained throughout the work. Attached to the enclosure is to be a fully functional three (3) stage decontamination unit to be used for entry and exit from the enclosure during work. Logging manometer is required for verification and documenation.

Specifically:

- Proper notification to the MDEQ regarding performance of project (annual permit included);
- Notification to an industrial hygienist regarding clearance sampling when project is initially scheduled, in order to provide assurance that samples can be taken without negative impact to project schedule;
- Isolation poly barrier (Critical barriers) to isolate the work area from adjacent areas;
- Two layers of poly for all critical barrier locations;
- All ventilation and openings inside the work area must be sealed with plastic. These areas are called “Critical barriers” in the abatement industry;
- Isolation of all surfaces from the work area that are not impacted or thorough cleaning of these surfaces to meet visual clearance criteria;
- A pre-work containment check by an industrial hygienist is preferred for all jobs and may be required depending upon scope, level of hazard and associated risk as determined by MSU project lead;
- Wet methods are to be used for removal as required by EPA and MDEQ regulations;
- Disposal is to be made of all Asbestos containing material (ACM) according to EPA and MDEQ requirements for wetting, bagging, labeling and manifesting;
- Compliance with air monitoring and worker protection standards is required per OSHA regulations;
- All removal of debris and equipment is to be performed through the negative pressure enclosure entry/access point using appropriate decontamination techniques and work practices;
- All enclosures are to be visually and analytically cleared (air clearance sampling) according to MDEQ requirements using either PCM or TEM analytical techniques; and
- All other requirements of federal, state, and local regulations are to be followed for friable removal.

V. Non-Friable Asbestos Material Inside

MSU has extensive non-friable abatement needs related to asbestos containing resilient floor tile, associated mastics, and cement asbestos materials. These materials are routinely handled in a non-friable fashion and have a reduced hazard of asbestos fiber generation. However, MSU must maintain a high standard of worker protection and building stewardship through all construction work. Thus all work is to be performed in a negative pressure enclosure with a minimum of 0.020 inches of water column negative pressure in relation to adjacent areas and with a HEPA filtered ventilation providing at a minimum four air changes per hour. Logging manometer use is required.

Specifically:

- Determination of method of removal and evaluation of breakage percentage;
- Mechanical removal methods are to be considered friable and thus comply with above friable requirements;
- Single layer (critical) barriers for isolation of work area and surfaces;
- Minimum of a two stage decontamination for HEPA vacuum of equipment and workers and disposal of coveralls and cleaning of PPE;
- Disposal of all materials in asbestos waste bags sealed and secured at all times—manifest of all disposal of material. Materials cannot be mixed with standard construction waste stream;
- All removal of waste debris and equipment is to be performed through controlled access points of the decontamination unit or “load out” access through the containment. All bags and equipment must be removed using appropriate decontamination techniques ;
- Pass of at a minimum visual clearance of work area—depending upon Work Control requirements air clearance may be required; and
- Where non friable material becomes friable air clearances and hygienist visual clearance is required. Hygienist is to be notified prior to start of work to ensure schedule is maintained.

VI. Wall Component Systems—Composite Analysis Less Than 1% Asbestos

Various locations on campus have drywall systems with joint compound/drywall mud that has been identified as containing varying amounts of asbestos mineral.

Thus all work impacting an area of wall greater than 10 square feet is to comply with OSHA requirements and to ensure the protection of occupants these wall systems are to be demolished as asbestos containing friable material. All applicable requirements for OSHA and above (friable material) are to be met or exceeded.
Specifically:

- Determination of method of removal and evaluation of breakage percentage;
- Mechanical removal methods are to be considered friable and thus comply with above friable requirements;
- Single layer (critical) barriers for isolation of work area and surfaces;
- Minimum of a three stage decontamination for HEPA vacuum of equipment and workers and disposal of coveralls and cleaning of PPE;
- Disposal of all materials in asbestos waste bags sealed and secured at all times—manifest of all disposal of material;
- All load out of debris and equipment is to be performed through controlled access points under negative pressure and using appropriate decontamination techniques and work practices; and

- Pass of a visual & Air clearance of work area—depending upon Work Control requirements TEM air clearance may be required.

Note: The Trades Supervisor and/or Project Manager can work with an industrial hygienist to adjust these requirements to suit work areas and to manage risk on a case-by-case basis.

Small impacts to the compound (less than 10ft^2) are to be performed using HEPA vacuum attendance and wet methods to ensure no dust generation and capture of the debris at the point of impact.

VII. Non-Friable Asbestos Materials---Outside

Non-friable roofing materials, siding materials, cement asbestos pipe, and paper are found on MSU-Bozeman campus and frequently require abatement. MSU recognizes that these materials are routinely handled without becoming friable and expects that all such materials are impacted by the contractor in a fashion to ensure non-friable removal. Where impact is required the following minimum steps are to be taken.

Specifically:

- Remove with methods preventing dust generation;
- When sawing/cutting/grinding/drilling keep material wet at all times and attend with HEPA vacuum to capture all dust;
- Collect material and appropriately bag, label, and manifest for disposal;
- CONTROL all material and ensure no debris escapes from work area;
- Critical (cover with poly) adjacent ventilation intakes, windows, or opening into occupied buildings; and
- Meet OSHA requirements for worker protection and monitoring at all times.

The compliance with regulatory requirements on the campus of MSU-Bozeman is seen as the minimum level of risk management. Compliance with the additional guidance in this document is seen as best business practice to most effectively protect people and environment and to manage risk.

MSU recognizes that each project will have specific needs and challenges. Variance from these requirements is only to be done with the approval from MSU work control or from MSU designated representatives in consult with an industrial hygienist. Variation from regulatory requirements of friable material is only allowed with written MDEQ approval and MSU written approval.

It is emphasized that MSU must maintain a visible and documented control of asbestos hazards at all times for the management of our buildings and the satisfaction of our occupants, students, faculty/staff, and administration. The cooperation of our contractors is critical to our success.

Questions can be directed to:
Tom Pike 994-7533
Chris Catlett 994-4146
Dan Archer 994-7597

SECTION 02112

REMOVAL OF EXISTING PAVEMENT, CONCRETE CURB, SIDEWALK, DRIVEWAY AND/OR STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work consists of removing and disposing of existing pavement, concrete curb, combined curb and gutter, sidewalk, private driveways, and crosswalks, along with any structures designated for removal in the contract documents. Details of removals are specified in the contract documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Dispose of all existing pavement, concrete curb, crosswalk and/or combined curb and gutter specified for removal in the contract documents or directed by the Engineer. Exercise care in such removal to assure that remaining nearby facilities and/or structures are not disturbed. Restore to original condition any such existing facilities or structures damaged by construction activities.

B. Cut, remove and dispose of designated existing pavement to the lines indicated on the contract documents, or directed by the Engineer. Make straight and approximately vertical cuts of edges along which new pavement is to be placed.

C. Remove and dispose of existing private concrete driveways and/or sidewalks which interfere with construction of street improvements or which do not match new grade as shown on the contract documents or as directed by the Engineer. Remove such driveways and/or sidewalks to distance of 8 inches (20 cm) behind curbs, or to greater distance if required to properly match the new curb and gutter grade. Remove along the neat line produced by a concrete saw cut. Make cuts to a depth of the thickness of the driveway and/or sidewalk or to a maximum depth of 6 inches (15 cm), whichever is lesser, and take care in removing the concrete assuring the slab breaks on the sawed neat line.

D. Exercise care in removal of existing tree roots that conflict with the work. Tree roots shall be removed by sawcutting the roots to a neat line at the extent of the excavation. Remove only the minimum amount of roots necessary in order to complete the work.

END OF SECTION

SECTION 02113

ADJUSTING EXISTING MANHOLES, LAMPHOLES, INLETS, WATER VALVE BOXES, WATER SERVICES, AND FIRE HYDRANTS TOGRADE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section consists of locating and adjusting to grade existing manholes, lampholes, inlets, water valve boxes or services, and fire hydrants as shown in the contract documents, staked in the field or as required in the Special Provisions.

1.2 STANDARD DRAWINGS

A. Standard drawings included in Appendix A of this specification book whichare applicable to this section are as follows:

Standard Drawing No. 02213-1	Manhole Adjustment
Detail Standard Drawing No. 02213-2 Detail	Water Valve Adjustment

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all materials including concrete, brick and mortar, complying with the specification section for the particular material involved, or if the material is not covered in these specifications, the material used for adjusting shall be equal, and comparable to that in the existing structure. If extensions for water valve boxes or services and fire hydrants are required beyond the length found to exist, provide items comparable to those in the existing structure.

PART 3 - EXECUTION

3.1 GENERAL

A. Bring to required grade all existing manholes, inlets, lampholes and water valve boxes by either lowering or raising in accordance with the details shown in the contract documents. Do not lower manholes, lampholes or inlets by removal of portions of the cones or barrel sections. Accomplish downward adjustments by replacement of existing sections with shorter sections. Assure that all structures have a minimum of one 2-inch (5cm) concrete adjusting ring and a maximum of 12 inches (30m) of rings under the casting. Do not use brick and/or mortar for adjustment of castings.

B. On manholes requiring steps, assure that maximum spacing between steps is 16 inches (40cm) and that 10 inches (25cm) is the maximum distance from the top of the manhole cone section to the first step.

C. Excavate water valve boxes and services to readily determine whether height adjustment can be made without substituting a longer section. Adjust water valve boxes and services laterally so the valve stems can be operated by the extension. Adjust water services by raising or lowering the curb key stop and extension box.

D. Adjust manholes, lampholes and water valve boxes to final grade before placing the final pavement surface. If required, make preliminary adjustment to allow placement of base courses and paving adjacent to the manhole, lamphole orwater valve.

E. Provide backfill material conforming to the requirements of Section 02235, 1inch (25 cm) Minus Crushed Base Course, and compacted to at least 97% percent of the maximum dry density as determined by AASHTO T99 or ASTMD698.

F. If required, make minor adjustments 5 feet (1.5 meters) to 10 feet (3.0 meters) in the horizontal location of existing fire hydrants to ensure that they are the required minimum distance behind the back of curb. At the time of construction staking, any hydrants which require horizontal adjustment will be located by the Engineer and the adjusted location will be staked by the Engineer.

G. Make any minor adjustments required as dimensioned in the contract documents to the height of existing fire hydrants to ensure that they are at a reasonable height above the back of curb. At the time of construction staking, any hydrants which require vertical adjustment will be located by the Engineer and the adjusted height will be staked by the Engineer. Accomplish extension of fire hydrant height only by the use of standard extension spools provided by the hydrant manufacturer.

H. Before final acceptance, clean all manholes, lampholes, inlets and water valve boxes/services. Assure that all water valve boxes, services and fire hydrants are operational.

I. All requirements of this section shall apply to new, as well as to existing, manholes, lampholes, valve boxes, water services and fire hydrants.

END OF SECTION

SECTION 02221

TRENCH EXCAVATION AND BACKFILL FOR PIPELINES & APPURTENANTSTRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is the excavation, trenching, and backfilling for pipelines and appurtenances. It includes all clearing, grubbing, site preparation, removal, and disposal of debris from the excavation, handling and storing materials for fill and backfill, all bracing, shoring and trench protection, construction dewatering, all backfill, subgrade preparation, final grading, site dressing, and cleanup.

1.2 REFERENCES

A. The current publications listed below form a part of this specification.

AASHTO T99	Moisture-Density Relations of Soils Using 5-lb (2.5kg) Rammer and 12-inch (305mm) Drop
ASTM D698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)(600 kn-m/m^3))
AASHTO T191 (ASTM D1556)	Density of Soil In-Place by the Sand-Cone Method
AASHTO T310 (ASTM D6938)	In-Place density and water content of the soil and soil aggregate by Nuclear Method (Shallow Depth)
AASHTO T11 (ASTM C117)	Materials Finer Than 0.075mm (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T27 (ASTM C136)	Sieve Analysis of Fine and Coarse Aggregate
AASHTO T89	Determining the Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
ASTM D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4253	Maximum Index Density and Unit Weight of Soils Using a Vibratory Tube
ASTM D4254	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

1.3 STANDARD DRAWINGS

A. Standard Drawings applicable to this Section are as follows:
   1. Standard Drawing No. 02221-1 - Typical Utility Trench Detail

1.4 TESTING

A. Field Density Testing
   1. Meet the quality control and quality assurance testing requirements in Section 01400, Contractor Quality Control and Owner Quality Assurance.
   2. In-place field density tests for quality assurance are at Owner expense meeting AASHTO T191 (ASTM D1556), Sand Cone Method; or by AASHTO T310 (ASTM D6938) Nuclear Densometer Methods. Quality assurance field density testing frequency is at the Engineer's discretion.
   3. Retesting failing areas is at the expense of the Contractor. Where Engineer provides testing on behalf of the Owner, the Contractor will be assessed the cost of all retests conducted by the Engineer, with that cost deducted from the progress payments.
   4. At the direction of the Engineer, provide the necessary equipment and labor to excavate and replace materials for test holes up to 5 feet deep into the compacted backfill to allow testing below the surface of any layers covered without inspection and approval by the Engineer.

B. Laboratory Maximum Density and Optimum Moisture
   1. Quality assurance tests will be made by the Engineer for each on-site natural soil or each source of off-site material, including borrow material, to determine the laboratory maximum density values and optimum compaction moisture content according to AASHTO T-99 or ASTM D698.

C. Material Submittals
   1. Submit to the Engineer material quality test results, including Type 1 Bedding gradation and plasticity index, and Type 2 Bedding gradation.
   2. Submit to the Engineer laboratory moisture-density relationship testing results of on-site and off-site borrow soils.
   3. If applicable, submit a blasting plan to the Engineer.

PART 2 - PRODUCTS

2.1 PIPE BEDDING MATERIALS

A. Type 1 Pipe Bedding
   1. Type 1 Pipe Bedding includes the material placed from 4 inches (10 cm) below the bottom of the pipe to 6 inches (15 cm) over the pipe.

2. Provide Type 1 Bedding consisting of imported sand, sandy gravel, or fine gravel having a maximum ¾ inch size and a maximum plasticity index of 6, determined by AASHTO T89 and T90 or by ASTM D4318.

3. Provide imported granular material with a gradation as follows and a maximum plasticity index of 6, determined by AASHTO T89 and T90 or by ASTM D4318.

Percent by Weight Passing	
Sieve Size	% Passing
1" (25 mm)	100
3/4" (19.0 mm)	90 - 100
3/8" (9.5 mm)	20 - 55
No. 4 (4.75 mm)	5 - 10
No. 8 (2.36 mm)	0 - 5

4. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 50 percent of the material retained on the No. 4 sieve has at least one fractured face.

5. To prevent migration of material from around the pipe, do not use sand, sandy gravel, or material composed mainly of sand for bedding material in the pipe zone where groundwater is or will be present or where existing material contains voids which would allow migration. Where trench excavation encounters wet or unstable material, Type 1 Pipe Bedding must be well graded, free-draining, and non-plastic.

6. Refer to the Special Provisions and details in the Drawings for other requirements.

B. Type 2 Pipe Bedding

1. Type 2 Pipe Bedding is used as directed by the Engineer to replace unsuitable material encountered in the trench bottom.

2. Place Type 2 Pipe Bedding from the bottom of the Type 1 Bedding material to the depth required to adequately support the pipe.

3. Type 2 Bedding consists of granular material meeting the following gradation and having a maximum plasticity index of 6 and a maximum liquid limit of 25%.

Percent by Weight Passing	
Sieve Size	Type B-Modified
3" (75 mm)	100
No. 4 (4.75 mm)	0 - 25
No. 8 (2.36 mm)	0 - 10

C. Separation Geotextile

1. The plans may require, or the Engineer may direct, the use of non-woven geotextile fabric intended to provide materials separation. The fabric will wrap all or part of the Type 1 Pipe Bedding and Select Type 1 Pipe Bedding to prevent materials migrating into the trench bottom and trench walls as shown on the plans or as directed by the Engineer. The fabric shall be AASHTO M288 Class 1, 2, or 3 as specified or determined by the Engineer and shall fully comply with MPW Section 2110.

2.2 TRENCH BACKFILL MATERIALS

A. Materials from Trench Excavation

1. Backfill material obtained from trench excavations must be free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials. Backfill materials and placement are further described in the Execution Section of this specification.

B. Imported Backfill Material

1. Imported backfill material is from borrow source(s) outside the project limits and is used when, in the opinion of the Engineer, an adequate volume of suitable backfill material is not available within the project limits. Imported Backfill Materials must comply with the requirements of Section 2.2.A, MATERIALS FROM TRENCH EXCAVATION.

2.3 FLOWABLE FILL

A. If used, Flowable Fill is to meet the requirements of Section 2225, Flowable Fill.

2.4 DETECTABLE BURIED WARNING TAPE

A. Detectable buried warning tape is to have a minimum 6-inch (15cm) width and 5-mil (0.12mm) thickness and a solid aluminum core running the full length and width of the tape enclosed in a color-coded inert plastic jacket, impervious to alkalis, chemical reagents and solvents in the soil. The tape is to meet APWA/ULCC Color Code requirements and is to have a maximum 36-inch(90cm) imprint.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING PROPERTIES

A. General

1. Take precautions to protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, and fences. Restore or replace all disturbed or damaged facilities to its original condition at the Contractor's expense.

2. Contact utility owners using the Montana One Call System in accordance with Section 01041, PROJECT COORDINATION, Paragraph 1.2.B., for utility locates before starting work. Protect the utilities exposed during the work and prevent damaging underground utilities adjacent to excavations. Immediately notify the utility owner of any construction damage. Repairs of damage to marked utilities are at the expense of the Contractor.

3. Re-locate existing water mains, sanitary sewers, and storm drains shown on the plans that conflict with new pipelines or structures, as indicated in the contract documents. No separate payment will be made for this work unless shown as a payment item. If the Owner authorizes the relocation of mains or sewers, which are not indicated in the bid documents, and the Engineer determines the work was not included in the original contract, payment will be made under the applicable sections of the General Conditions.

4. Cut and replace existing service lines interfering with trenching operations only with the Engineer's permission and at the Contractor's expense.

5. Show all repaired and/or adjusted water and sewer lines on the As-Built Plans.

6. Protect existing water and sewer mains and water and sewer services from freezing at all times during construction.

B. Privately Owned Utilities

1. If any existing private utility interferes with the work in either alignment or grade and has to be moved, the work will be performed by the appropriate Utility Owner unless otherwise specified in the contract documents. Such private utilities may include gas mains, underground electrical and telephone cables, telephone poles, light poles, etc.

2. If, however, such private utility relocation is performed by the Contractor, and the relocation is not a separate payment item, payment will be made under the Section 02221 conditions covering such changes.

3. Such payment will be made only if the work is determined by the Engineer to be a change from the original contract work scope.

C. Existing Structures

1. Prevent damage to existing buildings or structures in the work area. Repair all construction related damage to the satisfaction of the Owner.

D. Existing Overhead Utilities

1. Use extreme caution to avoid conflict, contact, or damage to overhead utilities during the work.

E. Exploratory Excavation

1. The location of existing buried public utilities may need to be verified by exploratory excavation before construction.

2. Where authorized by the Engineer, the Contractor will be reimbursed for exploratory excavation work at the unit price bid per hour for a backhoe/excavator with an operator and a laborer to assist. Use a backhoe/excavator having at least 60 horsepower (45kw), as rated by the manufacturer.

3. The unit price per hour includes the backhoe/excavator, operator, and one laborer based upon the actual time, to the nearest one-half hour, that the equipment and personnel are used in actual excavating and backfilling operations, including standby time between excavation and backfilling, which allows the Engineer to make the necessary survey of the underground utilities.

4. Exercise care to prevent damaging all utilities and repair any utility damage caused by exploratory excavation.

F. Pavement Removal and Stripping

1. Where trench excavation or appurtenant structure excavation requires removing curb and gutter, concrete sidewalks, asphalt concrete pavement, or Portland cement concrete pavement, cut the concrete or pavement in a straight line parallel to the excavation's edge using a spade-bitted air hammer, concrete saw or other suitable equipment to produce a straight, square and clean break. Re-cut edges broken during construction, before concrete or paving operations.

2. For trenches passing through the existing pavement, cut the pavement along a neat vertical line at least 12 inches (30cm) from the trench edge. Where the neat line cut is less than 3 feet (0.9m) from the edge of the existing pavement, remove and replace the entire pavement section between the trench and edge of the pavement.

3. Dispose of the asphalt concrete and/or Portland cement concrete debris off-site according to applicable state and local regulations.

G. When excavating across existing gravel streets or other developed surfaces, remove the surfacing material full depth and stockpile for inclusion in the trench backfill or legally dispose of the surfacing material.

H. When excavating across cultivated or sodded areas, remove full topsoil depth or a maximum 12-inch (30cm) depth, whichever is less, and stockpile for possible project use.

I. Re-sod or reseed, as specified in the contract documents, all established lawn areas cut by trenching or damaged during the construction, according to Section 2910 and/or 2920, to the Engineer's satisfaction.

3.2 MAINTENANCE OF FLOWS

A. Maintain the flow of sewers, drains, and watercourses encountered during construction. Restore culverts, ditches, fences, crosswalks, and structures disturbed by construction to their original condition upon completion of the work.

3.3 TRENCH EXCAVATION

A. General

1. Meet current OSHA Safety and Health Standards for all excavation, trenching, shoring, and related work.

2. Excavate at the specified locations for pipeline installations and appurtenant structures.

3. Crossings under sidewalks or curbs may be made by tunneling if approved by the Engineer. If a portion of a sidewalk or curb is removed, use a concrete saw to make joints, compact the backfill as specified, and replace the removed Section with a new concrete sidewalk or curb.

4. During excavation, stockpile backfill materials away from the trench banks to assure trench wall stability. Stockpile excavated materials on only one side of the trench without obstructing existing fire hydrants, valves, manholes, and other appurtenances. Assure surface drainage of adjoining areas is unobstructed.

5. Remove and dispose of all excess or unsuitable excavated materials.

6. Prevent surface water from flowing into excavations. Promptly remove all water accumulating in trench excavations. Do not permit water to accumulate in any open trench. Remove and re-lay all pipe out of alignment or grade caused by trench flooding.

7. Grade the trench bottoms to the specified lines and grades. Assure bedding material provides uniform bearing and support for each pipe section along its entire length. Excavate for bell and joints after the trench bedding is graded, limiting the excavation to the required length, depth, and width for making the particular type of joint used. Backfill over-excavations with Type 2 Bedding Material.

8. No classification of trench excavated materials will be made. Excavation and trenching work includes the removal and subsequent handling of all earth, loose or cemented gravel, loose or solid rock, and other materials excavated or otherwise removed in the performance of the contract work, regardless of the type, character, composition, or condition thereof. All materials excavated or otherwise removed, including asphalt, curb, gutter, sidewalk, soils, etc., will become the property of the Contractor, who will be responsible for environmentally sound disposal of said material in accordance with state and federal regulations.

9. The use of trench digging machinery is permitted, except in places where its operation is likely to cause damage to existing structures or features, in which case hand methods are to be employed.

B. Trench Dimensions

1. Excavate to the trench dimensions specified below.
2. Width
    a. Excavate to provide room to install and join the pipe as specified. The minimum trench width is 3'-6" (1.1m), for outside pipe diameters of 18 inches (0.5m) or less. The minimum trench width is 2'-0" (0.6m) plus the outside pipe diameter, for pipe sizes exceeding 18 inches (0.5m). Maximum trench width may be specified in the contract documents.
    b. If the trench is excavated wider than the specified minimum, provide Type 1 Pipe Bedding for the additional width to yield a consistent backfill for the entire width of the trench or take such other measures as the Engineer may direct to protect the pipe against the crushing forces of trench backfill at the Contractor's expense.
3. Depth
    a. Excavate the trench as required for the invert grade or pipe bury as specified in the contract documents, plus 4 inches (10cm) for the Type 1 Pipe Bedding. If bedrock, boulders, or large stones are encountered at the bottom of the trench, excavate at least 6 inches(15cm) below the bottom of the pipe for backfilling with Type 1 Pipe Bedding.

C. Soft or Unsuitable Trench Subgrade

1. When soft or unstable material is encountered at the trench subgrade, which will not uniformly support the pipe, excavate the material to the depth directed by the Engineer and backfill to trench subgrade elevation with Type 2 Pipe Bedding.

D. Blasting

1. Obtain Engineer approval to blast for excavation. If approved, the Engineer will establish the time limits blasting will be permitted.
2. Use the utmost care to protect life and property during blasting. Use only a licensed blaster with experience in the type of blasting required for the work.
3. Safely and securely store all blasting materials meeting local laws and ordinances, and clearly mark all storage places "Dangerous Explosives." Do not leave any explosives where they could endanger persons or property.
4. Blasting Rock in Trenches
    a. When blasting rock in trenches, cover the blasting area with earth backfill or approved blasting mats. Before blasting, station workers and provide danger signals to warn people and stop vehicles.
    b. Assume responsibility for all damage to property and injury to persons resulting from blasting or accidental explosions during the work.
    c. Furnish the following information to the Owner and Engineer at least 48 hours before the commencement of blasting operations: Name of the Contractor's powder man, powder man's experience, type of shot, type of explosives and detonator being used, proof of insurance covering liability for such operation, traffic control plans and planned procedures for protecting the public.

5. Assure the blasting plan meets federal, state, and local ordinances. Obtain all required permits before blasting starts.

E. Pavement Damage Cause by Equipment

1. Equip all track-mounted equipment operated on pavement surfacing with pads to prevent pavement damage.

2. Remove and replace all pavement damaged during construction by the Contractor's equipment, or the use thereof, to at least a depth of 1 inch (25 mm). Patches will not be allowed less than 1 inch (25 mm) in thickness.

3. Replace all asphalt pavement damaged during construction outside of restoration pay limits in conjunction with asphalt restoration and as otherwise required by the Engineer. Provide asphalt meeting the requirements of Section 02510: Asphalt Concrete Pavement, and place asphalt to produce a final surface uniform in texture and consistent with the line and grade of adjacent pavement or as directed by Engineer. No compensation will be allowed for removal and replacement of damaged pavement outside of the pay limits for asphalt restoration.

4. Assure work and materials for pavement restoration is in accordance with Section 02510: Asphalt Concrete Pavement.

F. Shoring, Bracing, and Sheeting

1. Provide all shoring, bracing, and tight sheeting required to prevent caving and protect workers, meeting current Occupational Safety and Health Act Requirements, and to protect adjacent property and structures. The cost of this work is included in the price of trench excavation.

G. Excavation for Appurtenances

1. Make excavations for manholes, hydrants, structures, and other appurtenances of the size and depth to permit compacting of backfill on all sides to the specified density. The requirements for removing water and other applicable portions of these specifications apply to excavation for appurtenances.

3.4 DEWATERING

A. General

1. Furnish all necessary labor, equipment, and incidentals necessary to dewater the project site during construction.

2. Keep all excavation dry and free from water during construction and the placement of materials. Do not place pipe, bedding, or backfill materials below the groundwater elevation established by dewatering operations. Do not allow groundwater or stormwater to enter or flow through the underground piping during installation.

3. The cost of dewatering operations will be incidental to the cost of pipeline and appurtenance installation, and no additional payment will be made for dewatering. Consider shifts in the groundwater level caused by changing seasons or local conditions in estimating the cost of dewatering operations, as no additional payments will be made for fluctuating groundwater levels.

4. Protect all structures that could be potentially impacted by dewatering operations. Repair any damage to structures caused as a result of dewatering at Contractor's expense.

B. Discharge

1. Do not discharge or dispose of water from dewatering operations in such a manner as to flood existing landscaped areas, graveled areas, or structures unless approved by Engineer. Written permission from the appropriate landowner shall also be required for discharge or disposal on private property.

2. It is the Contractor's responsibility is to comply with requirements and regulations of federal, state, and local agencies that govern areas affected by dewatering of the construction site and application for and maintenance of any required permits.

3.5 EXCAVATION STABILITY AND SAFETY

A. The stability of construction excavations and associated worker safety, including slope geometry and shoring/bracing considerations, are the Contractor's responsibility. Meet current OSHA regulations. This may require the design of temporary slopes and/or shoring by a licensed professional engineer.

3.6 TRENCH FILLING AND BACKFILLING

A. General

1. Backfill all trenches as specified immediately after grade, alignment, and pipe jointing has been inspected and approved by the Engineer. Conduct any pipe testing as specified in the respective water distribution, sewerage/drainage sections. Correct all defects discovered by tests prior to backfilling.

2. Storage of all imported backfill materials, including protecting said materials from adverse conditions that would disqualify them from use under these specifications, is the responsibility of the Contractor.

B. Pipe Bedding Placement

1. Type 1 Bedding.

a. Place Type 1 Pipe Bedding material 4 inches (10 cm) under, around the pipe, and to a point 6 inches (15 cm) above the top of the pipe in 6 inch (15 cm) lifts, using hand or other compaction methods without damaging or disturbing the pipe including mains and service lines and all appurtenances.

b. Place bedding material in equal lifts on both sides of the pipe for the full trench width. Thoroughly compact each lift of pipe bedding by tamping, vibration, slicing with a shovel, rodding, or by a combination of these methods. Take special care to assure complete compaction under the haunches of the pipe.

2. Type 2 Pipe Bedding

a. Use Type 2 Pipe Bedding described in PRODUCTS SECTIONas specified or as directed by the Engineer to replace unsuitable material encountered in the trench bottom, placing it from the bottom of the Type 1 Bedding material to the depth required to adequately support the pipe.

3. Separation Geotextile

a. Place Separation Geotextile where shown on the plans or where directed by the Engineer.

C. Trench Backfill

1. After the pipe bedding materials are placed and compacted as specified, backfill the trench.

a. Use backfill material free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious material.

b. From the top of the Type 1 Bedding to 6 inches (15 cm) below the ground surface, or the subgrade elevation, material containing stone up to 8 inches (20 cm) in the greatest dimension may be used.

c. Cost of screening, drying, or moistening excavated backfill to comply with specifications will be considered incidental to the Contractor's bid price per linear foot of pipe and service lines and unit prices for appurtenances, and no additional payment will be made for such work.

2. Trench backfill from the top of the pipe bedding to ground surface or to the street subgrade is separated into three classifications.

a. Type A Trench Backfill is compacted backfill typically used in streets or paved areas.

b. Type B Trench Backfill is typically used for unpaved alleys, cultivated areas, borrow pits, unimproved streets or other un-surfaced areas, and other areas where compaction is less critical.

c. Type C Trench Backfill is typically used in open and unimproved areas outside of the public right-of-way.

3. Meet the backfill and compaction requirements for all of the backfill types described in the contract documents.

4. Watering

a. Apply uncontaminated water, when required, at the locations and in the amounts required to compact the backfill material to the specified requirements. Maintain an adequate water supply during the work.

Assure the equipment used for watering is of the capacity and design to provide uniform water application.

b. Apply water during the work to control dust and to maintain all embankment and base courses in a damp condition in accordance with these contract documents.

c. Water required for compacting trench backfill may be obtained from the municipal system if approved by the Owner or from other sources. Water from the City of Bozeman's municipal system may only be obtained from the metered service located at the Vehicle Maintenance Facility, 1814 N. Rouse Ave. The Contractor shall reimburse the City Water Department for the cost of the water used at a rate determined by the Water Department.

5. Remove, replace, and re-compact backfill in trenches where settlement has occurred as directed by the Engineer at the Contractor's expense.

6. Trench backfill types are designated as follows:

a. Type A Trench Backfill. Place trench backfill in maximum 8 inch (20 cm) compacted lifts within 3% of optimum moisture content and compact to at least 95% of maximum dry density determined by AASHTO T99 or by ASTM D698. For materials that do not exhibit a typical well-defined moisture-density curve, compact backfill to 70% relative density as determined by ASTM D4253 and D4254.

b. Type B Trench Backfill. Place trench backfill in maximum 8 inch (20 cm) compacted lifts within 3% of optimum moisture content, and compact to at least 90% of maximum dry density determined by AASHTO T99 or by ASTM D698. For materials that do not exhibit a typical well-defined moisture-density curve, compact backfill to 50% relative density as determined by ASTM D4253 and D4254.

c. Type C Trench Backfill. Place and compact Type C Trench Backfill in maximum 12-inch (30 cm) lifts at densities equal to or greater than the densities of adjoining undisturbed soil. Mound earth over the trench top, if directed by the Engineer. In cultivated areas, place stripped topsoil uniformly over the backfilled trench to the original depth. Do not compact the topsoil, but grade to provide a smooth surface conforming to the adjoining ground surfaces.

d. Flowable Fill. Place flowable fill as trench backfill as shown in the contract documents or as directed by the Engineer. Flowable fill may also be used as a construction expedient, substituting for any type of trench backfill, subject to approval by the Engineer, and at the expense of the Contractor.

D. Replacement of Unsuitable Backfill Material

1. Remove and dispose of excavated soils that are saturated, contain deleterious materials, or have characteristics that, in the opinion of the Engineer, render the soils unsuitable as backfill and/or which cannot be readily conditioned or dried to

be made suitable.

2. Replace unsuitable soils with material obtained from trench excavations within the project limits at the expense of the Contractor.
3. If suitable replacement material is not available within project limits, notify the Engineer. The Engineer will quantify the extent of any unsuitable soils to be removed and replaced with material from an approved source, to be paid for as Imported Backfill Material, and provide written notification of the approved quantities to the Contractor. Payment for Imported Backfill Material will not be approved if the Contractor fails to notify the Engineer and/or proceeds with removal and disposal of unsuitable material prior to receiving written notice from the Engineer.
4. Provide imported backfill material with a gradation as follows and a maximum plasticity index of 10, determined by AASHTO T89 and T90 or by ASTM D4318. Imported backfill may not contain rock measuring greater than 6 inches (15 cm) in the greatest dimension.

Percent by Weight Passing	
Sieve Size	% Passing
1" (25 mm)	70 -100
No. 4 (4.75 mm)	40 - 80
No. 10 (2.00 mm)	25 - 60
No. 200 (0.075 mm)	2 - 35

5. Place and compact all imported material according to the applicable backfill specification requirements.

E. Backfill of Appurtenances
1. Place and compact backfill for appurtenances to finished grade around manholes, inlets, valve boxes, and other underground items without disturbing appurtenance alignments.
2. Meet the backfill material, placement, and compaction requirements specified for the adjoining trench.

F. Detectable Buried Warning Tape
1. Provide warning tape, as described in this Section. Bury tape a maximum of 18 inches (45 cm) below finish surface grade.

G. Quality Assurance Testing
1. Compaction testing frequency and location.
   a. Compaction testing shall be done on each lift of backfill material.
   b. Trench backfill tests shall be done within the first 100 feet of a mainline trench operation and at no more than 200-foot intervals thereafter.
   c. All service laterals shall be tested.
   d. Compaction testing around all manholes and valve boxes shall be done independently of the main line.

e. Testing shall be done by the project Engineer.

3.7 SURVEY MARKERS AND MONUMENTS

A. Protect all survey markers and monuments. Protection includes marking with flagged high lath and supervising work near markers and monuments. Do not disturb monuments without prior approval from the Engineer.

B. Replace all Contractor-disturbed or destroyed survey markers or monuments not approved during construction, using a licensed land surveyor. See Section 01050 for details on survey marker protection/disturbance.

3.8 CLEANUP

A. As work progresses, remove debris and complete to finish grade each portion of the work. Once the work is complete, clear debris and finish the entire site to smooth, uniform slopes presenting a neat and workmanlike appearance. Remove and dispose of all rocks brought to the surface during excavation or backfilling.

B. Dispose of vegetation; coarse debris resulting from pavement or sidewalk removal; stones, junk, debris, and other materials encountered in excavation work; and other similar waste materials away from the site of the work at the Contractor's expense.

3.9 TIME AND DISTANCE OF OPEN TRENCHES

A. Perform the work so that trenches will remain open the minimum time required to accomplish the work.

B. Do not begin trench excavating until appropriate compaction equipment is at the excavation site.

C. The maximum permissible distance between backfilling/compaction operations and the end of newly installed pipe is 100 feet (30 m) in existing streets (and/or alleys) and 200 feet (60 m) in all other areas.

D. The maximum distance between the newly installed pipe and the excavator is to be 100 feet (30m) in existing streets (and/or alleys) and 200 feet (60m) in all other areas.

E. For each workgroup consisting of a trench excavator, a pipe laying crew, and a backfilling/compaction crew, the maximum allowable open ditch at any time is 200 feet (60 m) in existing streets (and/or alleys) and 400 feet (120 m) in all other areas.

F. The maximum distance behind the end of the new pipe is 1,500 feet (460m) for gravel surfacing replacement, base placement, or pavement replacement.

G. At the completion of each working day, fill all trenches and/or provide safety netting, Jersey barrier, and other barricades required for public safety.

3.10 DRAINAGE CROSSINGS

A. Where trenches are constructed in or across roadway ditches or other watercourses, protect the backfill from surface erosion by adequate means. Where the grade of the ditch exceeds 1 percent, prevent erosion by a suitable method approved by the Engineer. Backfill trenches in such a manner that water will not accumulate in unfilled or partially filled trenches.

B. Remove all material deposited in roadway ditches or other water courses crossed by the trench immediately after backfilling is completed and restore the section, grades, and contours of such ditches or watercourses to their original conditions, in order that the surface drainage is obstructed no longer than necessary.

END OF SECTION

SECTION 02225

FLOWABLE FILL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work consists of furnishing and placing Flowable Fill to the lines and grades shown on the plans as backfill in trenches and/or at other locations. Flowable Fill is a self-compacting cementitious material using mineral aggregates (sand and/or gravel), native or processed materials, fly ash/cement, water, air-entraining solution, and (optionally) other admixtures. Flowable Fill is also known as Controlled Low-Strength Material (CLSM) and Controlled Density Fill (CDF). Flowable Fill is only permitted when specifically called out in the contract documents or approved by Engineer.

1.2 REFERENCES

A. The current publications listed below form a part of the specification.

ASTM D4832	Preparation/Testing of Soil-Cement Slurry TestCylinders ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM D6023	Standard Test Method for Unit Weight
ASTM C150	Specification for Portland Cement
ASTM C618	Specification for Fly Ash
ASTM C494	Specification for Chemical Admixture for Concrete
ASTM E329	Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction
ASTM C1064	Temperature of Freshly Mixed Portland Cement Concrete
ASTM C117	Materials Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Sieve Analysis of Fine & Coarse Aggregate
ASTM C117	Materials Finer Than No. 200 (0.075 mm)Sieve in Mineral Aggregates by Washing
ASTM D4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM C94	Ready Mix Concrete
ACI 301	Standard Specifications for Structural Concrete for Buildings

ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete

1.3 TESTING

A. The Engineer may perform occasional quality assurance tests on the flowable fill consisting of slump, air content measurements, and casting 3 cylinders for compressive strength test. The required compressive strength test method and required range are described in section 2.4, Compressive Strength below.

B. The Contractor is to provide the Engineer with a mix design by either trial batch or field experience methods to verify the required compressive strength of the flowable fill at the 28 day age. Mix design requirements are described in Section 2.3, Proportions; and in Section 2.4, Compressive Strength. Proportions shall be selected on the basis of unconfined, air-cured compressive strength test specimens.

PART 2 - PRODUCTS

2.1 MIXTURE OF MATERIALS

A. Provide a mixture of the materials described below to produce a self-compacting cementitious material batched on a per cubic yard basis.

2.2 MATERIALS

A. Portland Cement. Portland Cement shall conform to the requirements of ASTM C150, Type 11.

B. Fly Ash. Fly Ash shall conform to ASTM C618, Class C or F.

C. Coarse Aggregate, Fine Aggregate, and Native Materials. Any aggregate gradation which produces performance characteristics of the flowable fill specified herein will be accepted, except as follows: The amount of material passing the #200 sieve shall not exceed 20 percent. Also, liquid limit and plasticity index shall not exceed 25 and 5, respectively.

D. Water. Water used in mixing shall be free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finishedproduct.

E. Chemical Admixtures. Chemical Admixtures shall conform to the requirements of ASTM C494.

2.3 PROPORTIONS

A. A variety of sand/gravel aggregates and/or native (or processed) materials meeting the above requirements in conjunction with appropriate amounts of Portland Cement and fly ash, air-entraining solution, and (optionally) other admixtures may be used to produce the required mix properties described herein.

B. The Contractor shall submit to the Engineer a mix design based upon a trialbatch or field experience, including the proportions and sources of all constituent materials, air-entraining, and (optionally) other admixtures, expressed as cubic yard batch weights. The mix shall contain a minimum of 50 pounds (23 kg) of cement and up to 250 pounds (114 kg) fly ash per cubic yard, with the remainder of the volumes composed of aggregates, water, and any approved admixtures. Measured compressive strength, air content, and yield for the mix design trial batch (or for the field experience based mix design) shall be submitted.

2.4 COMPRESSIVE STRENGTH

A. Flowable Fill shall be designed to achieve a 28-day compressive strength of 30 to 500 psi (0.2 to 3.4 mPa) when tested in accordance with ASTM C39. Excavatable mixes shall be designed to attain 28-day strengths in the range of 30 to 150 psi (0.2 to 1.0 mPa). Test specimens shall be made in accordance with ASTM D4832. Compressive strength tests shall be performed at frequencies of at least one test set per 150 yd^3 (114m^3) and at least one test set per day of placement.

2.5 CONSISTENCY

A. Consistency of the fresh mixture shall be such that the mixture may be readily placed without segregation. High flowability material generally has a slump greater than 8 inches (20.3 cm). As an alternative to slump testing, desired consistency may be approximated by filling an open-ended 3 inch (76.2 mm) diameter cylinder, 6 inches (15.2 cm) high, with the mixture and cylinder immediately pulled straight up. The correct consistency of the mixture will produce an approximate 8 inch (20.3 cm) diameter circular type spread without segregation. Adjustments of the proportions of constituents may be made to achieve proper solid suspension and optimum flowability. However, strength requirements and proper yield shall be maintained for the actual batch weights.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Comply with ACI 304 and ASTM C94 for Measuring, Mixing, Transporting, and Placing the Flowable Fill, and as herein specified.

3.2 LIMITATIONS OF PLACEMENT

A. Do not place CLSM on frozen ground. Mix and place only when the air temperature is at least 35 degrees Fahreneheit (2°C) and rising. At the time of placement, Flowable Fill shall be at least 40 degrees Fahreneheit (4°C). Stop mixing and placement when the air temperature is 40 degrees Fahreneheit (4°C) and falling.

B. Flowable backfill shall be placed by methods that preserve the quality of the material in terms of compressive strength, flow, homogeneity, plasticity, and workability. The material shall be transported, placed, and/or consolidated to flow easily around, adjacent to, and under structures. It shall have the flow, consistency, and workability such that the material is self-compacting.

C. Protect freshly placed Flowable Fill from premature drying, excessive cold, or hot temperatures. The air in contact with the backfill surface shall be maintained at temperatures above freezing. Begin curing immediately following placement before the backfill has dried. Continue with curing until the backfill has attained the 28-day strength requirement. This strength is to be determined prior to any load applications or construction activity unless otherwise directed by an Engineer.

END OF SECTION

SECTION 02230

STREET EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is the clearing and grubbing, excavation, filling or backfilling, and subgrade preparation to the specified lines, grades and cross sections as preparation for overlying base course or other courses as shown in the contract documents. Also included are the removal and disposal of debris and excess soil, the furnishing and placement of fill materials, and compaction.

1.2 REFERENCES

A. The current publications listed below are a part of this specification.

AASHTO T99	Moisture-Density Relations of Soils Using 5-lb (2.5kg) Rammer and 12-inch(305mm) Drop
ASTM D698	Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft^3)(600 kN-m/m^3)
AASHTO T191 (ASTM D1556)	Density of Soil In-Place by the Sand-Cone Method
AASHTO T310	In-Place density and water content of the soil and soil aggregate
(ASTM D6938)	by Nuclear Method (Shallow Depth)
AASHTO T11 (ASTM C117)	Materials Finer Than No. 200 (0.075mm) Sieve in Mineral Aggregates by Washing
AASHTO T27 (ASTM C136)	Sieve Analysis of Fine and Coarse Aggregate
AASHTO T89	Determining the Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
ASTM D4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

1.3 DENSITY CONTROL TESTING

A. Field Density Testing
   1. Meet the quality control and quality assurance testing requirements in Section 01400, Contractor Quality Control and Owner Quality Assurance.
   2. In-place field density tests for quality assurance are at Owner expense meeting ASTM D1556A (ASHTO T191), Sand Cone Method; or ASTM D2922 and ASTM D3017 (AASHTO T238 and T239) Nuclear Densometer Methods. Quality assurance field density testing frequency is at the discretion of the Engineer.
   3. Retesting of failing areas is at the expense of the Contractor.

B. Laboratory Maximum Density and Optimum Moisture
   1. Quality assurance tests will be made by the Engineer for each on-site natural soil or each source of off-site material, including borrow material, to determine the laboratory maximum density values and optimum compaction moisture content under AASHTO T99 or ASTM D698.

C. Material Submittals
   1. Submit to the Engineer results of gradation tests for Sub-excavation/Replacement Below Subgrade pitrun gravel/sand.
   2. Submit to the Engineer samples of soils and/or aggregates for laboratory moisture-density relationship testing by the Engineer.

PART 2 - PRODUCTS

2.1 ON-SITE EMBANKMENT

A. Fill and backfill materials are to consist of natural soils free from organic matter, frozen material, refuse, construction debris or other man-made items. Obtain approval of the Engineer for all fill before placing and use only the fill from designated borrow areas.

2.2 IMPORTED BORROW MATERIALS (FOR EMBANKMENTS IN-PLACE)

A. If required, obtain borrow soil for embankments from areas off the project site. Furnish imported borrow at Contractor expense. Obtain Engineer approval of borrow areas. Imported borrow is to meet the requirements of Section 2.1, On-Site Embankment.

2.3 SUBEXCAVATION/REPLACEMENT BELOW SUBGRADE

A. Sub-excavation consists of removing and disposing of unstable material from below planned subgrade elevation in cut sections or from below the natural ground line in embankment sections.

B. Replacement material for sub-excavations consists of either:

1. Suitable materials from within the project limits if suitable material is present within the project limits, or

2. Imported materials if suitable material is not present within the project limits. Where imported pitrun gravel is used, furnish replacementmaterial meeting the following gradation requirement:

Sieve Opening	% Passing
3 Inch	100
No. 4	25 - 60
No. 200	12 Max.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Perform clearing and grubbing including the excavation, removal and disposal of roots, stumps, sod, or any organic material and buried debris from within construction limits. Construction limits are defined by all areas within the cut/fill limits and extending 1 foot (0.3 m) beyond the back of sidewalk and/or curb and gutter, or 2 feet (0.6 m) beyond the edge of pavement if no sidewalk or curb and gutter is present. Remove unsuitable material to at least 12 inches (30 cm) below subgrade elevation.

B. Stockpile for project use any topsoil removed by clearing andgrubbing.

C. Dispose of all clearing and grubbing material as specified.

3.2 EXCAVATION STABILITY AND SAFETY

A. Meet OSHA requirements for excavations and excavated material stockpiles. This may require design of temporary slopes and/or shoring by a licensed professional engineer.

3.3 PROTECTION OF PROPERTY

A. Take precautions to protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, fences, and vegetation. Any disturbed or damaged facilities will be suitably restored or replaced consistent with condition(s) which existed prior to construction.

3.4 EXCAVATION

A. Excavate to the specified lines and grades or as directed by the Engineer. Excavate without causing rutting, pumping or other disturbance to underlying materials.

B. Excavation made outside the specified grade limits is not measured for paymentin the Excavation or Embankment In-Place quantities.

1. Restore sub-excavated areas as directed by the Engineer. Correct subgrade disturbance by removing the disturbed soil and replacing and compacting to reach at least 95 percent of the maximum laboratory dry density determined by AASHTO T99 or ASTM D698.

2. Correct subgrade disturbance before placing overlying fill, backfill, base course or other courses. Disturbed soils may be replaced with imported material approved by the Engineer and compacted to 95% of maximum laboratory dry density determined by AASHTO T99 or ASTM D698.

C. Maintain the subgrade to drain at all times. Construct side ditches or gutters from cuts to embankments to prevent erosion damage to embankments.

D. Construct and maintain temporary drainage where existing surface drainage, sewers, or under-drainage are disturbed during the work until permanent drainage facilities are completed. Protect and preserve all existing drains, sewers, sub-surface drains, conduits, gas lines, and other underground structures which may be affected by the work. Repair all damage to these facilities or structures resulting from the work, to the satisfaction of the Engineer.

E. Excavate to minimize foundation soil and/or subgrade soil exposure to erosion, drying or infiltrating moisture. Perform excavation to provide drainage away from foundation/subgrade soils and minimize the potential for surface runoff to enter the foundation/subgrade soils.

F. Grade all intersecting streets and approaches within the project limits asspecified or as directed using suitable materials on the surfaces to produce smooth riding and satisfactory approaches to the intersections.

3.5 DISPOSAL OF EXCAVATED MATERIAL

A. Dispose of debris and unused excavated materials off the project site in accordance with all applicable state and local regulations. Locate and provide suitable disposal areas.

3.6 DUST CONTROL

A. Furnish dust control meeting Section 01500, Construction and Temporary Facilities, requirements.

3.7 SUBGRADE PREPARATION AND COMPACTION

A. General

1. Assure the subgrade beneath pavements, curb, or sidewalks is natural soil free of topsoil, organic material or refuse. Place pavement components, curb and sidewalk over the prepared subgrade as soon as practical. Donot place pavement components on frozen subgrade. No separate payment is made for subgrade preparation since it is considered incidental to construction of overlying pavements/structures.

2. If the surface of a previous roadbed or pavement surface matches the surface of the finished subgrade scarify the top 6 inches (15cm) of the previous surface the full width of the subgrade to permit uniform reshaping and compaction.

B. Fine Grading

1. Assure the finished surface does not deviate not more than 0.1 foot (3cm) at any point from the staked elevation; and that the sum of thedeviations from true grade of any two points less than 30 feet (9m) apart does not exceed 0.1 foot (3cm).

C. Compaction

1. Compact the upper 8 inches (20cm) of the subgrade to at least 95% of the laboratory maximum, determined by AASHTO T99 or ASTM D698. Proof roll the subgrade surface for observation by the Engineer. Compact all soft, yielding or otherwise unstable areas to provide adequate support of construction equipment as determined by the Engineer. Also compact the subgrade to meet the specified density requirements. Remove and replace any unstable or otherwise unsuitable subgrade as specified under Section 3.9, Sub-excavation/Replacement Below Subgrade.

3.8 EMBANKMENT PLACEMENT AND COMPACTION

A. General

1. Place fill materials (embankment) to the specified lines and grades. Place fill in uniform layers not exceeding 8 inches (20cm) in loose thickness. Once placed, moisten or aerate, mix, and compact each layer as specified. Work clay soils to maximum 2-inch (5cm) nominal size before compacting. Do not begin fill placement until the subgrade construction has been approved by the Engineer. Do not place fill on wet or frozen areas. Do not operate heavy equipment for spreading or compacting fill within 4 feet (1.2m) of structures.

2. If grading operations are suspended due to weather, blade the entire area until it is smooth, free of depressions and ruts, and crowned to drainwater.

B. Compaction

1. Control the fill moisture content to assist in obtaining the specified field density. Maintain the moisture content of fill soils within ± 3% of optimum moisture. Compact each fill layer and the top 8 inches (20cm)of subgrade soil to at least 95 percent of maximum laboratory density as determined by AASHTO T99 or ASTM D698. Compact areas within 4 feet (1.2m) of structures in maximum 8-inch (20cm) loose lifts using power-driven hand-held tampers.

2. Apply water, when required, at the locations and in the amounts required to compact the material to the specified requirements. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application. Apply water during the work to control dust and to maintain all embankment and base courses in a damp condition in accordance with Section 1500. Water required for compacting subgrade and/or embankments may be obtained from the municipal system if approved by the Owner, or from other sources.

3. Do not place fill or embankment when moisture content prevents effective compaction or causes rutting. Dry all embankments having excessive moisture by scarifying and blading the affected areas before compacting or placing succeeding layers.

3.9 SUBEXCAVATION/REPLACEMENT BELOW SUBGRADE

A. Sub-excavation consists of removing and disposing of unsuitable material from below planned subgrade elevation in cut sections or from below the natural groundline in embankment sections.

B. Soil is unsuitable if, in the opinion of the Engineer, it contains excessiveorganics, refuse, construction debris, or other objectionable material; or if it unstable, rutting or yielding; or if it contains excessive moisture. Generally, soils will be sub-excavated and replaced only if they are unable to adequately support equipment typically used for excavation and soil transport.

C. Assure the Engineer has measured the area where unstable materials have been removed before backfilling. Do not backfill any area where unstable foundation soils have been excavated until authorized by the Engineer. Backfill placed without approval may be ordered removed and replaced at Contractorexpense.

D. Backfill with either suitable soils from within the project limits or imported pitrun gravel complying with the requirements of Section 2.3, Sub-excavation/Replacement Below Subgrade. Different measurement and payment items are used for the on-site soil and pitrun gravel replacements.

E. Compact the replacement material to 95% of the maximum laboratory density as determined by AASHTO T99 or ASTM D698.

3.10 PROTECTION OF THE WORK

A. Repair damaged embankments to the specified elevations and grades. Maintain ditches and drains along the subgrade to drain the subgrade. Assure the finished grade does not deviate more than 0.1 (3cm) foot at any point from the staked elevation and the sum of the deviations from true grade of any two points not more than 30 feet (9m) apart does not exceed 0.1 foot (3cm). Do not place any surface course or pavement until the subgrade has been checked and approvedby the Engineer.

END OF SECTION

SECTION 02234

SUB-BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is constructing a sub-base course of either crushed or uncrushed materials meeting the specified gradations and other quality criteria specified herein.

1.2 REFERENCES

AASHTO T11	Amount of Material Finer Than No. 200 (0.075 mm) Sieve in Aggregate
AASHTO T27	Sieve Analysis of Fine and CoarseAggregates
AASHTO T89	Determining Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T176	Plastic Fines in Graded Aggregates and Soils by the Use of the Sand Equivalent Test
AASHTO T96	Resistance to Degradation of Small-Size Course Aggregate By Abrasion and Impact in theLos Angeles Machine
AASHTO T99 (ASTM D698)	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb (2.5kg) Rammer and 12-Inch (305mm) Drop
ASTM D5821	Determining the percentage of Fractured Particles in Coarse Aggregate
AASHTO T191 (ASTM D1556)	Density of Soil in-Place By Sand Cone Method
AASHTO T310 (ASTM D6938)	In-Place density and water content of the soil and soil aggregate by Nuclear Method (Shallow Depth)

1.3 DENSITY CONTROL TESTING

A. Field Density Testing
   1. Meet the quality control and quality assurance testing requirements in section 01400, Contractor Quality Control and Owner QualityAssurance.
   2. In-place field density tests for quality assurance are at Owner expense meeting AASHTO T191 (ASTM D1556) Sand Cone method orAASHTO T310 (ASTM D 6938), Nuclear Densometer method. Quality assurance field density testing frequency is at the discretion of the Engineer.

3. Retesting of failing areas is at the expense of the Contractor.

B. Laboratory Maximum Density and Optimum Moisture
1. Moisture density curves will be provided by the Contractor for each base material supplied. These will be provided at the expense of the Contractor.

C. Materials Submittals
1. Submit to the Engineer gradations, moisture density curves and other preliminary test results for sources to be used for base materials prior to delivery to the site for approval by the Engineer. If recycled materials are proposed, CBR test data must be submitted to the Engineer to assure consistency with design requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish select sub-base material meeting the applicable aggregate quality. Limit use of recycled concrete and/or asphalt in the sub base course to a maximum of 50% by weight. Recycled material shall be mechanically blended to assume thorough mixing.

2.2 UNCRUSHED SUBBASE

A. Furnish material consisting of hard, durable stone, gravel or other similar materials mixed or blended with sand, stone dust, recycled concrete and/or asphalt or other binding or filler materials produced from approved sources, providing a uniform mixture meeting these specifications and compacted into a dense and well-bonded subbase. Oversize material of acceptable quality may be crushed and used in the base material, if the blend meets the specified gradations.

B. Assure the material retained on the No.4 sieve has a wear not exceeding 50% at 500 revolutions as determined by AASHTO T96.

2.3 CRUSHED SUBBASE

A. Furnish material having both fine and coarse crushed stone or crushed gravel, and/or natural gravel, and when approved, blended with soil, sand,screenings, recycled concrete and/or asphalt or other materials.

B. Furnish crushed gravel or stone consisting of hard, durable particles, not containing excessive flat, elongated, soft or disintegrated rock, dirt, or other deleterious matter, and having a wear not exceeding 50% at 500 revolutions as determined by AASHTO T96.

C. Use production methods that produce a percent of fractured rock in the finished product that is constant and uniform. Crush aggregate so that at least 25% of the material is retained on the No.4 sieve and has one or more mechanically fractured faces.

2.4 GRADATION

A. Produce material, including any added binder or filler, meeting the following Table of Gradations as determined by AASHTO Methods T11 and T27:

TABLE OF GRADATIONS

PERCENTAGES BY WEIGHT PASSING SQUARE MESH SIEVES

Passing	4" Minus	3" Minus	2" Minus	1 1/2" Minus	1" Minus
4 Inch	100				
3 Inch	---	100			
2Inch	---	---	100		
11/2 Inch	---	---	---	100	
1 Inch	---	---	---	---	100
No.4	25-60	25-60	25-60	25-60	25-70
No.40	10-30	10-30	10-30	10-30	10-30
No.200	2-10	2-10	2-10	2-10	2-10

B. Up to 5% "oversized" material is permitted provided that the "oversized" material passes the screen size immediately larger than the top size specified. The material between the maximum screen opening and the No.4 sieve shall be reasonably well graded.

C. Suitability of the aggregate is determined by the gradation testing of material placed in the project as required in the Contract documents, within the allowable limits described by the Table of Gradations for the particular grading specified.

D. Assure the liquid limit for the aggregate fraction passing a No.40 sieve does not exceed 25, nor the plasticity index exceed 6, as determined by AASHTO T89 and T90.

2.5 WATERING:

A. Use water from an approved source.

PART 3 - EXECUTION

3.1 PREPARATION

A. Immediately before placing the base course, blade smooth and shape the underlying subgrade, subbase or base course to the plan cross-section before the base course is placed on the street. Do not place sub-base course on wet ormuddy subgrade or subbase course. Maintain at least 1 completed area of finished and accepted subgrade or sub-base course in advance of placing base course.

3.2 PLACEMENT AND SPREADING

A. Mix and place the material in maximum 6-inch (15 cm) horizontal layers loose thickness. Deposit and spread each load of material on the prepared subgrade, or on a completed sub-base course layer continuously without breaks. Assure hauling over the subgrade or over any completed subbase course does not damage the subgrade, sub-base or base course.

B. Spread using dump boards, spreader boxes, or moving vehicles equipped to distribute the material in a uniform layer or a windrow. Place and spread the material in a uniform layer to the specified depth without causing segregation. Once the base course is spread, blade-mix it the full depth by alternately blading the entire layer to the centerline and back to the roadway edge.

C. For multiple layers, mix each layer as specified above. Blade smooth and compact each layer before placing the succeeding layer.

D. Uniformly add water, when required, on site and place in amounts required to compact the material as necessary to aid in densification and to limit segregation. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.

E. Apply water during the work to control dust and to maintain the base course in a damp condition.

F. Where crushed sub-base is specified, produce a product with at least 25% of the material retained on the No.4 sieve having one or more fractured faces.

G. Water required for compacting base gravel may be obtained from the municipal system if approved by the Owner, or from other sources.

H. Compact the material using appropriate tamping equipment or power rollers. Correct all irregularities or depressions that develop under rolling by scarifying the material and adding or removing material, as required, until the surface meets specifications.

I. Blade and compact alternately, as required to produce the specified surface until final inspection. Tamp the material along curbs, headers, manholes, and similar structures and all places inaccessible to rollers using approved mechanical tampers or hand tampers meet field density requirements.

3.3 FIELD DENSITY REQUIREMENTS

A. Furnish watering and rolling to obtain a minimum field density of 95% of the maximum dry density determined by AASHTO T99. No separate compensation is allowed for rolling and watering the sub-base course other than the sub-base course bid item or items listed on the Contract documents.

3.4 SURFACE TOLERANCES

A. Finish the sub-base course so that when tested using a 10-foot (3m) straight edge placed on the surface with its center line parallel to the street center, the maximum surface deviation from the straight edge does not exceed ½ inch (12.7mm). Additionally, the finished grade cannot deviate more than 0.1 foot (30mm) at any point from the staked elevation and the sum of the deviations from two points not more than 30 feet (9.14m) apart cannot exceed 0.1 feet (30mm).

B. Perform all sub-base course corrections to meet the above tolerances using approved methods and materials. Payment for patching aggregate is at the unit price bid for the sub-base course material.

END OF SECTION

SECTION 02235

CRUSHED BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is the placing of one or more base courses composed of crushed gravel, stone or other similar materials meeting the gradation and other quality criteria specified herein.

1.2 REFERENCES

AASHTO T11	Materials Finer than No. 200 (0.075 mm) Sieve in Aggregate
AASHTO T27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T89	Determining Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T176	Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
AASHTO T96	Resistance to Degradation of Small-Size Coarse Aggregate By Abrasion and Impact in the Los Angeles Machine
AASHTO T99 (ASTM D698)	Moisture-density Relations of Soils and Soil-Aggregate Mixtures Using 5-lb (2.5 kg) Rammer and 12-Inch (305 mm) Drop
ASTM D5821	Determining the Percentage of Fractured Particles in Coarse Aggregate
AASHTO T191 (ASTM D1556)	Density of Soil In-Place By Sand Cone Method
AASHTO T310 (ASTM D6938)	In-Place density and water content of the soil and soil aggregate by Nuclear Method (Shallow Depth)

1.3 DENSITY CONTROL TESTING

A. Field Density Testing
   1. Meet the quality control and quality assurance testing requirements in section 01400, Contractor Quality Control and Owner Quality Assurance.
   2. In-place field density tests for quality assurance are at Owner expense meeting AASHTO T191 (ASTM D1556) Sand Cone method or AASHTO T310 (ASTM D6938) Nuclear Densometer method. Quality assurance field density testing frequency is at the discretion of the Engineer.

3. Retesting of failing areas is at the expense of the Contractor.

B. Laboratory Maximum Density and Optimum Moisture

1. Moisture density curves will be provided by the Contractor for each base material provided. These will be provided at the expense of the Contractor.

1.4 MATERIALS SUBMITTALS

A. Submit to the Engineer gradations, moisture density curves and other test results for sources to be used for base materials prior to delivery to the site for approval by the Engineer. If recycled materials are proposed, CBR test data must be submitted to the Engineer to assure consistency with design requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish aggregate base material meeting the applicable aggregate quality requirements. Limit use of recycled concrete and/or asphalt in the crushed base course to a maximum of 50% by weight. Recycled material shall be mechanically blended to assure thorough mixing.

2.2 CRUSHED BASE MATERIAL

A. Consists of both fine and coarse fragments of crushed stone or crushed gravel, and/or natural gravel, and when approved, blended with sand, finely crushed stone, crusher screenings, recycled concrete and/or asphalt or other similar materials. Where recycled materials are permitted, project specifications shall state the minimum required CBR value (design minimum) of the Crushed Base Course.

B. Use crushed stone or gravel consisting of hard, durable particles of fragments of stone, free of excess of flat, elongated, soft or disintegrated pieces, dirt, or other deleterious matter, and having a percent of wear of not exceeding 50 at 500 revolutions when tested under AASHTO T96.

C. Crush material so that the percentage of fractured particles in the finished product is as constant and uniform as practical. Crush to produce material where at least 50% of the material retained on the No. 4 sieve has at least one fractured face.

D. Incorporate all material produced in the crushing operation and passing the No. 4 mesh sieve into the base material necessary to meet the gradation requirements.

E. When available, incorporate reclaimed glass cullet into the base course material. A minimum of 3% and a maximum of 15% of the base course material shall be reclaimed glass. The reclaimed glass shall be crushed so that 100% of the crushed glass passes a 3/8 inch screen. No more than 10% of the material retained on an individual sieve ¼

inch or larger shall be glass, based upon visual examination and weight.

2.3 GRADATION

A. As determined by AASHTO Methods T11 and T27, furnish material for the grading specified in the contract documents including binder or filler, which may have been added at the plant or at the site, meeting the requirements of that grading in the Table of Gradations below:

TABLE OF GRADATIONS

PERCENTAGES BY WEIGHT PASSING SQUARE MESH SIEVE

Passing	1½" Minus	1" Minus	¾" Minus
1½ Inch	100		
1 Inch	—	100	
¾ Inch	—	—	100
½ Inch	—	—	—
No. 4 Sieve	25 - 60	40 - 70	40 - 70
No. 10 Sieve	—	25 - 55	25 - 55
No. 200 Sieve	0 - 8	2 - 10	2 - 10

B. Up to 5% "oversized" material is permitted provided that the "oversized" material passes the screen size immediately larger than the top size specified. The produced material between the maximum screen opening and the No.4 sieve shall be reasonably well graded.

C. Suitability of the aggregate is based on samples obtained during placement in the project within limits allowed in the table for the particular grading specified.

D. That portion of the fine aggregate passing the No. 200 sieve must be less than 60% of that portion passing the No. 40 sieve.

E. The liquid limit for that portion of the fine aggregate passing a No. 40 sieve cannot exceed 25, nor the plasticity index exceed 6, as determined by AASHTO T89 and T90.

2.4 WATERING:

A. Use water from an approved source.

PART 3 - EXECUTION

3.1 GENERAL

A. Before placing the base course, smooth and shape the surface of the underlying subgrade, sub-base or base course to the cross section shown on the plansbefore placing the base

course.

B. Do not place base course on a wet or muddy subgrade or sub-basecourse. Complete at least one area of finished and accepted subgrade, sub-base or underlying base before the placing of any base course.

3.2 PLACEMENT AND SPREADING

A. Mix and place the material in maximum 8 inches (20 centimeters) compacted layers unless otherwise approved. Deposit and spread each load of material on the prepared subgrade, or on a completed sub-base or base course layer continuously without interruption. Discontinue operating haul units over subgrade, or over any sub-base or base course completed if the haul units damage the subgrade, sub-base or base course.

B. Deposit and spread the material in a uniform layer, without segregation, to a loose depth so that when compacted, and making allowance for any filler to be blended on the road, the layer has the specified thickness.

C. Spread material using dump boards, spreader boxes, or vehicles equipped to distribute the material in a uniform layer. The material may be deposited in windrows mixed and spread as described below.

D. Construct each layer meeting these requirements. Blade smooth and thoroughly compact each layer as specified before placing the succeeding layer.

E. If segregation or moisture problems exist, or if the material was placed on the road in windrows, thoroughly blade-mix the material of the affected layer by alternately blading to the center and back to the edges of the street.

F. Uniformly add water, when required, on site and place in amounts required to compact the material as necessary to aid in densification and to limit segregation. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.

G. Apply water during the work to control dust and to maintain the base course in a damp condition in accordance with Section 01500 under Dust Control.

H. Uncontaminated water required for compacting base gravel may be obtained from the municipal system if approved by the owner, or from other sources.

3.3 FIELD DENSITY REQUIREMENTS

A. Compact placed material the full width by rolling with suitable tamping equipment or power rollers. Correct all irregularities or depressions that develop during rolling by loosening the material in these places and adding or removing material, as required.

B. Perform blading and compacting alternately as required or directed, to maintain a

smooth, even, uniformly compacted surface until the final inspection. Along curbs, headers, manholes, and similar structures, and at all places not accessible to the roller, compact the base course material with suitable mechanical tampers or hand tampers to reach the compaction requirements.

C. Provide the watering and rolling required to obtain a minimum field density of 95% of maximum dry density as determined by AASHTO T99. No separate compensation is made for rolling and watering the base course other than the base course bid item or items listed on the contract documents.

3.4 SURFACE TOLERANCES

D. The base course surface when finished and tested with a 10-foot (3.0 meter) straight edge placed on the surface with its center line parallel to the center line of the street, will not have a surface deviation from the straight edge exceeding 3/8- inch (1.0 centimeter). Additionally, the finished grade cannot deviate more than 0.05 feet (1.5 centimeters) at any point from the staked elevation, and further, the sum of the deviations from two points not more than 30 feet (9.0 meters) apart cannot exceed 0.05 feet (1.5 centimeters).

E. For base course receiving asphalt concrete surfacing, the finished grade cannot deviate more than 0.02 feet (0.6 centimeters) at any point from the staked elevations, and the sum of the deviations from two points not more than 30 feet (9.0 meters) apart cannot exceed 0.02 feet (0.6 centimeters).

F. If patching of the base course is necessary to meet the tolerances, perform patching using methods and aggregates approved by the Engineer. Payment for patching aggregate is at the unit price bid for the base course material.

END OF SECTION

SECTION 02502

ASPHALT PRIME AND/OR TACK COAT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is the single application of asphalt material as specified in the contract documents on a prepared sub-grade, sub-base, base or asphalt surface meeting the plans and specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified in the contract documents, do not use type SS-1h emulsified asphalt. Furnish asphalt material grade and typed as specified below.

1. Furnish Liquid Asphalt, MC-70 meeting the requirement of Section 702 of the MDT Standard Specifications for all asphalt prime coat applications.
2. Furnish Liquid Asphalt, MC-800 and/or MC-3000 meeting the requirement of Section 702 of the MDT Standard Specifications for all chip seal applications on gravel roads.
3. Furnish Emulsified Asphalt, SS-1 meeting the requirements of Table 1 in this section for all asphalt tack coat applications.
4. Furnish Emulsified Asphalt, CRS-2 or CRS-2P meeting the requirements of Table 2 in this section for all asphalt chip seal applications.

B. Furnish Blotter Sand as specified below meeting the requirements of MDT 407.02.2.

1. Blotter material shall be 100% passing the ½-inch (12.5 mm) screen having a PI of 6 or less.

TABLE 1
SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALTS

TYPE	RAPID SETTING				MEDIUM SETTING						SLOW SETTING			
GRADE	RS-1		RS-2		MS-1		MS-2		MS-2h		SS-1		SS-1h	
Test of Emulsions:	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt-Furol at 77°F (25°C)	20	100	…	…	20	100	100	…	100	…	20	100	20	100
Viscosity, Saybolt-Furol at 122°F (50°C)	…	…	75	400	…	…	…	…	…	…	…	…	…	…
Demulsibility*, 35ml, 0.02N $CaCl_2$, percent	60	…	60	…	…	…	…	…	…	…	…	…	…	…
Residue by Distillation, percent	55	…	63	…	55	…	65	…	65	…	57	…	57	…
Test on Residue from distillation tests														
Penetration, 77°F (25°C), 100g, 5s	100	200	100	200	100	200	100	20	40	90	100	200	40	90
Ductility, 77°F (25°C), 5cm/min, cm.	40	…	40	…	40	…	40	…	40	…	40	…	40	…
Solubility in Trichloroethylene	97.5	…	97.5	…	97.5	…	97.5	…	97.5	…	97.5	…	97.5	…
Suggested Uses:	Surface treatment penetration macadam and tack coat		Surface treatment and penetration macadam		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve, tack		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.				Plant or road mixture with graded and fine aggregates, substantially quantity of which passes a No. 8 (2.36 mm) sieve and a portion of which may pass a No. 200 (0.075 mm) sieve. Slurry seal treatment.			

* The demulsibility test shall be made within 30 days from the date of shipment.

TABLE 2
SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALTS ASSHTO M208

TYPE	RAPID SETTING				MEDIUM SETTING				SLOW SETTING				
GRADE	CRS-1		CRS-2		CMS-1		CMS-2h		CSS-1		CSS-1h		
Test of Emulsions:	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Viscosity, Saybolt-Furol at 77°F (25°C)	…	…	…	…	…	…	…	…	…	20	100	20	100
Viscosity, Saybolt-Furol at 122°F (50°C)	…	20	100	100	400	50	450	50	450	…	…	…	…
Demulsibility[A] 35ml, 0.08% sodium dioctyl sultrosuccinate, %	40	…	40	…	…	…	…	…	…	…	…	…	…
Particle Charge Test	Pos	…	Pos	…	Pos	…	Pos	…	Pos [B]	…	…	…	Pos [B]
Distillation: Oil distillation by volume of emulsion, percent	…	…	3	…	3	…	12	…	12	…	…	…	…
Residue, percent	60	…	…	65	…	65	…	65	…	…	57	…	57
Test on Residue from distillation tests													
Penetration, 77°F (25°C), 100g, 5s	100	250	100	250	100	250	40	90	100	250	40	90	…
Ductility, 77°F (25°C), 5cm/min, cm.		40	…	40	…	40	…	…	40	…	40	…	40
Solubility in Trichloroethylene	97.5	…	…	97.5	…	97.5	…	97.5	…	…	97.5	…	97.5
Suggested Uses:	Surface treatment, penetration macadam and tack coat		Surface treatment and penetration macadam		Plant or road mixture with course aggregate, substantially all of which is retained on a No. 8 (2.36 mm) sieve and practically none of which passes a No. 200 (0.075 mm) sieve.				Plant or road mixture with graded and fine aggregates, a substantial quantity of which passes a No. 8 (2.36 mm) sieve and a portion of which may pass a No. 200 (0.075 mm) sieve. Slurry seal treatment.				

[A] The demulsibility test shall be made within 30 days from the date of shipment.

B If the particle charge test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

PART 3 - EXECUTION

3.1 DISTRIBUTORS

A. Use a pressure distributor for prime and tack coats that distributes the required amount of asphaltic material at the specified temperature in a uniform spray, without atomization. Assure the distributor is pneumatic tired and does not rut or otherwise damage the surface being sprayed. Equip it with a bitumeter having a dial visible to the truck driver for maintaining the constant speed required for application at the specified rate.

B. Assure the pump is operated by a separate power unit or by the truck power unit. Equip the pump with a tachometer having a dial readily visible to the operator, registering gallons per minute passing through the nozzles.

C. The distributor shall be designed so that the normal width of application shall be not less than 12 feet (3.66 m), with provision for the application of lesser or greater width when necessary. The distributor shall be designed or equipped so that the height of the spray bar above the surface to be sprayed, may be set and maintained within a tolerance of 1/2 inch (13 mm) (plus or minus) of the height required to provide a uniform application.

D. Assure the distributor is equipped and operated so that the asphaltic material is circulated or agitated throughout the entire heating system. Provide a means for constant, accurate temperature indication of the asphaltic material is provided. Assure the thermometer well is placed without contacting the heating tube.

3.2 ASPHALT PRIME COAT

A. Asphalt prime coat will be applied only if specified in the plans or special provisions. See section 02502.4.

B. Apply MC-70 at a rate of 0.20 gallons per square yard (0.91 L/m^2) on all asphalt prime coat application.

C. Immediately before applying the prime coat, clean the surface to be primed of all dirt and loose materials using blowers or a power broom, supplemented by hand brooming if necessary. Finish the surface to receive the asphalt material to the specified requirements for smoothness, compaction, and grade. Apply prime coat when the surface is dry or slightly damp and when the air temperature in the shade is not less than 50° Fahrenheit (10° C).

D. Apply asphalt material using a pressure distributor at the rate or rates directed by the Engineer.

E. Before spraying, spread building paper over the surface from the joint back, for the distance required for the spray bar to begin spraying and operating at full force when the surface to be treated is reached. Once the asphalt is applied, remove and dispose of the building paper. Assure the spray bar is shut off instantaneously at each construction joint to assure a straight line and full application of asphalt prime up to the joint. If required to prevent dripping, insert a drip pan under the nozzle where the application ends. Use a hand sprayer to apply primer material to touch up all spots missed by the distributor.

F. Protect the surfaces of structures and trees adjacent to the area being treatedfrom being spattered or marred. Do not discharge asphalt material into borrow pits or gutters.

G. After the prime coat has been applied, assure it is left undisturbed for at least 24 hours or until it is cured or blotted. Blot all excess asphalt material remaining on the surface after 24 hours with sand before opening the surface to traffic. Maintain the primed or tacked surface until the surfacing has been placed. Maintenance includes spreading any additional sand required to prevent asphalt material adhering to the tires of vehicles using the surface and patching all breaks in the surface with additional bituminous material. Any area of surface disturbed by traffic or otherwise, is to be cleaned before the next course is placed. Before placing the surface course, sweep all excess and/or loose sand used for blotter from the surface.

3.3 ASPHALT TACK COAT

A. The asphalt tack coat is the application of a diluted, slow-breaking, SS-1 asphalt emulsion to ensure bond between the surface being paved and the overlying course. Immediately before applying the tack coat, clean the surface to be tacked of all dirt and loose materials using blowers or power brooms, supplemented by hand brooming if necessary.

B. Apply tack coat when the surface is dry or slightly damp, and when the air temperature in the shade is at least 50° Fahrenheit (10° C).

C. Dilute the asphalt emulsion, SS-1, with water at one part emulsion to one part water. Apply the diluted emulsion using a pressure distributor at the rateof 0.1 gallon per square yard (4.5 liters per square meter).

D. Before application, spread building paper over the surface, from the joint back, for the required distance for the spray bar to begin spraying and operating at full force when the surface to be treated is reached. Once the asphalt is applied, remove and dispose of the building paper. Shut off the spray bar instantaneously at each construction joint to assure a straight line and full application of asphalt tack up to the joint. If required to prevent dripping, insert a drip pan under the nozzle where the application is stopped. Use a hand sprayer to apply primer material for touching up all spots missed by the distributor.

E. After the tack coat has been applied, assure it is undisturbed until the asphalt emulsion has “broken”, generally within 30 minutes of application. Place the next paving course after the emulsion has broken.

F. Schedule operations so that all tack coats are placed with the asphalt-paving course in the same day.

END OF SECTION

SECTION 02504

ASPHALT SEAL COAT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is applying a single application of asphalt material on a prepared asphalt surface, followed by spreading seal coat aggregate meeting these specifications.

1.2 REFERENCES

AASHTO T11	Amount of Material Finer than No. 200 (0.075 mm) Sieve in Aggregate
AASHTO T27	Sieve Analysis of Coarse and Fine Aggregates
AASHTO T89	Determining the Liquid Limit of Soils
AASHTO T90	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T96	Resistance to Degradation of Small-Size Coarse Aggregate By ASTM
C131	Abrasion and Impact in the Los Angeles Machine
MT 309	Determining the Percentage of Adhesion of Bituminous Materials to Aggregate
MT 228	Method of Test for Evaluating Cleanness of Cover Coat Material

PART 2 - PRODUCTS

2.1 ASPHALT

A. Furnish asphalt material meeting the specifications in Section 02502; ASPHALT PRIME AND/OR TACK COAT and the contract requirements.

2.2 AGGREGATE

A. Unless otherwise specified, furnish ½ inch (13 mm) seal coat aggregate meeting the requirements of Section 2510: Asphalt Concrete Pavement and Table 1 in this section for all chip seal applications on gravel roads.

B. Unless otherwise specified, furnish 3/8 inch (9.5 mm) seal coat aggregate meeting the requirements of Section 2510: Asphalt Concrete Pavement and Table 2 for all chip seal applications on asphalt roads.

C. Furnish material consisting of crushed stone or crushed aggregate that is clean, durable fragments free from an excess of flat, elongated, soft ordisintegrated pieces, clay balls or other deleterious material. Assure the material produced is free from adherent films of clay or rock dust and is washed thoroughly. No combination of shale, clay, coal, or soft particles can exceed 1.5 percent. Assure the aggregate has a minimum cleanness value of 75 when tested under Montana Test Method MT228.

D. The material cannot exceed a wear of 40% at 500 revolutions when tested under AASHTO Method T96 Grading C. A minimum of 70% by weight of the coarse aggregate (retained on No.4 Sieve) must have at least one fracturedface.

E. The aggregate, or a composite mixture, must show no detrimental stripping when tested under Montana Test Methods MT-309. If stripping exceeds 5%, the aggregate will be rejected or an alternate grade of asphalt substituted to reduce stripping below 5%.

F. For all gradings, that portion of the aggregate passing a No. 40 sieve must be non-plastic as determined by AASHTO T89 and T90.

G. When tested by AASHTO Methods T11 and T27 in conjunction with water wash, chips must meet the grading requirements of the following tables:

TABLE 1
1/2" SEAL COAT AGGREGATE - TABLE OF GRADATION

Sieve Designation	Percentage of Weight Passing Sieves
5/8-inch Sieve	100
3/8-inch Sieve	35 - 55
No. 4 Sieve	0 - 15
No. 8 Sieve	0 - 5
No.200 Sieve	0 – 2

TABLE 2
3/8" SEAL COAT AGGREGATE - TABLE OF GRADATION

Sieve Designation	Percentage of Weight Passing Sieves
1/2-inch Sieve	100
3/8-inch Sieve	85 - 100
No. 4 Sieve	10 - 30
No. 10 Sieve	0 - 10
No. 40 Sieve	0 - 2

TABLE 3
1/4" SEAL COAT AGGREGATE - TABLE OF GRADATION

Sieve Designation	Percentage of Weight Passing Sieves
3/8-inch Sieve	100
1/4-inch Sieve	85 - 100
No. 8 Sieve	0 - 25
No. 16 Sieve	0 - 10
No. 40 Sieve	0 - 2

TABLE 4
SAND SEAL COAT AGGREGATE - TABLE OF GRADATION

Sieve Designation	Percentage of Weight Passing Sieves
1/4-inch Sieve	100
No. 8 Sieve	10 - 40
No. 16 Sieve	0 - 10

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Distributor
   1. Furnish distributors meeting the requirements of Section 02502; ASPHALT PRIME AND/OR TACK COAT.

B. Brooms
   1. Provide power brooms, or a power blower or both.

3.2 AGGREGATE SPREADER

A. Furnish an independent, self-propelled aggregate spreading equipment (Flaherty Spreadmaster or equal) that can be adjusted to spread the specified quantity of cover aggregate per square yard (square meter).

3.3 CONSTRUCTION METHODS:

A. Seasonal Limitations

1. Seal coating operations cannot be performed after September 1 for areas higher than 3,500 feet (1,070 meters) above sea level. For areas below 3,500 feet (1,070 meters) above sea level, seal coating operations are not permitted after September 15.

B. Weather Limitations

1. Do not apply asphalt material when the street face is damp or wet, or when the atmospheric temperature in the shade is less than 65° F (18° C). Do not start work without the Engineer's approval and terminate work at once in event of rain. Terminate seal coating work just before dark, and stop work during wind that blows sand, dust or other foreign matter into the spread asphalt material before the aggregate is applied.

2. Do not perform seal coat work if the local weather forecast includes a predicted temperature lower than 45 degrees Fahrenheit (7° C) within 12 hours after the intended close of the work for the day.

3. Do not perform seal coat work if the local weather forecast includes a probability of precipitation greater than 45% within the intended schedule of operations for the day. Regardless of the weather forecast, seal coat work may be suspended if impending adverse weather conditions occur in the vicinity of the work.

C. Preparation of Surfaces

1. General
   a. Do not start coat operations until the Engineer determines the asphalt surface course to be seal coated is thoroughly compacted and rolling and all holes and breaks in the surface and edges are repaired. In no event, unless ordered in writing by the Engineer,is the seal coat to be placed on newly constructed or reconditioned surfaces within 7 days of the surface having been placed.
2. Cleaning
   a. Immediately before applying the asphalt material, clean the surface of all dust, dirt, sand or other objectionable material that prevents complete coverage or bond between the asphalt material and the street surface, using a rotary power broom or blower, by hand sweeping, or both, as required. Thoroughly clean the outer edges adjacent to vertical curbs. Do not mix material removed from the surface with the cover aggregate.

D. Application of Asphalt Material

1. Apply asphalt material at a rate of 0.35 gallons per square yard (1.6 L/m2) when using Emulsified Asphalt CRS-2 or CRS-2P, and at a rate of 0.50 gallons per square yard (2.3 L/m2) when using Liquid Asphalt MC-800 or MC-3000.

2. Apply asphalt material at a rate of 0.20 gallons per square yard (0.9 L/m2) for sand seal applications.

3. Apply the asphalt material uniformly at the rate specified.

4. The Engineer may require adjustments in the application during the work. When heating is required, take precautions to avoid fire hazard. Thoroughly clean the distributor before use unless its last use was with the same type of asphaltic material specified for the work.

5. Before application, spread building paper over the surface, from the joint back, for the distance required for the spray bar to begin spraying and operating at full force when it reaches the surface to be treated. After the asphalt is applied, remove and dispose of the building paper.

6. Shut off the spray bar instantly at each construction joint to assure a straight line and the full application of asphaltic binder up to the joint. If required to prevent dripping, insert a drip pan under the nozzles when the application is stopped.

7. Use a hand sprayer to apply asphaltic binder to touch up all spots missed by the distributor.

8. Before and during seal coating operations, calibrate or check the adjustments on the distributor as follows:

    a. Tank calibration

    b. Nozzle adjustment and pressure

    c. Spray bar height

    d. Bitumeter calibration

    e. Transverse and Longitudinal Spread of Asphalt Material.

        1) Transverse spread variation shall not exceed 15%

        2) longitudinal spread variation shall not exceed 10% plus or minus of the rate specified.)

E. Application of Seal Coat Material

1. Apply seal coat material at a rate of 25 pounds per square yard (13.6 kg/m2) on all chip seal applications. Apply seal coat material at a rate of 15 pounds per square yard (8.1 kg/m2) on all sand seal applications. During the course of the work, make adjustments in the rate of application as required or as directed by the Engineer.

2. Assure the cover coat material is stockpiled enough in advance of the work so that excess water has drained from the aggregate. Do not spread seal coat aggregate if the moisture content of the aggregate exceeds 2 percent.

3. Uniformly distribute the cover coat at the specified rate using a mechanical or a self-propelled spreader immediately after the asphaltic material application. If weather or surface conditions make require, restrict the application of asphalt material to the area coverable by the cover coat material available in the trucks. Assure cover aggregate is available at all times to assure continuous seal coating operations. Do not apply seal coat aggregate to cold, dried or partially dried asphalt material.

4. Immediately after spreading, roll the aggregate with self-propelled, pneumatic-tired rollers. Roll in a longitudinal direction, beginning at the outer edges of the treatment and working toward the center. Overlap the previous strip by about one-half the roller width. Do not allow the roller speed to exceed 7 mph during initial rolling or 15 mph after initial rolling. Complete the first rolling of the aggregate within one- half hour of it being spread. Continue rolling until a smooth, thoroughly compacted surface is obtained. Roll at least 3 complete passes with each roller. If the seal coat is finished in partial widths at a time, leave 4 to 6 inches (100 mm to 150 mm) of the inside edge uncovered with aggregate to permit overlap of asphaltic material when the remaining portion of the surface is treated.

5. Remove all loose aggregate from the pavement after the work is completed, and dispose of at the specified location. If a location is not designated the chips become the Contractor's property.

3.4 PROTECTION OF STREET SIDE STRUCTURES AND TRAFFIC CONTROL:

A. Protect all sign posts, street lamp posts, trees, shrubs and tops of curbs andgutters from splashing asphaltic material. Compensation for furnishing, erecting and removing such protection is included in the unit price bid for the application of asphalt material.

B. Keep traffic off of freshly sprayed asphalt.

C. It is the sole responsibility of the Contractor to furnish and post "No Parking" signs along both sides of the street(s) intended for seal coating. The "No Parking" signed shall be posed at 100-foot intervals and securely fastened to their support posts. (Wood laths may be used.) It is also the responsibility of the Contractor to remove and dispose of all "No Parking" signed and their supports immediately after the seal coating operations have been completed on each street. "No Parking" signs shall be posed 24 hours in advance of seal coating operations. The Contractor shall notify the public as to the proposed streets to be seal coated and the corresponding dates of the construction activities. The Contractor shall be responsible for removing all vehicles from streets to be seal coated. Traffic will be allowed onto streets upon completed of the seal coat improvements. However, traffic will be required to operate at 15 mph for a period of 48 hours following completion of the seal coat. It is the responsibility of the Contractor to erect, maintain and remove the temporary speed control signs for the appropriate streets.

END OF SECTION

SECTION 02510

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Work is the production and placement of plant mix asphalt concrete pavement.

B. Hot plant mix asphalt concrete is a mineral aggregate and asphalt material mixed at a hot plant meeting these specifications and placed in one or more courses on a newly prepared or existing street roadway in accordance with the contract documents.

1.2 REFERENCES

AASHTO T11 (ASTM D1140)	Amount of Material Finer than No. 200 (0.075 mm) Sieve in Aggregate
ASTM D5361	Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing
AASHTO T27 (ASTM C136)	Sieve Analysis of Fine and Coarse Aggregate
AASHTO T89 (ASTM D4318)	Determining Liquid Limit of Soils
AASHTO T90 (ASTM D4318)	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T283 (ASTM D4867)	Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
AASHTO T176 (ASTM D2419)	Plastic Fines in Graded Aggregates and Soils by Use of The Sand Equivalent Test
AASHTO T96 (ASTM C131)	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T312 (ASTM D6925)	Standard Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor
ASTM D2041	Theoretical Maximum Specific Gravity and Density of Bituminous Mixtures
ASTM C1097	Hydrated Lime for Use in Asphalt Cement or Bituminous Paving Mixtures
ASTM D3666	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

ASTM D5821	Percentage of Fractured Particles in Coarse Aggregate
ASTM C123	Lightweight Particles in Aggregate
ASTM D6307	Asphalt Content of Asphalt Mixture by Ignition Method
ASTM C142	Clay Lumps and Friable Particles in Aggregates
MS-2	Asphalt Institute – Mix Design Methods

PART 2 - PRODUCTS

2.1 GENERAL:

A. The Asphalt Concrete Surface Course must have at least a 3-bin separation, when continuous flow mixing types of plants are used. When a drum dryer is used with a weight batching system from dry bins, separate and stockpile the crushed aggregate into two sizes.

B. Unless otherwise specified, furnish Type B or B-Modified aggregate meeting the requirements of Table 1 in this section for all asphalt pavement applications.

C. Unless otherwise specified, furnish (PGAB) PG58-28 Asphalt Binder Material meeting the requirements of Table 2 in this section for all asphalt pavement application.

D. Prepare pavement course to conform to the lines, grades, thickness and typical cross sections shown in project documents and plans, and shall be rolled, finished, and approved by the Engineer before the placement of the next course.

2.2 PLANT MIX AGGREGATES

A. Furnish aggregates from acceptable sources approved by the Engineer.

B. Furnish test data as outlined in this section on each source to be used for acceptance by the Engineer.

C. Designation of the source of supply and the acceptability of the material there from, does not extend to the grading of the material as it may naturally come from the pit or crusher. Adjust the crusher and screens to remove certain portions of the material as may be necessary to furnish gravel that will comply with the specifications in the contract. No additional compensation will be allowed for such adjustment of the equipment or the rejection of waste. It is understood that the Engineer may order procurement of material from any portion of any area designated as a pit site and may reject portions of the deposit as unacceptable.

D. Aggregate materials shall not contain more than 1.5% by weight of clay lumps, shale, or coal, nor shall light weight particles exceed 3.5% by weight. No combination of clay, shale, coal, or lightweight particles shall exceed 3.5% by weight. Do not use Scoria (fired clay). Aggregate materials shall conform to the grading stipulated in the contract documents. Use reasonable care in the selection of material in a pit so that uniform product will be produced at all times. No compensation will be allowed for such stripping of the pit as may be required in order that satisfactory material may be secured.

E. Aggregate used shall consist of gravel, crushed to the specified size, crushed stone, composed of hard durable pebbles or stone fragments, reclaimed asphalt pavement, and finely crushed stone filler, sand or natural clean material, or other fine mineral material. The portion of the material retained on the No. 4 sieve (4.74 mm) will be called coarse aggregate and that passing the No. 4 sieve (4.74 mm) and retained on the #200 sieve (0.075 mm) will be call fine aggregate. The material Passing the #200 (0.075 mm) will be called mineral filler. The reclaimed asphalt pavement shall be removed from its original location and reduced by suitable means to such particle size as may be required for use in hot plant mix asphalt concrete.

F. For all gradings of fine aggregate, including any blended fine aggregate and mineral filler, passing a No 40 sieve (0.425 mm), shall have a liquid limit not exceeding 25 and a plasticity index of not more than 6.

G. Produce coarse aggregate retained on the No. 4 sieve (4.75 mm) having a minimum of 75% by weight of particles with at least two mechanically fractured faces. When fractures are contiguous, assure the angle between the fracture planes is at least 30 degrees to count as two fractured faces.

H. Preliminary acceptance of aggregates proposed for use may be made at the point of production. Final acceptance will be made only after tests of the aggregates are complete and in place.

I. Surface Course Asphalt Plant Mix Aggregate:

TABLE 1

REQUIREMENTS FOR GRADING OF SURFACE COURSE AGGREGATE

Percentage by Weight Passing Job Mix Target Bands						
Sieve Size	A 1"	B ¾"	C ½"	D 3/8"	E #4	Job Mix Tolerances
1" (25.0 mm)	90 - 100	100				---
¾" (19.0 mm)	90 Max	90 - 100	100			+/- 5
½" (12.5 mm)		90 Max	90 - 100	100	100	+/- 5
3/8" (9.5 mm)			90 Max	90 - 100	95 - 100	+/- 5
No 4 (4.75 mm)				90 Max	90 - 100	+/- 5
No 8 (2.36 mm)	19 - 45	23 - 49	28 - 58	32 - 67		+/- 4
No 30 (0.600 mm)						+/- 3
No 200 (0.075 mm)	1 - 7	2 - 8	2 - 10	2 - 10	6 - 13	+/- 2

1. The above gradation bands represent the job mix target limits, which determine the suitability of aggregate for use. The final job mix target gradation must be within the specified bands and uniformly graded from coarse to fine and not vary from the low limits on one screen to the high limits on the adjacent screen, or vice versa. The final job mix gradation limits are established by applying the job mix tolerances to the job mix targets.
2. The job mix formula establishes target values. During production of the mix, the gradations shall lie within the job mix gradation limits specified in Table 1. For example, "Type A, No. 200" band is "1-7". QA job mix target of 5 has been selected for the final mix. The job mix gradation limits is 5, plus and minus 2. Therefore, the job mix gradation limits for production is 3-7.

J. Reclaimed class may be added to the aggregate for plant mix. A maximum of 3% crushed glass may be blended in the mix. The glass shall be crushed so that 100% of the glass passes a 3/8 sieve, and no more than 8% passes a No. 200 sieve. If glass is used in the mix, 1% hydrated lime (by weight) shall be added to the mix as an anti-stripping agent. Hot plant mix asphalt with glass is limited to binder or base courses and is not to be used in surface or friction courses.

2.3 ASPHALT BINDER MATERIAL

A. Unless otherwise specified in the Contract Documents, the type and grade of asphalt cement shall be performance grade 58-28 (AASHTO Performance Graded Binder Specification MP-1). Furnish asphalt binder material to be used as specified in the contract documents that meet the type and grade specified requirements in this section in Table 2.
1. Grades:
    a. (PGAB) PG 58-28
    b. (PGAB) PG 64-22
    c. (PGAB) PG 64-28 (Polymer Modified)
    d. (PGAB) PG 70-28 (Polymer Modified)

B. The percentage of asphalt by weight, to be added to the aggregate will be, generally, between 4 and 8% of the weight of the total mix. A minimum effective asphalt binder content of 4.5% is required for ¾" for Type B and ½" mixes, 5.0% for ½" for Type C mixes. The mix design will establish the exact percentage of asphalt in the mix, based upon preliminary laboratory tests, sieve analysis and grading and character of the aggregate furnished within the specification limits. No claim is allowed for the payment for rejecting any batch or load of mixture containing an excess or deficient amount of asphalt binder varying more than 0.4 of a percent from the fixed mix design percentage.

C. Obtain Engineer approval of the asphalt material source before shipments are made to any project. The source of supply cannot change after work is started unless approved in writing by the Engineer. The Engineer is not liable for the quantity shipped.

D. Samples of asphalt binder material may be taken, as directed by the Engineer,and placed in uncontaminated one-quart containers. When sampled, these shall be taken from the tanker car or truck at the point of delivery on the project and submitted to the Engineer.

E. All transport vehicles must be equipped with a spigot or gate valve installed in either: (1) the unloading line, (2) in the tanker at the centerline on the tank, (3) in the pressure line from the unloading pump, or other locations approved by the Engineer. Assure the spigot or gate valve has a diameter of between 3/8 inch (1 cm) and 3/4 inch (2.5 cm). The spigot valve must be located to prevent contamination from plant dust or other contaminants.

F. The supplier furnishing the asphalt binder material shall inspect each tanker car or truck before it is loaded and ship only in clean, uncontaminated, fully insulated cars or trucks, sealed after loading by the supplier.

G. The material supplier shall issue, in duplicate, a certificate showing full compliance with the specifications for the designated grade of material, together with the following information. Project number, date of shipment, source of the material, car or truck initial and number, destination, gross quantity loaded, loading temperature, and net quantity in gallons at 60° F (15.5° C) or tons, whichever unit of measurement is stipulated. Assure the certificate of compliance accompanies the shipment and is furnished to the Engineer. The certificate, signed by the supplier representative, must also certify that the conveyance vessel was inspected and found to be free of contaminating material.

H. The certificate of compliance is the basis for tentative acceptance and use of the material. Samples taken according to applicable sampling methods and retained by the Engineer may be tested at the Engineer's discretion. Failure of the asphalt material to meet these specifications may result in rejection of the entire, associated work. If rejected, removed and replace rejected work.

I. Apply asphalt material at temperatures that assure uniform mixing or spreading. Application temperature ranges for each grade of material should be accompanied with the mix design. Application temperature for mixing applications will be in accordance with the mix design.

J. Upon request by the Engineer, furnish the Engineer and/or laboratory (responsible for completing the mix design) with data or a report showing the temperature-viscosity relationship of each asphalt binder used on the project. Assure this data covers the range of temperatures used for mixing and compaction. In addition, the Engineer may request a complete set of test results from Table 2 for each grade used on the project.

TABLE 2
PERFORMANCE GRADED ASPHALT BINDER (PGAB)

Performance Grade	PG 58	PG 64		PG 70	Test Methods
	-28	-22	-28	-28	
Average 7-day Maximum Pavement Design Temperature, °C	<58	<64		<70	
Minimum Pavement Design Temperature, °C	>-28	>-22	>-28	>-28	
Original Binder					
Flash Point Temp.: Minimum °C	230				AASHTO T48

Viscosity: Maximum, 3 Pa ·s (3000 CP), Test Temp, °C	135			ASTM D4402
Dynamic Shear: G* / sin delta, Minimum, 1.00 kPa Test Temp @ 10 rad / s, °C	58	64	70	AASHTO T315
Rolling Thin Film Oven (AASHTO T240) or Thin Film Oven (T179) Residue				
Mass Loss, Maximum, %	1.0			AASHTO T240
Dynamic Shear: G* / sin delta, Minimum, 2.20 kPa Test Temp @ 10 rad / s, °C	58	64	70	AASHTO T315
Pressure Aging Vessel Residue (AASHTO PP1)				
PAV Aging Temp, °C	100	100	100	AASHTO R28
Dynamic Shear: G* / sin delta, Maximum, 5000 kPa Test Temp @ 10 rad / s, °C	19	25 / 22	25	AASHTO T315
Creep Stiffness [a]: S, Minimum, 300 MPa m-value, Minimum, 0.300 Test Temp, @ 60 sec, °C	-18	-12 / -18	-18	AASHTO T313
Direct Tension [a]: Failure Strain, Minimum, 1.0%, Test Temp @ 1.0 mm/min. °C	-18	-12 / -18	-18	AASHTO T314

1. If creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

2.4 HYDRATED LIME FOR ASPHALT CONCRETE.

A. Mineral filler may be incorporated in the asphalt concrete mixture. Furnish hydrated lime as filler when specified. Assure it is free of lumps and extraneous material and meets the following gradation requirements as per ASTM D242:'=

Sieve	Percent Passing
No. 30 (0.60 mm) Sieve	100
No. 80 (0.180 mm) Sieve	95-100
No. 200 (0.075 mm) Sieve	70-100

B. Assure the hydrated lime meets paragraph 2 (chemical composition) and paragraph 7 (a) requirements (chemical analysis) of ASTM C1097.

C. Where required, the mineral filler will be effectively mixed with the hot plant mix asphaltic concrete.

2.5 COMPOSITION OF MIXES:

A. General

1. Submit to the Engineer for approval a mix design for each mix required on the project. Assure the job-mix formula is within the gradation limits in Part 2 Products in this section.
2. Have the job-mix formula prepared by an independent testing laboratory approved by the Engineer and performed under the supervision of a Professional Engineer. The requirements of ASTM D-3666 are the guidelines for testing laboratory approval. The cost of the job-mix formula(s) is at Contractor expense.
3. Keep the job mix formula current and contain the following minimum information:
    a. Gradation of all constituent aggregates.
    b. Specific gravity of constituent aggregates and asphalt cement.
    c. Source of supply of all materials and grade of asphalt cement.
    d. Marshall design curves for stability, unit weight, flow and volumetric requirements (VMA and total voids) at asphalt contents below and above optimum (four points minimum).
    e. Measured void less (Rice's) specific gravity used in voids computations.
    f. Composite aggregate grading.
    g. Recommended asphalt cement content.
    h. Marshall or gyratory compactive effort.
    i. Date of mix design (job mix formula).
    j. Index of retained strength.
4. In addition to the job mix formula, all asphalt concrete surfacing mix submittals will have laboratory tests indicating that the Tensile Strength Ratio (TSR) as determined by AASHTO T-283 is at least 70%. Testshall be performed at 7.0 +/- 0.5% air voids and shall include the freeze cycle. Mixtures that fail to meet this minimum criteria may be resubmitted with and approved anti-strip agent meeting the same 70% criteria.

B. Asphalt Concrete Surface Course

1. The maximum permissible variation from the job-mix formula within the specification limits is as follows:
    a. Aggregate gradation within job mix tolerances
    b. Asphalt ± 0.4%*
    c. Temperature of mix ± 20°F.

    * This tolerance will be permitted only if the job mix parameter curves indicate that the corresponding design limits are not exceeded.
2. Produce Hot Plant Mix Asphalt Concrete Surface courses having the following characteristics as measured by AASHTO T245, ASTM D6726 & D6927 "Resistance to Plastic Flow of Bituminous Mixtures by Means of the Marshall Apparatus":
    a. Number of compaction blows, each end of specimen 50.
    b. Stability, minimum 1500.
    c. Flow 8 – 18.
    d. Air voids, percent 3-5.
    e. Percent voids in mineral aggregate (minimum)

All type B-modified asphaltic concrete surfacing shall meet the following Marshall Design criteria as determined by ASTM D1559.

a. Number of Compaction Blows, Each End of Specimen 75
b. Stability, Minimum 1500 lbs.
c. Flow 8 – 16
d. Air Voids, Percent 3 - 5
e. Percent Air Voids Filled with Bitumen 65-75

3. As an alternative to Marshall mix production, SuperPave Hot Plant Mix Asphalt Concrete Surface courses can be produced having the following characteristics as measured by AASHTO R 35 and M 323.

TABLE 3
SUPERPAVE GYRATORY COMPACTION EFFORT

20-Year Design ESALs" (in millions)	**Compaction Parameters**			**Typical Roadway Applications**
	$N_{initial}$	N_{design}	$N_{maximum}$	
< 0 .3	6	50	75	Applications include roadways with very light traffic volumes, such as local roads, county roads and city streets where truck traffic is prohibited or at a very minimal level. Traffic on these roadways would be considered local in nature, not regional, intrastate or interstate. Special-purpose road ways serving recreational sites or areas may also be applicable to this level.
0.3 to< 3	7	75	115	Applications include collector roads or access streets. Medium- trafficked city streets and the majority of county roadways may be applicable to this level.

a. Air voids, percent ..... 3-5.
b. Voids Filled with Asphalt 65-80
c. Dust to Effective Binder ratio 0.6-1.4
d. N_{Max} 98
e. N_{Min} 91.5
f. N_{Design} 95-97
g. Percent Voids in Mineral Aggregate ..... See Table 4.

TABLE 4
REQUIRED VOIDS IN MINERAL AGGREGATE (VMA)

Nominal particle size (table 2)	Voids in Mineral Aggregate, Min.

No 4 (4.75 mm) 3/8 – inch (9.5 mm) ½ - inch (12.5 mm) ¾ - inch (19.0 mm) 1 – inch (25.0 mm)	16 15 14 13 12
Nominal maximum particle size is one size larger than the first sieve to retain more than 10 percent.	

PART 3 - EXECUTION

3.1 CRUSHING:

A. Crushing Equipment

1. Fit crushing plant-screening equipment, when required, with blowers or other devices capable of removing excess and undesirable fines.

B. Screening Plants

1. Screening plants consist of a revolving trommel screen, shaker screen, vibrating screen, or other devices capable of removing oversize material, excess and undesirable fines.

C. Scales

1. Furnish scales, when required, satisfactory to the Engineer. Test and certify scales prior to their use on the project and as often thereafter as the Engineer may consider necessary to ensure their accuracy. Have on hand not less than ten, 50-pound weights for testing scales.
2. House the recording devices of the scales in a suitable manner. Place the scales in a location suitable to facilitate accurate weighing of loads. The scales shall be accurate to one-half of one percent at any weight. Alternate methods or devices for weighing may be acceptable, provided that these methods or devices produce the same degree of accuracy as required of platform scales.

3.2 MATERIAL HANDLING:

A. All work involved in clearing and stripping pits and quarries, including handling unsuitable material encountered, are performed with no additional compensation being allowed for this work. The pits as utilized shall immediately be opened so as to expose the vertical faces of the various strata of acceptable material and, unless otherwise directed, the material shall be secured in successive vertical cuts extending through all the exposed strata.

B. Provide, unless otherwise specified, material containing as large a proportion as possible of crushed aggregate. Combine the crushed material with the screened material to obtain a uniform product.

C. No material will be accepted which is loaded into hauling units in a segregated condition

or which does not meet the required grading. In case the material deposit contains sand or other material in excess of the specification gradation requirements, or of an unacceptable quality, such excess or undesirable material shall be removed and disposed of prior to crushing, or during screening operations, if crushing is not required.

D. Provide a storage bin of ample capacity to ensure uniform quality and delivery of material. Loading of trucks directly from the conveyor belt, from the crusher or screening plant will not be permitted.

3.3 STOCKPILES:

A. Grub and clean sites for aggregate stockpiles prior to storing aggregates. Assure the site is firm, smooth and well drained. Maintain a bed of aggregate suitable to avoid the inclusion of soil or foreign material.

B. Build up coarse aggregate stockpiles in tiers of not more than 4 feet (1.2 m) in thickness. Assure each tier is completely in place before the next tier is placed. Do not allow material to “cone” down over the next lower tier.

C. Dumping, casting or pushing over the sides of stockpiles will be prohibited, except in the case of fine aggregate stockpiles.

D. Space stockpiles of different gradations of aggregate far enough apart, or separated by suitable walls or partitions, to prevent the mixing of theaggregates.

E. Any method of stockpiling aggregate, which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate, will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has operated and failure of such samples to meet all grading requirements for the aggregate discontinuance of such stockpiling procedures.

F. Transfer the aggregate from the stockpiles in such a manner that uniform grading of the material is preserved.

3.4 CONVEYOR STOCKPILING:

A. Materials stockpiled by conveyors shall be deposited in a succession of merging-cone piles. Do not drop material over 12 feet (3.66 m) nor allow cones to exceed 12 feet (3.66 m) in height. Cones should be leveled to a thickness of approximately 4 feet (1.2 m) prior to starting another tier.

3.5 TRUCK STOCKPILING:

A. Materials stockpiled by trucks shall construct the stockpile in tiers approximately 4 feet (1.2 m) in thickness. Complete each tier before the next tier is started.

3.6 ASPHALT MIXING PLANTS:

A. Use mixing plants of either the weight batching type, the continuous flow mixing type, or drum dryer type. Use drum dryer mixers specifically designed and constructed for producing hot mix.

B. Equip all plants with approved conveyors, power units, aggregate handling equipment, aggregate screens and bins that are coordinated and operated to produce a uniform mixture within the specified job mix tolerances.

C. Use batch-type plants having a minimum batch production capacity of 2,000 pounds (900 kg). Use continuous flow or drum dryer plants having a minimum production capacity of 60 tons per hour (27 kg per hour). These capacity requirements may be modified if specified in the Contract Documents.

D. Stop production and remove from the project mixing plants that fail to continuously produce a mixture meeting requirements as specified.

3.7 INSPECTION AND CONTROL OF ASPHALT MIXING PLANT:

A. For verification of weights and measures, character of materials and determination of temperatures used in the preparation of the paving mixes, the Engineer or Engineer's authorized representative will, at all times, have access to all portions of the mixing plant, aggregate plant, storage yards and other facilities for producing and processing the materials for the work. All sampling and testing of processed and unprocessed material is performed in accordance with the provisions of the Contract Documents.

3.8 MIX DESIGN:

A. The Owner's acceptance testing agency may make gradation analyses of the completed mix to assure that the materials being produced and used are within the tolerances of the mix design and the specifications of the mix being used.

3.9 SAMPLING AND TESTING FOR ACCEPTANCE:

A. Sampling and testing of aggregates or other constituent materials may be performed by the Owner's testing agency at a frequency determined by the Owner or the Owner's representative. Field control is performed under AASHTO T245, ASTM D6926 & D6927, and ASTM D6925. Field density testing is by core testing for acceptance purposes. Densities to conform to Section 2510,3.28. Gradations to be within the job mix gradation limits. Oil content to be within 0.4% of the Mix Design.

B. Samples will be used to verify compliance with the requirements set forth in this Section. If there is a dispute, a third party testing firm may be retained by the contractor for additional retesting.

3.10 WEATHER LIMITATIONS:

A. When the moisture in the stockpiled aggregate or the dryer adversely effects the quality of mix production, normal plant operations, or when pools of water are observed on the base, mixing and placing of hot-mix asphalt is prohibited.

B. Do not place asphalt hot-mix surface course mixture when the air temperature is less than 40° F (4° C) and rising. Do not place asphalt hot-mix base course mixtures of compacted lifts 4 inches (10 cm) or more when the air temperature is less than 30° F (-1° C) and rising. Do not place asphalt upon a surface which is frozen or that has a temperature of less than 32° F (0 ° C). Do not place paving during rainfall or in standing water.

3.11 SURFACE PREPARATION:

A. Assure the area to be paved is true to line and grade and has a dry and properly prepared surface before starting paving operations. Assure the surface is free from all loose screenings and other loose or foreign material.

3.12 NEW WORK:

A. For new work, meet the surface preparation requirements in Sections 02230, 02234 or 02235 of these specifications. Prime prepared soil or aggregate bases if indicated as a bid item in the Contract Documents.

B. Before paving, proof-roll the base with equipment having at least one 18 kip single axle load or equivalent. Excavate and replace areas that yield or crack under these wheel loads as directed. This does not replace or relax the base or subgrade compaction requirements.

C. Paint the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in contact with asphalt mixes with a thin coating of asphaltic material to provide a water-tight joint.

3.13 OVERLAYS OVER EXISTING PAVEMENTS AND OLD BASE:

A. Where a base is rough or uneven, place a leveling course using a paver or motor grader and compact before the placing of subsequent courses.

B. When specified, place construction fabric to control reflective cracking, as detailed, meeting Section 02110.3.4 Pavement Overlay Applications.

C. When a leveling course is not specified, patch or correct all depressions and other irregularities, subject to the Engineer's approval, before starting other paving operations. Remove all rich and unsuitable patches, excess crack or joint filler, and all surplus bitumen from the area to be paved. Do not blot excessive deposits of asphalt with sand or stone.

D. Apply a tack coat when the surface to be paved is an existing Portland Cement concrete, brick or asphalt pavement. When a tack coat is required, use the asphalt material indicated, at the rate specified in Section 02502.

E. Coat the surfaces of curbs and gutters, vertical faces of existing pavements and all structures in actual contact with asphalt mixes with a thin, complete coating of asphalt material to provide a water-tight joint.

3.14 PATCHING:

A. Weather Limitations
   1. Follow procedures set out in section 3.10.

B. Surface Preparations
   1. Assure the area to be paved is true to line and grade, is dry and properly prepared surface before starting paving operations. Clean the surface of all loose screenings and other loose or foreign material.
   2. Before paving, proof roll the base. Areas that yield excessively or crack under such wheel loads will be excavated and replaced, to correct yielding and cracking problems. This does not replace the base or subgrade compaction requirements. Cut the edge of existing pavements against which additional pavement is to be placed straight and vertical.
   3. Minimum standards for patching new or existing pavement includethe following:
      a. Neatly cut all asphalt edges using an asphalt saw.
      b. Cut asphalt edges to form as regular a patch shape as practical and should, in general, approximate a rectangle.
      c. Cut asphalt edges at least 30 cm (12 inches) wider than the trench width on each side of trench excavations; and, in general, be cut parallel to the street centerline for mainline construction and perpendicular to the street centerline for service lateral construction.
      d. Skin patches will not generally be considered a satisfactory method of repair.
      e. Tack coat all existing edges prior to placing new asphalt concrete.
      f. If hot plant mix asphalt is not available, temporarily patch the pavement using a 3,000 psi (minimum) concrete (M-3000 or C-3000), with a minimum thickness of 3 inches. Remove the temporary patches and replace with hot mix asphalt when it becomes available.
      g. Thickness of the pavement patch will equal that of the existing pavement, unless otherwise approved.
   4. Remove and replace asphalt surface widths of less than 3 feet (90 cm).

C. Compaction
   1. Compact to a density equal to or greater than 92% of Maximum Theoretical Density (RICE) as determined by ASTM D2041.

3.15 TRANSPORTATION OF MIX:

A. Transport the mix in vehicles cleaned of all foreign material which may affect the mix. The truck beds must be painted, or sprayed with a lime-water, soap or detergent solution at least once a day or as often as required. After this operation elevate the truck bed and thoroughly drain it, with no excess solution being permitted. Dispatch the vehicles so that all material delivered is placed in daylight, unless the Engineer approves artificial light.

Deliver material to the paver at a uniform rate and in an amount well within the capacity of the paving and compacting equipment.

3.16 SPREADING AND FINISHING:

A. Spread and finish meeting the following requirements
   1. The minimum lift thickness shall be no less than three times the Nominal Maximum Aggregate Size for gradations above the Maximum Density Line, and no less than four times the Nominal Maximum Aggregate Size for gradations below the Maximum Density Line.
   2. The maximum lift thickness is 3 inches for surface courses and 4 inches for base courses.

3.17 MECHANICAL PAVERS:

A. Spread and strike off the base and surface courses with a mechanical paving machine. Operate the paving machine so that material does not accumulate and remain along the sides of the receiving hopper.

B. Do not use equipment which leaves tracks or indented areas, which cannot be corrected in normal operation, produces flushing or other permanent blemishes, or fails to produce a satisfactory surface.

C. Construct longitudinal joints and edges to true line markings. Establish lines for the paver to follow in placing individual lanes parallel to the centerline of the proposed roadway. Position and operate the paver to follow closely the established lines.

D. When using pavers in echelon, assure the first paver follows the marks or lines with the second paver following the edge of the material placed by the firstpaver. To assure a hot joint and obtain proper compaction, assure the pavers work as close together as possible not exceeding 100 feet (30 m) apart. In backing trucks against the paver, take care not to jar the paver out of its proper alignment.

E. As soon as the first load of material has been spread, check the texture of the unrolled surface to determine its uniformity. Segregation of materials is not permitted. If segregation occurs, suspend spreading operation until the cause is determined and corrected.

F. Offset transverse joints in succeeding courses at least 2 feet (0.6 m). Offset longitudinal joints at least 6 inches (15 cm).

G. Correct all irregularities in alignment left by the paver by trimming directly behind the machine. Immediately after trimming, thoroughly compact the edges of the course by tamping. Avoid distorting the pavement during thisoperation.

H. Assure edges against which additional pavement is to be placed is straight and approximately vertical. Use a lute or covered rake immediately behind thepaver, when

required, to obtain a true line and vertical edge. Correct all irregularities in the surface of the pavement course directly behind the paver. Remove excess material forming high spots by a shovel or lute. Fill low areas with hot mix and smooth it with the back of a shovel being pulled over the surface. Fanning of material over such areas is not permitted.

3.18 MOTOR GRADER:

A. When motor graders are used for the spreading of leveling courses, place the material on the roadbed so that the proper amount of material is available. Spread the mix to the required thickness, line and grade, with a uniform surface texture, while at a workable temperature.

3.19 HAND SPREADING:

A. In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Engineer. Wood or steel forms, approved by the Engineer, rigidly supported to assure correct grade and cross section, may be used. In such instances, measuring blocks and intermediate strips must be used to obtain the required cross-section. Perform hand placing carefully. Uniformly distribute the material to avoid segregation of the coarse and fine aggregate. Broadcasting of material is not permitted. During the spreading operation, loosen and uniformly distribute all material using lutes or covered rakes. Reject material that has formed into lumps and does not break down readily. Following placing and before rolling, check the surface with templates and straightedges and correct all irregularities.

B. Maintain on the project heating equipment for keeping hand tools free from asphalt. Exercise caution to prevent heating that may burn the material. Assure the temperature of the tools when used is not greater than the temperature of the mix being placed. Use heat only to clean hand tools; petroleum oils or solvents are not permitted.

3.20 COMPACTION:

A. Furnish the number of rollers necessary to provide the specified pavement density. During rolling, keep the roller wheels moist to avoid picking up the material.

B. After the longitudinal joints and edges have been compacted, start rolling longitudinally at the sides and progress toward the center of the pavement. For transverse graded streets, begin rolling on the low side and progress to the high side, overlapping passes by at least one-half the width of rollers and uniformly lapping each preceding pass. Operate the rollers at a slow, uniform speed with the drive roll or wheel nearest the paver. Do not exceed 3 miles per hours (4.8 km per hour).

C. Do not quickly change the line of rolling reversing direction suddenly. If rolling displaces the material, re-work the area using lutes or shovels and restore to the original grade of the loose material before re-rolling. Do not permit heavy equipment or rollers to stand on the finished surface before it has been compacted and has thoroughly cooled.

D. When paving in single width, roll the first lane placed as follows:
   1. Transverse joints
   2. Outside edge
   3. Initial or breakdown rolling, beginning on the low side and progressing toward the high side
   4. Second rolling, same procedure as 3
   5. Finish rolling

E. When paving in echelon, or abutting a previously placed lane, perform the longitudinal joint rolling the same as transverse joint rolling.

F. When paving in echelon, leave 2 or 3 inches (5 to 7.5 cm) of the edge unrolled, which the second paver can match unrolled. Then the joint between the lanes can be rolled together. Do not leave edges exposed more than 15 minutes without being rolled.

G. In laying a surface mix adjacent to any finished area, place it high enough so that, when compacted, the finished surface is true and uniform.

H. On slight grades, check gutters with a straightedge and test with running water to assure drainage to the planned outlet.

I. The average density shall be equal to or greater than 93% of the maximum density as determined by ASTM D2041 and no individual sample shall be less than 92% of maximum density.

3.21 TRANSVERSE JOINTS:

A. Construct and compact transverse joints to provide a smooth riding surface. Joints will be straight edged and string lined to assure smoothness and true alignment.

B. Joint formed with bulkheads to provide a straight line and vertical face will be checked with a straightedge before fresh material is placed against it to complete the joint. If bulkheads are not used to form the joint and the roller is permitted to roll over the edge of the new material, locate the joint line in back of the rounded edge the distance required to provide a true surface and cross-section. If a joint has been distorted by traffic or by other causes, trim it to line. Paint the joint face with a thin coating of asphalt before the fresh material is placed against it.

C. Place the material against the joints vertical face with the paving machine positioned so that the material overlaps the edge of the joint 1 to 2 inches (2.5 to 5 cm). Maintain a uniform depth of the overlapped material. Remove and dispose of the coarse aggregate in the overlapped material that dislodged during raking.

D. Position rollers on the previously compacted material transversely so that no more than 6 inches (15 cm) of the rolling wheel rides on the edge of the joint. Operate the roller to pinch and press the mix into place at the transverse joint. Continue rolling along this line, shifting position gradually across the joint, in 6-to 8-inch (15 to 20 cm) increments, until the joint has been rolled by entire width of the roller wheel.

E. Keep the number of transverse joints to a minimum. When paving single width and maintaining traffic, pave one lane no farther than one block. Complete all lanes to the same station at the end of each paving day. When paving in echelon, bring the lanes up even as is practical.

3.22 LONGITUDINAL JOINTS:

A. Roll longitudinal joints directly behind the paving operation. Assure the first lane placed is true to line and grade and has a vertical face. Place the material in the lane being paved up firmly against the face of the previously placed lane. Position the paver during spreading to assure the material overlaps the edge of the lane previously placed by 1 inch to 2 inches (25 to 50 mm). Uniformly maintain the width and depth of the overlapped material at all times. Keep the paver aligned with the line or markings placed along the joint for alignment purposes. Before rolling, remove and dispose of the coarse aggregate in the material overlapping the joint.

B. Shift rollers onto the previously placed lane so that not more than 6 inches (15 cm) of the roller wheel rides on the edge of the fine material left by brooming. Operate the rollers to compact the fines gradually across the joint. Continue rolling until a compacted, neat joint is obtained. When the abutting lane is not placed in the same day, paint the joint with a very thin coating of asphalt before placing the abutting lane. If the joint is distorted during the day's work bytraffic or by other causes, carefully trim the edge of the lane to a neat line.

3.23 EDGES:

A. Roll the pavement edges concurrently with or immediately after rolling the longitudinal joint.

B. Exercise care in consolidating the course along the entire length of the edges. In rolling pavement edges, extend the roller wheels 2 to 4 inches (5 to 10 cm) beyond the pavement edge.

3.24 BREAKDOWN ROLLING:

A. Immediately begin breakdown rolling following the rolling of the longitudinal joint and edges. Operate rollers as close to the paver as required to obtain density without causing undue displacement. Operate the breakdown roller with the drive roll or wheel nearest the finishing machine. The Engineer may make exceptions when working on steep slopes or super-elevated curves.

3.25 SECOND ROLLING:

A. Assure the second rolling follows the breakdown rolling as close as possible while the paving mix is still at a temperature that will provide the specified density.

3.26 FINISH ROLLING:

A. Perform the finish rolling while the material is still warm enough to remove roller marks. If necessary, the Engineer may require using pneumatic-tired rollers. Complete finish rolling the same day the mixture is placed.

B. In places inaccessible to standard rollers, perform compaction using trench rollers or others to meet the specified compaction requirements. Operate the trench roller as directed until the course is compacted. Hand, manual or mechanical tamping, may be used in such areas if it is proved to the Engineer that the operation will provide the specified density.

3.27 SHOULDERS:

A. Where paved shoulders or curbs are not specified, do not place the shoulder material against the pavement edges until the surface course rolling is completed. Take care to prevent distortion of the pavement edge from specified line and grade. When shoulders are paved (except in conjunction with the traveled way paving), cold joint construction procedure is required to assure a tight bond at the joint.

B. When the rolling of the surface course has been completed and the edges have been thoroughly compacted, immediately place shoulder material against the edges and roll it.

3.28 DENSITY AND SURFACE REQUIREMENTS:

A. The average mat density shall be equal to or greater than 93% of the maximum density as determined by ASTM D2041 for single lift applications. For two lift applications, the first lift on base course shall be a minimum of 92% of the maximum density and the second lift shall be a minimum of 93% of the maximum density. In both cases individual sample shall be no less than 92% of maximum (Rice's) density, prepared as specified in Part 2-Products in this section and made from plant mix meeting the job-mix formula. Verification of maximum density as determined by ASTM D2041 from plant produced material during production is recommended.

B. The longitudinal joints shall be compacted to a target density of 91 percent of the theoretical maximum specific gravity as determined by ASTM D2041 and no individual sample shall be less than 89 percent of maximum (Rice's) density. The theoretical maximum specific gravity used to determine the joint density will be the average of the daily theoretical maximum specific gravities for the material that was placed on either side of the joint.

C. Produce a final surface that is uniform in texture and meets the line and grade specified. Before final acceptance of the project or during the progress of the work, the Engineer will determine the thickness of all courses. Repair or replace all unsatisfactory work.

D. Assure density and thickness meets the plans and specifications. During compaction, preliminary tests to aid in controlling the thickness, may be performed by inserting a flat blade, correctly graduated, through the materialto the top of the previously placed base, or by other approved methods.

E. In checking compacted depth, the cutting of the test holes, refilling with acceptable materials and proper compaction may be performed by the Owner's testing agency.

F. For testing the surface on all courses, a 10-foot (3 m) straightedge will be used with the centerline of the straightedge placed parallel to the roadway centerline.

G. Any variations that exceed 5/16-inch (0.8 cm) in 10 feet (3 m) for base course and 1/4-inch (0.64 cm) in 10 feet (3 m) for surface course must be corrected. Correct irregularities that may develop before the completion of rolling by loosening the surface mix and removing or adding materials as is required. If any irregularities or defects remain after the final compaction, remove the surface course and place and compact new material to a true and even surface. All minor surface projections, joints and minor honeycombed surfaces must be rolled smooth to grade, as directed

H. Remove and replace areas of new pavement requiring patching as directed. Patching material will be tested for meeting specifications. The cost of testing is at Contractor expense.

3.29 PAVEMENT AND MATERIAL TESTING REQUIREMENTS:

A. Contractor will produce their own core samples of the asphalt surface courses under the supervision of the Owner's testing agent and give completed cores to the Owner's testing agency to check in place density and compacted depth. The cores are 4-inch (10 cm) diameter. Materials and acceptance tests will be made by the Owner's testing agency to determine the Contractor's compliance with the specifications.

B. Materials failing to meet the tests specified may be retested if approved and as directed by the Engineer. The Contractor shall pay the costs of any required re- testing for acceptance purposes. Re-testing will be performed by the Owner's testing agency unless otherwise approved by the owner. If there is a dispute, a third party testing firm may be retained by the contractor for additional retesting for the Engineer's review and consideration.

C. The costs of the following tests are at Contractor expense:
   1. Initial aggregate quality tests
   2. Job-mix formula
   3. Any tests the Contractor requires to control his crushing, screening or other construction operations
   4. Retesting of failing tests as provided above

D. Correct all pavement composition, field density, or thickness, deficiencies at Contractor expense.

E. The field density and thickness of the pavement is determined by measuring the cores tested. The actual thickness must be no less than 1/4-inch (6.5 mm) from the specified thickness.

F. When the measurement of any core is less than the plan thickness by more than the allowable deviation, the actual thickness of the pavement in this area may be determined by taking additional cores at intervals parallel to the centerline ineach direction from the affected location. Continue in each direction until a core is found which is not deficient by more than the allowable deviation. The Engineer will evaluate areas found deficient in thickness and determine which areas warrant removal. Remove and replace the areas with asphaltic concrete of the thickness shown on the plans. Additional coring is considered as re-testing of failing areas.

END OF SECTION

SECTION 02515

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is constructing Portland Cement concrete pavement to the lines, grades, thicknesses, and cross sections on the plans on a prepared subgrade or base course.

1.2 REFERENCES

ASTM C-143	Slump of Hydraulic Cement Concrete
ASTM C-231	Air Content of Freshly Mixed Concrete
ASTM C-138	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C-39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C-78	Flexural Strength of Concrete
ASTM C-150	Standard Specification for Portland Cement
ASTM C-595	Standard Specification for Blended Hydraulic Cements
ASTM C-157	Standard Performance Specification for Hydraulic Cement
ASTM C-33	Standard Specification for Concrete Aggregates
ASTM C-94	Standard Specification for Ready-Mixed Concrete
AASHTO M 85	Standard Specification for Portland Cement
AASHTO M 183	Standard Specification for Structural Steel
AASHTO M 157	Standard Specification for Ready-Mixed Concrete
AASHTO M 213	Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO M 182	Standard Specification for Sheet Materials for Curing Concrete
AASHTO M 148	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish materials meeting the following, section requirements:

1. Portland Cement Section 3310
   a. Use Portland Cement for paving meeting AASHTO M 85, ASTM C150 Types I, II, III and V or ASTM C-595 Type IP or ASTM C-1157 Types GU, MS, HE, and HS. The Engineer will specify the type of cement to be used.
2. Air Entraining Agents Section 3310
3. Admixtures Section 3310
4. Water Section 3310

5. Fine Aggregate for Concrete
    a. Use fine aggregate for concrete meeting ASTM C33.
6. Coarse Aggregate for Concrete
    a. Use coarse aggregate for concrete meeting ASTM C33.
7. Reinforcing Steel
    a. Use reinforcing steel meeting Section 03210 and the following.
    b. Dowels
        1) Use dowel bars for Rigid Pavement Expansion Joints or Devices meeting AASHTO M1 83 (ASTM A36). Assure dowel bars are plain and free from burring or other deformations that prevent slippage in the concrete. Paint one-half the bar length with one coat of zinc or tar paint.
    c. Sleeves
        1) Use metal sleeves for dowel bars of standard manufacture that cover 2-in mm), plus or minus 1/4-inch (6-5 mm), of the dowel, having one closed end and internal stop that holds the dowel bar at least 1-inch (25 mm) from the end. Avoid collapsing the sleeve during construction.

B. Joint Fillers and Sealers
1. Furnish a one-piece joint filler sized the full depth and width of the joint. If a multiple pieced joint filler is approved, fasten the abutting ends following the filler manufacturer's recommendations.
2. Use pourable joint sealer meeting ASTM D3406.
3. Use two-component polyurethane or polysulfide-base sealant meeting A.N.S.I A 116.1-1960 flow and strength requirements where specified.
4. Use either Class A (self-leveling) or Class B (non-sag) sealant for horizontal joints. Use Class B sealant for sloped or vertical joints.
5. Use preformed joint filler meeting, AASHTO M213 requirements, punched to receive the dowels shown on the plans.
6. Use preformed compression joints manufactured to the dimensions specified on the plans, from materials meeting ASTM D 2628.
7. Furnish a certification for each shipment of joints indicating that the material has been sampled, tested, and inspected under ASTM D 2628. Assure each certification furnished is signed by a manufacturer's authorized agent or independent testing agency.
8. If recommended by the manufacturer, use a manufacturer approved lubricant-adhesive to provide lubrication and bond for the joint.

C. Curing and Protective Coating Materials
1. Furnish materials meeting, the following requirements:

AASHTO M182 (Class 3)	Burlap Cloth made from Jute or Kenaf
AASHTO M171 (ASTM C171)	Sheet Materials for Curing Concrete
AASHTO M148	Liquid Membrane-Forming Compounds for Curing Concrete

D. Proportioning

1. Have a qualified independent testing laboratory, approved by the Engineer, determine the mix design to meet flexural or compressive strength of the pavement as specified in the Contract documents. Proportion the concrete mix under Section 03310.2.3 and have a maximum 4" (102 mm) slump and minimum 1.5” (38.5 mm) slump (using slip form method).

PART 3 - EXECUTION

3.1 GENERAL

A. Obtain the Engineer's approval of equipment and tools used for handling, materials and performing all parts of the work. Approval applies to design, capacity, and mechanical conditions. Assure the equipment is on site ahead of the start of construction operations for the Engineer's examination.

3.2 BATCHING PLANT AND EQUIPMENT

A. General

1. The batching plant includes bins, weighing hoppers and scales for the fine aggregate and each coarse aggregate size. Furnish a separate scale, bin, and hopper for cement if cement is used in bulk. Assure the weighing hopper is properly sealed and vented to prevent dust during operation.

B. Bins And Hoppers

1. Provide bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate in the batching plant.

C. Scales

1. Use either beam type or springless-dial type scales for weighing aggregates and cement. Assure the scale is accurate to within 0.5% throughout the range of use. When beam-type scales are used, equip the scale with a "tell-tale" dial or other device for indicating that the required load in the weighing hopper is being approached. The device on weighing beams must clearly indicate critical position. Assure poises are designed to be secured in any position and to prevent inadvertent change. Assure the weigh beam and "tell-tale" device are in full view of the operator as the hopper is charged and operator has convenient access to all controls.
2. Have certified scales. Have on hand not less than ten, 50-pound (22.7 kg) weights for frequent testing of all scales.
3. Batching plants may be equipped to proportion aggregates and bulk cement using automatic weighing devices of an approved type.
4. Obtain the Engineer's approval for any deviations from the above stated batch plant and equipment requirements before concrete manufacture.

3.3 STOCKPILED AGGREGATE

A. This work is storing aggregate material for use on the project at the specified locations.

B. Materials

1. Assure the aggregates meet the applicable requirements of ASTM C-33; AGGREGATES, for the type of material required.

C. Construction

1. Clear and grub the stockpile site. Assure the site is firm, smooth and well drained. Place an aggregate bed to prevent contamination of thestockpiles.
2. Build the stockpiles in maximum 4 feet (1.22 m) layers, with the preceding layer completely in place before starting the next layer. Deposit the material to prevent coning, excluding fine aggregate approximately 90% finer than a No.4 sieve.
3. Do not dump, cast, or push material over stockpile sides excluding fine aggregate specified above.
4. Space or separate using walls, stockpiles of different aggregate types or sizes to prevent intermingling of the aggregates.
5. Submit and obtain Engineer's approval of operational plan for stockpiling any material obtained by wet pit or dredging operations.
6. The Engineer may take random samples from stockpile areas where equipment has been operated. Stop operating equipment over stockpiles if tests show degradation is occurring
7. Remove and transport stockpiled material to prevent segregation.

3.4 MIXING

A. General

1. Mix concrete on site, at a central plant, or wholly or partially in truck mixers. Assure each mixer has a manufacturer's plate showing the drum capacity of mixed concrete and rotation speed of the mixing drum or blades attached in a prominent place.

B. On Site Mixers

1. Mix concrete in an approved mixer able to combine the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging and distributing the mixture without segregation on the prepared grade. Assure the mixer is equipped with an approved timing device that automatically locks the discharge lever when the drum has been charged and releases at the end of the mixing period.
2. Follow the manufacturer's recommendations for cleaning the mixer. Repair or replace the pickup and throw-over blades in the drum or drums when they are worn down 1 inch (25.4 mm) or more.
3. Have available at the job site a copy of the manufacturer's design, showing blade dimensions and arrangement, and original blade height and depth; or place permanent marks on blades 1 inch (25.4 mm) from the new blade end. Drilled holes of 1/4-inch (6.4 mm) diameter near each end and at the mid-point of each blade are acceptable markings.

C. Truck Mixers And Truck Agitators

1. Assure truck mixers for mixing and hauling concrete, and truck agitators used for hauling central-mixed concrete meet Section 03310.3.3 MIXING requirements.

D. Non-Agitator Trucks

1. Assure bodies of non-agitating, hauling equipment for concrete are smooth, mortar tight metal containers, capable of discharging the concrete at a controlled rate without segregation. Discharge of concrete should be from the bottom of the container. If the equipment body is tilted to discharge concrete, assure baffles slow down the load.

3.5 FINISHING EQUIPMENT.

A. Finishing Machine

1. Use a suitable finishing machine.

B. Vibrators

1. Vibrators may be either the surface pan type or the internal type with immersed tube or multiple spuds. Vibrators may be attached to the spreader, the finishing machine, or mounted on a separate carriage. Do not permit vibrators to come in contact with joints, load transfer devices, subgrade, or side forms. Maintain the surface vibrator frequency at 3,500 or more impulses per minute. Maintain frequency of internal types at 5,000 impulses per minute or more for tube vibrators. Maintain 7,000 impulses per minute or more for spud vibrators.
2. Maintain a minimum frequency of 3,500 impulses per minute when spud-type internal vibrators, either hand-operated or attached to spreaders or finishing, machines, are used adjacent to forms.

C. Concrete Saw

1. When sawing concrete joints, use sawing equipment capable of producing the specified cut producing a straight line. Provide artificial lighting for night work to produce work of daytime quality. Assure this equipment is on the job both before and during concrete placement.

D. Forms

1. Use straight side metal forms having:
   a. a minimum 7/32-inch (5.6 mm) thickness
   b. a minimum 10 feet (3.05 m) length.
   c. a depth at least equal to the prescribed edge thickness of the concrete
   d. no horizontal joints
   e. a base width equal to at least the depth of the forms.
2. Use flexible or curved forms for curves of 100-foot (30.5 m) radius or less. Obtain Engineer approval before using flexible or curved forms. Provide form anchors capable of withstanding, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Assure flange braces extend outward on the base at least two- thirds the height of the form.
3. Do not use forms with battered top surfaces, bent, twisted, or broken forms in the work.

4. Do not use repaired forms until inspected and approved. Use built-up forms only where the total pavement area of any specified thickness on the project is less than 2,000 square yards (1672 m^2). Assure the top form face does not vary from a true plane more than 1/8-inch in 10 feet (3.2 mm in 3.05 m), and the upstanding leg does not vary more than 1/4-inch (6.35 mm). Assure the forms are capable of locking the ends of abutting form sections together tightly providing a secure setting.

3.6 GRADE PREPARATION

A. Once the base and/or subgrade is graded and compacted to the specified requirements, trim the grade to specified elevation.

B. Bring the subgrade or base course to the specified cross section when side forms are set to grade.

C. Fill and compact low areas with approved material or fill with concrete integral with the pavement.

D. Maintain the finished grade until the pavement is placed.

E. Keep the subgrade or base course uniformly moist until the concrete is placed. Do not over wet creating mud or water to pond.

3.7 SETTING FORMS

A. Base Support

1. Prepare the foundation under the forms so that when the form is set, it is in contact for its whole length at the specified grade. Fill and compact to grade with granular material, any grade at the form line found to be below established grade. Correct out of specification grade lines by tamping, or by cutting, as required.

B. Form Setting

1. Set forms in advance of concrete placing to prevent placing delays. Once forms are set to correct grade, compact the grade on the inside and outside edges of the form base. Stake forms with at least three pins for each 10- foot (3.05 m) section. Pin each side of every joint. Assure form sections are tightly locked, free from play or movement in any direction. Assure the forms do not deviate from true line in excess of 1/4-inch (6.35 mm) at any point. Correct all form settlement or springing, under the finishing, machine. Clean and oil forms before placing concrete.

C. Grade and Alignment

1. Check and correct all form alignment and grade elevation immediately before placing concrete.

D. Curbs and Gutters as Forms

1. Edges of previously placed concrete gutter section may be used as a form.

3.8 HANDLING, MEASURING, AND BATCHING MATERIALS

A. Set up the batch plant site, layout, equipment, and transporting material to assure an uninterrupted supply of material to the work. Stockpile aggregates from different sources and of different gradations to prevent co-mingling.

B. Handle aggregates from stockpiles or other sources to the batching plant to prevent segregation. Aggregates that are segregated or mixed with earth or foreign material cannot be used in the work. Stockpile or bin all aggregates produced or handled by hydraulic methods and washed aggregates for at least 12 hours before batching. Rail shipment exceeding 12 hours will be accepted as adequate binning only if the car bodies permit free drainage.

C. Separately weigh the fine and coarse aggregate into hoppers in the amounts specified in the mix. Measure cement by the sack or by weight. Use separate scales and hoppers for weighing the cement, with a device that indicates the complete cement batch discharge into the batch box or container. One sack of bulk cement is 94 pounds (42.64 kg).

D. Measure all admixtures into the mixer within ± 3% accuracy.

3.9 MIXING CONCRETE

A. Mix the concrete at the work site using a central-mix plant or truck mixers.

B. Mixing time is measured from the time all materials, except water, are in the drum. Meet AASHTO M 157 and or ASTM C-94 requirements for ready-mix concrete mixing and delivery.

C. Operate the mixer at the manufacturer's recommended drum speed on the name plate. Remove and dispose of outside the work at Contractor expense, any concrete mixed less than the specified time. Do not exceed the mixer’s nominal capacity, in cubic feet, as shown on the manufacturer's standard rating plate on the mixer. An overload up to 10% above the mixer's nominal capacity may be permitted if concrete tests for strength, segregation, and uniform consistency are satisfactory, and if no concrete spill occurs.

D. Re-tempering concrete by adding water or by other means is not permitted. When concrete is delivered in transit mixers or agitators, additional water may be added to the batch materials and additional mixing time to increase the slump to meet the specified requirements, if permitted by the Engineer, providing the following conditions are met:
   1. maximum allowable water-cement ratio is not exceeded;
   2. maximum allowable slump is not exceeded;
   3. maximum allowable mixing and agitating, time (or drum revolutions) is not exceeded;
   4. concrete is remixed for at least one-half the minimum required mixing time or number of revolutions.

E. Concrete not meeting these requirements will be rejected. Obtain the Engineer's approval for admixtures that increase the workability or accelerate the set.

3.10 LIMITATIONS OF MIXING

A. Do not mix, place, or finish concrete when light conditions prevent meeting the contract requirements. Obtain the Engineer's approval of artificial lighting.

B. Discontinue concrete mix operations when the ambient temperature is 40° F (4°C) and falling. Do not resume concrete work until the ambient temperature is 35°F (2°C) and rising.

C. When concreting work is approved during cold weather, the aggregates may be heated by either steam or dry heat before being placed in the mixer. Assure the material is uniformly heated without injuring it.

D. Maintain the mixed concrete temperature between 50°F (10°C) and 90°F (32°C) during placement in the forms

E. The Engineer may direct heating the water and aggregates if the air temperature is 35°F (2°C) or less at the time of placing, concrete. Heat water and aggregate to between 70°F (21°C) and 150°F (66°C). Do not place concrete on frozen subgrade or use frozen aggregates in the concrete.

3.11 PLACING CONCRETE

A. Each placing/finishing crew must have at least one ACI Flatwork Finisher Technician level or above on site at all times.

B. Place the concrete on the grade, handling it as little as possible. Assure truck mixers, truck agitators, or non-agitating hauling equipment are capable of concrete discharge without segregating the materials. Unload the concrete into an approved spreader and spread on the grade to prevent segregation. Continuously place concrete between transverse joints without the use of intermediate bulkheads. Perform necessary hand spreading, using only shovels. Do not permit workmen to walk in freshly mixed concrete with boots or shoes coated with earth or foreign substances.

C. Where concrete is to be placed adjoining a previously constructed lane of pavement and mechanical equipment will be operated upon the existing lane of pavement, assure that lane has attained 80% of design strength. If only finishing equipment is carried on the existing lane, paving in the adjoining lanes may be permitted.

D. Thoroughly consolidate concrete against and along the faces of all forms and along the full length and on both sides of all joint assemblies using vibrators. Do not permit vibrators to contact joint assemblies, the grade, or a side form. Do not operate vibrators more than 15 seconds in any one location.

E. Deposit concrete as close to expansion and contraction joints as possible without disturbing them. Do not dump from the discharge bucket or hopper onto a joint assembly unless the hopper is centered on the joint assembly.

F. Immediately remove any concrete spills from completed slab surfaces, using methods approved by the Engineer.

3.12 TESTING

A. Use ACI Grade I or equivalent certified field-testing technicians for all concrete tests.
   1. Furnish the concrete required for testing as per section 01400.
   2. Sample, make specimens, and test concrete under the following:

AASHTO T119 (ASTM C143)	Slump
AASHTO T152 (ASTM C231)	Air Content (Gravel or Stone)
ASTM C-173	Air Content (slag or highly porous Aggr.)
AASHTO T121 (ASTM C138)	Cement Content & Unit Weight
AASHTO T22 (ASTM C39)	Strength (Compressive)
AASHTO T97 (ASTM C78)	Strength (flexural, third point method)
AASHTO T23 (ASTM C-31)	Making and Curing Test Specimens in the Field

   3. Cure beams in the field by the method specified for the pavement.

3.13 STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

A. Place the concrete, strike it off, consolidate, and finish it to the planned cross section and elevation.

B. When placing reinforced concrete pavement in two layers, strike-off the first layer to plan depth and place the reinforcing full length its final position without further manipulation. Place the second concrete layer, strike it off, and screed. Remove and replace any bottom layer concrete that has been in place more than 30 minutes without being covered with the top layer at Contractor expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed by mechanical or vibratory means in plastic concrete, after the concrete is spread.

C. Assure reinforcing steel is free from dirt, oil, paint, grease, mill scale, and loose or thick rust.

3.14 JOINTS

A. Construct joints as specified in the contract documents.

B. Longitudinal Joint
   1. Place deformed steel tie bars of specified length, size, spacing, and material as shown on the plans. Place using approved mechanical equipment or rigidly secured by chairs or other approved supports. Assure tie bars are not painted, coated with asphalt or other material, or enclosed in tubes or sleeves. When adjacent lanes of pavement are constructed separately, use steel side forms that will form a keyway along the construction joint. Tie bars may be bent at right angles against the form of the first lane constructed and straightened into final

position before the concrete of the adjacent lane is placed, or instead of bent tie bars, approved two-piece connectors may be used.

2. Longitudinal formed joints are a groove, or cleft, extending downward from, and normal to, the pavement surface. Make these joints using an approved mechanically or manually operated device to the plan dimensions and line while the concrete is in a plastic state. Seal the groove, or cleft, with either a pre-molded strip or poured material as required.
3. Place the longitudinal sawed joints so that their ends contact with any transverse joints.
4. Cut longitudinal sawed joints using approved concrete saws to the plan depth, width, and line. Use guide lines or devices to assure cutting the longitudinal joint as shown on the plans. Saw the longitudinal joint before the cure period ends or shortly thereafter and before any equipment or vehicles are permitted on the pavement. Thoroughly clean the sawed area using both water and compressed air. Immediately remove from the joint all concrete pieces, aggregate and residue left from the sawing. Assure that the cut depth is uniform. Start sealing as soon as the joint is dry. Form longitudinal joints by placing a continuous strip of plastic or other inert material. Assure the joint insert material is strong, non-stretchable, 3 mil thick, 2-inch (50.8 mm) wide, incapable of bonding with the concrete and will form a weakened plane 2-inch (50.8 mm) minimum depth.
5. Insert the joint material using a mechanical device that places the material in a continuous strip, except where intervening structures break the continuity of paving. Splices in the joint material are permitted if they can maintain the continuity of the joint material as placed. Place the joint material so that the top of the strip is not above, nor more than 1/4-inch (6.35 mm) below, the finished concrete surface. Once placed, assure the vertical axis of the joint material is within 10 degrees of a plane normal to the pavement surface. Assure final strip alignment is parallel with the pavement center line and does not vary more than 1 inch (25.4 mm) from the edge of a 12-foot (3.7 m) straightedge. The installation device must consolidate the concrete about the joint material. Once the joint material is installed, assure the concrete is free of segregation, rock pockets or voids and the finished concrete surface on each side of the joint is in the same plane.

C. Transverse Expansion Joints

1. Place the expansion joint filler continuously from form to form, shaped to the subgrade and the keyway along the form. Furnish preformed joint filler in lengths equal to the pavement width or equal to one lane width. Use damaged or repaired joint filler only with the Engineer's approval.
2. Ensure the expansion joint filler is held vertically. Use an approved installing bar, or other device if required to secure preformed expansion joint filler at the proper grade and alignment during concrete placing and finishing. Assure finished joints do not deviate more than 1/4-inch (6.35 mm) horizontally from a straight line. If joint fillers are assembled in section, no offsets are permitted between adjacent units. No concreteplugs are permitted anywhere within the expansion space.

D. Transverse Contraction Joints

1. Transverse contraction joints are weakened planes created by forming or cutting grooves in the pavement surface and, when shown on the plans, are to include load transfer assemblies.
2. Form transverse strip contraction by installing a parting strip to be leftin place.
3. Make formed grooves by depressing an approved tool or device into the plastic concrete. Leave the tool or device in place until the concrete has attained its initial set and then remove it without disturbing the adjacent concrete, unless it is designed to remain in place.
4. Make sawed construction joints by sawing grooves in the pavement surface of the dimensions and spacing and lines on the plans, using an approved concrete saw. Start sawing joints as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling. Saw all joints before uncontrolled shrinkage cracking occurs. When required, continue saw operations both during the day and night, regardless of weather conditions. Do not saw a planned joint when a volunteer crack develops at or near the planned joint location. Discontinue sawing when a crack develops ahead of the saw. Typically, saw all joints in sequence. Saw all contraction joints in lanes and adjacent to previously constructed lanes before uncontrolled cracking occurs. If conditions exist that make it impractical to prevent erratic cracking by early sawing, form the contraction joint groove before initial set of concrete as provided above.
5. When directed, rout or saw random cracks and fill with joint sealer. Thoroughly clean the sawed area using water and compressed air. Immediately remove all pieces of concrete, aggregate and residue from the joint caused by sawing. Take care to maintain uniform cut depth. Seal the joint as soon as it is dry.
6. Make sure transverse formed contraction joints comply with Section 02515 3.14 requirements for the longitudinal formed joint.
7. Construct transverse construction joints if there is an interruption exceeding 30 minutes in the concreting work. Do not construct a transverse joint within 5 feet (1.5 m) of an expansion joint, contraction joint, or weakened plane. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 5 feet (1.5 m.) long, remove and dispose of excess concrete back to the last preceding joint as directed.

3.15 LOAD TRANSFER DEVICES

A. When used, hold dowels in position parallel to the surface and centerline of the slab by a metal device that is left in the pavement.

B. Thoroughly coat, with an approved lubricant, the portion of each dowel painted with one coat of lead or tar paint, as required under Section 02515.2.1; MATERIALS. Furnish an approved metal dowel cap or sleeve meeting Section 02515.2.1; MATERIALS requirements, for each dowel bar used with the expansion joints. Assure the caps or sleeves fit the dowel bar tightly.

C. Instead of using dowel assemblies at contraction joints, dowel bars may be placed in the full pavement thickness using an approved mechanical device.

3.16 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING

A. Sequence

1. Sequence the work as follows: strike-off, consolidate, float, and remove latency, straight-edge, and final surface finish.
2. If applying water to the surface is permitted, apply it as a fog spray using an approved spray equipment.

B. Finishing at Joints

1. Place the concrete adjacent to joints, under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement, free of voids or segregation. Mechanically vibrate concrete adjacent to joints meeting Section 02515.3.11; PLACING CONCRETE requirements.
2. Once the concrete has been placed and vibrated adjacent to the joints as required in Section 02515.3.11; PLACING CONCRETE, bring the finishing machine forward, operating it to avoid damage to or misalignment of joints. If uninterrupted operation of the finishing machine, to, over, and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, lift the finishing machine and set it directly on top of the joint and resume the finishing. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, lift the screed and carry it over the joint. Thereafter, the finishing machine may be run over the joint without the screeds being lifted, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

C. Machine Finishing

1. Vibrate all concrete pavement unless otherwise approved for small areas or for short periods of time due to equipment failure. Assure vibrators for full width vibration of concrete paving slabs meet Section 02515.3.5.B; VIBRATORS requirements. If concrete uniformity and density is not obtained using the vibratory method at joints, along forms, at structures, and throughout the pavement, furnish equipment and methods which will produce pavement meeting specifications.

D. Hand Finishing

1. Hand finishing is permitted under the following conditions:
    a. If mechanical equipment breaks down, hand finishing concrete already deposited on the grade when the breakdown occurs is permitted.
    b. Widths or areas of irregular dimensions where mechanical finishing equipment is impractical.
    c. As soon as concrete is placed, strike it off and screed it. Use an approved portable screed. Provide a second screed for striking off the bottom layer of concrete if reinforcement is used.
    d. Assure the screed for the surface is an approved design, sufficiently rigid to retain its shape, and constructed of metal, and at least 2 feet (.6 m) longer than the maximum width of the slab to be struck off.
    e. Obtain consolidation using a vibrator or other approved equipment.

f. Move the screed forward on the forms with a combined longitudinal and transverse motion, always moving in the direction the work is progressing and operated to ensure that neither end is raised from the side forms during the strike off process. If necessary, repeat this until the surface is uniform in texture, true to grade and cross section, and free from porous areas.

2. Floating

a. Once the concrete is struck off and consolidated, use one of the following methods as specified or approved.

b. Hand Method

1) Use a hand-operated, longitudinal float at least 12 feet (3.7 m) long and 6 inches (152.4 mm) wide, stiffened to prevent flexing and warping. Work the float in a sawing motion, operating from foot bridges resting on the side forms and spanning and not touching the concrete. Move ahead along the pavement centerline in successive sections not exceeding one-half the length of the float. Waste all excess water or soupy material over the side forms on each pass.

c. Mechanical Method

1) Obtain the Engineer's approval of the mechanical float before use. Adjust the float tracks to the required crown. Assure the float is adjusted to the transverse finishing machine to maintain a mortar wave ahead of the float at all times. Ensure the float passes over each pavement area at least twice. Waste all excess water or soupy material over the side forms on each pass.

d. Alternate Mechanical Method

1) As an alternate to item (1) above, the Contractor may use a machine having a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. This frame must be carried by 4 or more visible wheels riding on, and in constant contact with, the side forms.

2) If necessary, following one of the preceding float methods, long-handled floats having blades a minimum 5 feet (1.52 m) long and 6 inches (152.4 mm) wide may be used to smooth and fill in open-textured areas in the pavement. Do not use long-handled floats to float the entire pavement surface in place of, or supplementing, one of the preceding floating methods. When strike-off and consolidation are performed by hand and the pavement crown will not permit using a longitudinal float, float the surface transversely using the long-handled float. Take care to not work the pavement crown during the work.

E. Straight Edge Testing and Surface Correction

1. Once floating is completed, excess water removed, and the concrete is still plastic, test the concrete surface for trueness with a 10-foot (3.05 m) straightedge. Furnish and use a 10-foot (3.05 m) straightedge swung from handles 3 feet (.91 m) longer than one-half the slab width. Hold the straightedge in contact with the surface in successive positions parallel to the road centerline

and the go over the whole slab area, as required. Advance along the road in not to exceed one-half the straightedge length. Immediately fill any depressions with fresh mixed concrete, strike off, consolidate, and refinish. Trim high areas and refinish. Give special attention to assure that surfaces across joints meet the smoothness requirements. Continue straightedge testing and surface corrections until the entire surface meets the required grade and cross section.

F. Final Finish

1. The final finish refers to the type of surface texture as specified in the Contract documents. The following types of surface textures may be specified: Type I - Transverse Tining, Type II - Longitudinal Tining, Type III - Nylon or Artificial Grass Drag, Type IV.- Nylon or Bristle Broom, Type V - Belt Finish, and Type VI - Burlap Drag. When final longitudinal texturing has been completed by the burlap drag, texture the plastic pavement surface to the designated texture as approved by the Engineer. A belt finish does not need to be preceded by a burlap drag.

   a. Type I - Transverse Tining

      1) Produce the mainline finish using mechanical equipment described as follows: The transverse grooving machine must be either a vibrating roller or a comb equipped with steel tines. The machine must be self-propelled and automatically lift the roller or tine comb at the pavement end. Obtain the Engineer's approval of hand grooving methods in those areas where the mechanical equipment is not practical.

      2) Assure the equipment has rectangular or circular shaped spring steel tines that are spaced 1/2- to 1-inch (12.7 - 25.4 mm) center to center. Make the grooves perpendicular to the pavement center line and the transverse grooves being 0.090 to 0. 125 inches (2.3 - 3.2 nun) wide and 1/8- to 3/16-inch (3.2 - 4.8 mm) deep. Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical, if they produce a similar transverse groove.

   b. Type II - Longitudinal Tining

      1) Produce the mainline finish using mechanical equipment meeting the following: The longitudinal grooving machine must be either a vibrating roller or a comb equipped with steel tines, be self-propelled and automatically lift the roller or tine comb at the pavement end. Obtain the Engineer's approval of hand grooving methods in areas where mechanical equipment cannot be used.

      2) Assure the equipment has rectangular or circular shaped spring steel tines that are spaced 1/2- to 1-inch (12.7 - 25.4 mm) center to center. Make the grooves parallel to the pavement center line and the longitudinal grooves 0.090 to 0.125 inches (2.3 - 3.2 mm) wide and 1/8- to 3/16-inch (3.2 - 4.8 mm) deep. Operate the mechanical equipment from a bridge when the pavement is 4.9 m (16 feet) or more in width.

3) Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical, if they produce a similar type of longitudinal groove.

c. Type III - Nylon or Artificial Grass Drag

1) Produce the pavement finish using a nylon or artificial grass drag, approved by the Engineer. Produce a surface by pulling the drag longitudinally. For a pavement width of 16 feet (4.9 m) or more, mount the drag on a bridge that travels on the forms. Use a drag of at least 3 feet (.91 m) wide and maintain full contact the pavements full width. Maintain drags clean and free from encrusted mortar. Replace drags that cannot be cleaned with new ones.

d. Type IV - Nylon or Bristle Broom

1) Apply broom texturing when the water sheen has disappeared. Draw the broom from the center to the edge of the pavement with adjacent strokes overlapping. Perform the brooming so that the surface corrugations are uniform in appearance and have a minimum depth of 1/16-4nch (1.6 mm) and a maximum depth of 1/8-inch (3.2 mm). Complete brooming before the concrete surface will be tom or roughened by the work. Produce a finished surface free from rough and porous areas, irregularities and depressions resulting from poor workmanship. Mechanical brooming, in lieu of the manual brooming, is permitted if the specified results can be obtained.

e. Type V - Belt Finish (Paving with Rigid Forms)

1) When straight edging is complete and the water sheen has disappeared, and just before the concrete becomes non-plastic, belt the surface with a two-ply, canvas belt a minimum 8 inches (203.2 mm) wide and a minimum 3 feet (.9 m) longer than the pavement width. Equip hand belts with handles to permit controlled, uniform manipulation. Work the belt with short strokes transverse to the road centerline advancing parallel to the centerline.

f. Type VI - Burlap Drag

1) Use a drag of seamless strip damp burlap or cotton fabric to produce a roughened surface, dragging it longitudinally along the pavement's full width. For pavement 16 feet (4.9 m) or more in width, mount the drag on a bridge that travels on the rails. Use a drag at least 3 feet (.91 m) wide, maintaining contact with the full pavement width. Maintain drags clean and free from encrusted mortar. Replace drags that cannot be cleaned with new drags.

3.17 EDGING AT FORMS AND JOINTS

A. After the final finish and before the concrete has taken its initial set, round the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints

with an approved tool to the specified radius. Produce a radius having a smooth, dense mortar finish. Do not disturb the slab surface with the tool during the work.

B. At all joints, remove all tool marks on the slab adjacent to the joints by brooming the surface. Do not disturb the rounding of the slab comer when brooming the surface. Completely remove all concrete on top of the joint filler.

C. Test all joints with a straightedge before the concrete has set and correct if one side of the joint is higher than the other or if an edge is higher or lower than the adjacent slabs.

3.18 SURFACE TEST

A. As soon as the concrete has hardened to permit testing, test the pavement surface with a 10-foot (3.05 m) straightedge or other approved device. Mark and grind high spots exceeding 1/4-inch (6.35 mm.), but under 1/2-inch in 10 feet (12.7 mm in 3.05 m), using an approved grinding tool to an elevation where the area or spot will not show surface deviations exceeding 1/4-inch (6.35 mm) when tested with a 10- foot (3.05 m) straightedge. Use stacked head, vertical blade grinders that will provide a coefficient of friction approximately equal to that of the un-ground pavement. Keep grinding grooves parallel to the direction of travel. Where the departure from correct cross section exceeds 1/2-inch (12.7 mm)), remove and replace the pavement by hand at Contractor expense.

B. Any area or section so removed cannot be less than 5 feet (1.52m) long the full lane width. When required to remove and replace a section of pavement remove and replace any remaining portion of the slab adjacent to the joints that is less than 5 feet (1 .52 m) long.

3.19 CURING

A. Immediately after the finishing operations are complete and the surface cannot be marred, cover and cure the entire surface of the newly placed concrete meeting one of the following methods. Immediately stop concrete work when insufficient cover material or lack of water would prevent obtaining the specified cure results. Do not leave the concrete exposed for more than 1/2-hour between stages of curing or during the curing period.

1. Cotton or Burlap Mats
    a. Cover the entire pavement surface with mats, extending at least twice the pavement thickness beyond the slab edges. Assure that the entire surface and both edges of the slab are completely covered. Before placing mats, saturate the mats thoroughly with water. Place and weight the mats to remain in contact with the covered surface. Keep the mats wetted and in place for 72 hours after the concrete has been placed.
2. Waterproofed Paper
    a. Cover the pavement top and sides entirely with waterproofed paper. Lap the units at least 18 inches (.46 m). Place and weight the paper to maintain contact with the surface. Assure the paper extends beyond the slab edges at twice the pavement thickness. If laid longitudinally, paper not manufactured in sizes that will provide this width, must be securely

sewed or cemented together with joints being sealed so that they do not open up or separate during the cure period. Maintain the covering in place for 72 hours after the concrete has been placed. Thoroughly wet the pavement surface before placing the paper.

3. Straw Curing
   a. When using this type of curing, initially cure the pavement using burlap or cotton mats, meeting Section 02515.3.19.A.a above, until after final set of the concrete or, in any case, for 12 hours after the concrete is placed. Once the mats are removed, thoroughly wet and cover the surface and sides of the pavement with at least 8 inches (203.2 mm) (wetted thickness) of straw or hay. Repair or replace straw or hay covering displaced during the curing period and saturate with water for 3 days. Thoroughly wet the covering down the morning of the fourth day. Keep this cover in place until the concrete has attained the required strength. When permission is given to open the pavement to traffic, remove and dispose of the covering leaving the right-of-way in a neat and presentable condition. Do not dispose of the covering by burning on, or adjacent to, the pavement.
4. White Pigmented Impervious Membrane
   a. Uniformly spray the entire pavement surface with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with burlap or cotton mats, the curing compound may be applied upon removal of the mats.
   b. Do not apply the curing compound during rainfall.
   c. Apply curing compound under pressure at 1 gallon per 150 square feet (3.79 L per 13.95 square meters) using mechanical sprayers. Use spraying equipment of the fully atomizing type equipped with a tank agitator. At the time of use, assure the compound is thoroughly mixed with the pigment uniformly dispersed throughout the vehicle. During application, continuously stir the compound using mechanical means. Hand spraying of odd widths or shapes and on concrete surfaces exposed by the removal of forms is permitted. Do not apply curing compound to the inside faces of joints to be sealed.
   d. Use curing compound producing a film that will harden within 30 minutes after application. Immediately re-apply curing compound damaged from any cause within the required curing period.
   e. Upon removal of side forms, apply curing compound to the exposed slab sides.
5. White Polyethylene Sheeting
   a. Cover entirely the top surface and sides of the pavement with polyethylene sheeting. Lap the pieces at least 18 inches (35 cm). Place and weight the sheeting so it remains in contact with the surface. Lay sheeting so it extends beyond the edges of the slab at least twice the thickness of the pavement. Maintain the covering in place for 72 hours after the concrete has been placed.

B. Curing in Cold Weather

1. When the average daily temperature is below 40°F (4°C), cure by covering the pavement with at least 12 inches (304.8 mm) of loose, dry hay or straw, or equivalent protective covering authorized by the Engineer. Leave covering in place for 10 days.
2. When concrete is placed and the air temperature could drop below 35°F (2°C), provide the volume of straw, hay, grass, or other blanketing material at the work site. Anytime the temperature may be expected to reach the freezing point during the day or night, spread the material over the pavement to the required depth to prevent freezing of the concrete. Maintain the covering for a minimum 10 days. Be responsible for the quality and strength of the concrete placed during cold weather and remove and replace at Contractor expense any concrete injured by freezing.

3.20 REMOVING FORMS

A. Remove forms only after the freshly place concrete has set for 12 hours, excluding auxiliary forms used temporarily in widened areas. Carefully remove forms to prevent damage to the pavement. Once the forms are removed, cure the slab sides as specified herein. Remove and replace major honeycombed areas. The minimum area to be removed is 10 feet in length (3.05 m), the full width of the lane involved. When it is necessary to remove and replace a pavement section, any remaining portion of the slab, adjacent to the joints, less than 5 feet (1.52 m) in length is to be removed and replaced.

3.21 SEALING JOINTS

A. If the joints are to be sealed, fill them with joint sealing material before the pavement is opened to traffic and as soon as practical after completion of the curing period. Just before sealing, thoroughly clean each joint of all foreign material, including membrane curing compound, assuring the joint faces are clean and surface dry when the seal is applied. Stir material for hot applied seal during heating

B. Apply the sealing material to each joint opening meeting the plan details or as directed by the Engineer. Pour so that the material does not spill on theexposed concrete surfaces. Remove and clean from concrete surfaces all excess sealing material. The use of sand or similar material as a cover for the seal is not permitted. Do not place poured joint sealing material when the ambient temperature is less than 50°F (10°C), unless approved by the Engineer.

3.22 PROTECTION OF PAVEMENT

A. Protect the pavement and its appurtenances against both public and Contractor traffic. This includes supplying personnel to direct traffic and the erection and maintenance of warning signs and lights.

B. To protect the concrete against rain before the concrete is sufficiently hardened, have available at all times materials for the protection of the edges and surface of the unhardened concrete. Protective materials consist of standard metal forms or wood plank

having a minimum nominal thickness of 2 inches (50.8 mm) and a minimum nominal width of the pavement thickness at its edge for the protection of the pavement edges, and covering material such as burlap or cottonmats, curing paper, or plastic sheeting material for the protection of the surface of the pavement. Stop paving when rain appears imminent and have all available personnel begin placing forms against the side of the pavement and cover the surface of the unhardened concrete with the protective covering.

C. Repair or replace all damage to the pavement occurring before final acceptance at Contractor expense.

3.23 OPENING TO TRAFFIC

A. Obtain the Engineer's approval to open the pavement to traffic. Pavement cannot be opened to traffic until specimen beams, meeting 3.12; TESTING, have reached the design flexural strength, tested under the third-point method according to Section 3.12; TESTING. If the tests are not performed, the pavement may be opened at the discretion of the Engineer. Clean the pavement before opening to traffic.

3.24 CONCRETE PAVEMENT - SLIPFORM METHOD

A. Pavement may be constructed without using fixed forms. When the slipform method is used, meet the following provisions:

1. Grade
    a. Once the grade or base is placed and compacted to the specified density, cut the grade and areas that will support the paving machine to the required elevation using an approved fine-grading machine. Use a self-propelled or towed fine-grading machine having the weight and power to trim the compacted material without gouging or tearing the surface. Assure the machine is equipped with cutting edges or surface shavers controlled from an independent control reference wire having an automatic control device. To avoid excessive depths of cut, the machine is to fine grade making successive passes, with each pass controlled from the independent reference line through the automatic control. Re-compact to the specified density, all base disturbed by the grading operation, before placing concrete. Maintain the grading operations in advance of concrete placement. Repair damage to the grade caused by traffic before placing the concrete.
2. Placing Concrete
    a. Place concrete using an approved, slipform paver able to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass to the specified line, grade, and cross section with a minimum of hand finishing. Assure the machine is equipped with vibrators, vibrating the concrete the pavements full width and depth. Vibrators must be vibrating tubes or arms working in the concrete, or a vibrating screed or pan operating on the concrete surface. Assure the sliding forms are capable of resisting displacement by the wet concrete.

Use forms that trail behind the paver and prevent slumping of the concrete during the work.

b. Assure the concrete does not exceed a slump of 2 inches (50.8 mm). Operate the slipform paver at a uniform speed. Coordinate all concrete mixing, delivering, and spreading to maintain uniform progress with minimum stopping and starting of the paving work. Immediately stop vibratory and tamping when it is necessary to stop the paver. Do not apply any outside tractive force to the paver not controlled by it.

3. Finishing
   a. Meet the surface smoothness and texture requirements of Section 02515.3.16.F; FINAL FINISH, and Section 02515.3.18; SURFACE TEST.
4. Curing
   a. Perform curing using one of the methods in Section 02515.3.19; CURING.
5. Joints
   a. Construct all joints under Section 02515.3.14; JOINTS.

3.25 TOLERANCE IN PAVEMENT THICKNESS

A. The pavement thickness will be determined by measuring cores. The actual pavement thickness must be within 1/4-inch (6.35 mm) of the specified thickness.

B. When any core is less than the plan thickness by more than the allowable deviation, additional cores will be taken from the area at minimum 10-foot (3-05 m) intervals parallel to the centerline in each direction from the affected location until, in each direction, a core is found which is not deficient by more than the allowable deviation. The Engineer will evaluate areas found deficient in thickness by more than the allowable deviation. Remove and replace deficient areas to the specified thickness at Contractor expense.

END OF SECTION

SECTION 02528

CONCRETE CURB AND GUTTER

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is constructing combined curb and gutter using structural concrete and meeting the lines, dimensions, and grades shown on the plans and these specifications.

B. Standard drawings in Appendix A that are applicable to this section are:
   1. Standard Drawing 02528-1, Standard Curb and Gutter

1.2 REFERENCES

AASHTO M 213	Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO M 148	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

PART 2 - PRODUCTS

2.1 STRUCTURAL CONCRETE

A. Furnish structural concrete meeting the requirements of Section 03310, STRUCTURAL CONCRETE.

2.2 REINFORCING STEEL

A. Furnish reinforcing steel meeting the requirements of Section 03210, REINFORCING STEEL.

2.3 PRE-FORMED EXPANSION JOINT MATERIAL

A. Furnish pre-formed expansion joint material meeting the requirements of AASHTO M213.

2.4 GRAVEL BASE MATERIAL

A. Furnish gravel base meeting all applicable portions of Section 02235, CRUSHED BASE COURSE, and meeting gradation requirements for 1" minus material.

2.5 CURING AND PROTECTIVE COATING MATERIALS

A. Liquid Membrane-Forming Compounds for Curing Concrete
   1. Furnish liquid membrane-forming compound meeting the requirements of AASHTO M148, Type 1, clear or translucent.
   2. Apply liquid membrane forming compound between April 15 and August 14 of each year unless daily temperatures outside of that date range are between 40 and 90 degrees Fahrenheit.

B. Emulsified Linseed Oil Compound
   1. Assure it meets all requirements of AASHTO M148 and contains at least 2.7 pounds (0.32kg) of linseed oil per gallon (liter). Furnish a manufacturer's certification showing that the formulated weight of linseed oil per gallon equals or exceeds this limit.
   2. Apply water-soluble or emulsified linseed oil compound between August 15 and April 14 of each year.

PART 3 - EXECUTION

3.1 GENERAL

A. Concrete curb and gutter may be machine-laid or hand-formed. Perform work meeting these requirements and the applicable requirements of Section 03310, STRUCTURAL CONCRETE.

3.2 FOUNDATION PREPARATION

A. Excavate the foundation to the specified depth. Assure the subgrade or base course for the concrete has a firm and even surface and is compacted meeting Section 02230, STREET EXCAVATION, BACKFILL, AND COMPACTION.

B. Complete excavation to the lines shown in the contract documents or as specified by the Engineer.

C. Place at least 6 inches (7.5 cm) of gravel base material and compact it to 95% of ASTM D-698. This requirement is waived if curb and gutter is installed on a portion of street base course material of 3 inches (7-5 cm) or more in thickness.

D. For new street construction or street reconstructing, place gravel base course for the street 9 inches beyond back of the curb.

3.3 FORMS

A. Use metal forms unless otherwise approved of the depth equal to the face of the item being constructed. Obtain Engineer approval of in-place forms before placing concrete.

B. Assure forms produce the shape, lines, and dimensions shown on the plans and/or drawings. Assure forms prevent leakage of mortar and maintain position and alignment. Thoroughly clean and oil before placing and do not remove forms until the concrete has hardened sufficiently to prevent damage.

C. Where the curb and gutter is to abut an existing sidewalk, use an approved face-of-gutter form secured to maintain an established gutter grade. Vary the curb height to assure the top of curb matches as nearly as possible the standard curb and gutter cross section. Obtain Engineer approval to hand form lengths not exceeding 10 feet (3m).

D. Form radii using flexible or curved metal forms set to fit the specified curvature. Obtain Engineer approval before using wood forms. Radii may be formed by using segments of straight forms if the length of the straight segment does not exceed $1/10^{th}$ of the length of the radius.

3.4 REINFORCEMENT

A. Place reinforcement as required. Place and hold in position before placing concrete.

3.5 PLACING CONCRETE

A. Place and compact the subgrade to the specified grade before placing concrete. Dampen the subgrade just before placing the concrete. Spade and tamp the concrete thoroughly into the forms to provide a dense, compacted concrete free of rock pockets. Float, finish, and broom the exposed surfaces. Each placing/finishing crew shall have at least one ACI Flatwork Finishing Technician level or above, on site at all times.

B. Do not place concrete at a rate that exceeds the finishing operation's ability to meet these specifications.

C. Machines or equipment that extrude curb and gutter may be used when approved, provided they produce a finished product matching that obtained by the set-form method. Use slip-form machines that are automatically controlled for longitudinal grade, alignment, and transverse slope by sensing devices operating from string lines set from construction stakes placed by the Engineer or a stringless slip-form machine operating from an integrated machine control model.

3.6 STRIPPING FORMS AND FINISHING

A. Forms

1. Remove forms when the concrete is sufficiently set to prevent chipping or spalling. When forms are removed before the curing period has expired, protect the concrete edges with moist earth or spray edges with curing compound. Clean, oil, and examine all forms for defects before they are used again.

B. Finishing

1. Finish the surface of concrete curbs and gutters true to the lines and grades shown on the plans. Work concrete until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed.
2. Fill honeycomb or other blemishes in formed surfaces with grout to the specified finish. Tool all edges to a ¼-inch (6.4 mm) radius. Float the surface using a magnesium float to a smooth and uniform surface. When the concrete in the curb and gutter has hardened sufficiently, give the surface a broom finish. Obtain Engineer approval of the broom before use. Broom the surface without tearing the concrete. Broom to produce regular corrugations not exceeding 1/8-inch (3.2 mm) deep.
3. After finishing and brooming, stamp and mark into the concrete to mark sewer and/or water service lines if required by the owner.

C. Crew

1. Do not apply additional surface water. The Engineer may permit adding water, but it must be applied by fog spray only. Use of an evaporation retardant, Confilm, or equal, following the manufacturer's directions is permitted.

3.7 CURING

A. Curing meeting Section 03310, STRUCTURAL CONCRETE, requirements.

3.8 JOINTS

A. Place curb and gutter monolithically with no construction joints permitted, except at planned expansion joints.

B. Construct expansion joints at construction joints, junctions with existing concrete, and opposite to or at expansion joints in adjacent concrete, and at maximum 300-foot intervals in a continuous run of concrete being placed. Form expansion joints using ½-inch (12.7 mm) thick, pre-formed expansion joint filler, as specified in Section 02528.2.3.

C. Form or cut contraction joints 1/8-inch (3.2 mm) wide to one-fourth the depth of the concrete being placed. Construct the joints to coincide with the joints in adjacent concrete or in uniform sections 10 feet (3 m) in length. Where required to make a closure, sections less than 10 feet (3 m) in length will be permitted with the minimum length being 4 feet (1.2 m). When contraction joints are made by approved forming or grooving before the concrete has set, tool the edges to the approved radius.

3.9 CURB BACKFILL

A. Complete the curb backfill to 4 inches (10 cm) below the top of curb before final grading of the subgrade and placing the street section base course.

B. Backfill using impervious dirt up to 4 inches (10 cm) below top of curb. Do not use sand or gravel backfill in this area.

C. In areas of existing lawns, use black loam or approved topsoil for the top 4 inches (10 cm) of backfill. Place it out from the curb and in the amount required to replace the turf or lawn removed during installation. Place the backfill to a point level with the top of the curb, immediately adjacent to the curb, and grade and blend to match the existing undisturbed lawn area.

D. Where lawns do not exist, place the top 4 inches (10 cm) of backfill using impervious dirt and conforming to the typical sections shown on the plans.

E. Compact backfill to prevent settlement and level the surface to be freedraining. Complete all backfill within 3 days of adequate curing.

3.10 PRIME AND SEAL COAT PREPARATION

A. Paint the edge of the gutter adjacent to the asphalt surfacing with an asphalt prime coat before placing the pavement surface course. When an asphalt seal coat is specified, apply the oil and cover aggregate 3 inches (7.6 cm) on to the gutter to provide a good seal on the joint between the concrete and pavement.

3.11 TOLERANCES

A. Perform the work to produce a curb and gutter meeting the specified line and grade uniform in appearance and structurally sound. Remove and replace at contractor expense curb and gutter having unsightly bulges, ridges, and/or low spots in the gutter, or other defects as directed. Grade cannot deviate more than 1/8-inch (3.2 mm), and alignment not vary more than ¼-inch (6.4 cm) from plan elevation, grade, or alignment. Tolerances may be checked using survey instruments, straight edges, or water puddling. Puddled water cannot exceed ¼- inch (6.4 mm) in depth.

END OF SECTION

SECTION 02529

CONCRETE SIDEWALKS, DRIVEWAYS, APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is the construction of concrete sidewalk and driveway approaches, curb turn fillets, valley gutters, new street monuments, and all other miscellaneous new concrete construction complete in place.

1.2 REFERENCES

AASHTO M 213	Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO M 148	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

A. Standard drawings in Appendix A applicable to this section are as follows.

1. Standard Drawing No. 02529-1, Double Gutter Detail For Street Intersection
2. Standard Drawing No. 02529-2, Standard Fillet
3. Standard Drawing No. 02529-3, Type I Street Monument
4. Standard Drawing No. 02529-4, Type II Street Monument
5. Standard Drawing No. 02529-5A, Boulevard Driveway Approach
6. Standard Drawing No. 02529-5B, Curb Walk Driveway Approach
7. Standard Drawing No. 02529-6, Retrofit Drive Approach
8. Standard Drawing No. 02529-7A, Boulevard Alley Approach
9. Standard Drawing No. 02529-7B, Curb Walk Alley Approach
10. Standard Drawing No. 02529-8, Accessibility Ramp
11. Standard Drawing No. 02529-9, Swale Crossing
12. Standard Drawing No. 02529-10, Mailbox Mounting For Curbline Delivery

PART 2 - PRODUCTS

2.1 STRUCTURAL CONCRETE

A. Furnish structural concrete meeting the requirements of Section 03310, STRUCTURAL CONCRETE.

2.2 REINFORCING STEEL

A. Furnish reinforcing steel meeting the requirements of Section 03210, REINFORCING STEEL. Use 6 x 6 x 10 gauge wire mesh unless otherwise specified.

2.3 PRE-FORMED EXPANSION JOINT FILLER MATERIAL

A. Furnish joint material meeting the requirements of AASHTO M213.

2.4 GRAVEL BASE MATERIAL

A. Furnish crushed base material meeting applicable requirements of Section 02235, CRUSHED BASE COURSE, and meeting the gradation requirements for 1 inch minus material.

2.5 CURING AND PROTECTIVE COATING MATERIALS

A. Liquid Membrane-Forming Compounds for Curing Concrete
   1. Use liquid membrane-forming compounds meeting the requirements of AASHTO M148, Type 1, clear or translucent. Apply the compound between April 15 and August 14 unless daily temperatures outside of that date range are between 40 and 90 degrees Fahrenheit (4-32° C).

B. Emulsified Linseed Oil Compound
   1. Apply water-soluble or emulsified linseed oil compound between August 15 and April 14 as a protective coat. Assure it meets all requirements of AASHTO M148 and contains at least 2.7 pounds of linseed oil per gallon. Furnish a manufacturer's certification showing that the formulated weight of linseed oil per gallon equals or exceeds this limit.

C. The curing compound used on colored concrete shall be a high solid acrylic cure, Day/Chem Aggre-Gloss J-25 (manufactured by Dayton Superior) or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Construct sidewalks and driveway approaches, either new or replacement, valley gutter and curb turn fillets at the locations shown on the plans and where directed by the

Engineer meeting these specifications and the applicable portions of Section 03310, STRUCTURAL CONCRETE.

B. The use of slip form machines is prohibited for items in this section unless otherwise specified or permitted by the Engineer.

C. During periods of cold weather, Contractor must submit to Engineer a cold weather concreting plan applicable to Section 03310 for approval.

3.2 FOUNDATION PREPARATION

A. Excavate to the specified depth, or as directed by the Engineer. Assure the concrete subgrade has a firm and even surface and is compacted as specified in Section 02230: Street Excavation, Backfill, and Compaction, as may be modified by the Standard Modifications.

B. Place and compact at least 3 inches (75 mm) of gravel base material compacted to 95% of ASTM D-698. This requirement is waived for concrete if it is to be installed on street base course material exceeding 3 inches (75 mm) or more in thickness and is approved by Engineer.

C. Do not remove sidewalks, private driveways, or conduct foundation preparation activities more than 4 days prior to the planned concrete pour.

3.3 FORMS

A. Furnish forms to produce the shape, lines, and dimensions shown on the plans and/or drawings. Assure forms prevent leakage of mortar and are maintained in proper position and accurate alignment. Thoroughly clean and oil forms with an approved form oil before placing concrete and remove forms only after the concrete has hardened sufficiently to support all loads without damage.

B. Form radii using flexible or curved forms set to the required curvature. Use wood forms only with the Engineer’s approval. Radii may be formed by using segments of straight forms if the length of the straight segment does not exceed one-tenth of the length of the radius.

C. Use forms and pre-formed expansion joint filler material for same depth as concrete.

3.4 REINFORCEMENT

A. Place and hold in position reinforcement meeting the contract requirements, or as directed by the Engineer, before placing the concrete.

3.5 PLACING CONCRETE

A. Assure the subgrade is compacted and brought to specified grade before placing concrete. During extreme drying conditions, dampen the subgrade immediately before placing the concrete. Spade and tamp the concrete into the forms providing a dense, compacted concrete free of rock pockets. Float, finish and broom the exposed surfaces. Each placing/finishing crew shall have at least one ACI Flatwork Finisher Technician level or above, on site at all times.

B. Assure the rate of concrete placement does not exceed the rate at which the various placing and finishing operations can be performed in accordance with these specifications.

3.6 STRIPPING FORMS AND FINISHING

A. Forms

1. Remove forms when the concrete is sufficiently set to prevent chipping or spalling. When forms are removed before the curing period has expired, protect the concrete edges with moist earth or spray edges with curing compound. Clean, oil, and examine all forms for defects before they are used again.

B. Finishing

1. Finish the concrete surface true to lines and grades shown on the drawings. Work concrete until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. Float the concrete surface using a magnesium float to a smooth and uniform surface. Plastering of the surface is prohibited. Edge all outside edges of the slab and all joints using a ¼ inch (6.4 mm) radius edging tool.

2. Immediately after the forms have been removed, remove all form bolts and tie wires to a depth of at least ½ inch (12.5 mm) below the surface of the concrete. Clean and fill all holes and depressions caused by the removal or setting back of form bolts or tie wires with Portland Cement mortar composed of 1 part cement by volume and 2 parts sand. Chip out, clean and fill all rock pockets, honeycombs, and air pockets with mortar, in compliance with instruction of the Engineer. If, in the judgment of the Engineer, rock pockets are of such an extent or character as to materially affect the strength of the structure or to endanger the life of the steel reinforcement, they may declare the concrete defective and order the complete removal and replacement of that portion of the structure so affected.

3. Carefully make all mortar patches using a very dry mortar tamped firmly in the void. Keep the patches wet for a period of 3 days after which it will be inspected for shrinkage cracks. Excessive cracking will require complete removal and replacement of the patch.

4. Screed, float and light broom finish sidewalks, exterior slabs, approaches, etc. and membrane cure. After concrete has hardened sufficiently, give the surface a broom finish. Obtain Engineer approval of the broom before use. Assure the broom strokes are square across the concrete from edge to edge, overlapping adjacent strokes. Broom without tearing the concrete. Assure the broomed finish produces regular corrugations not exceeding 1/8 inch (3.2 mm) in depth.

5. Steel trowel finish interior floor surfaces which will be exposed after construction is completed, surfaces to be covered with resilient floor coverings or seamless floor coverings, the exposed portion of the top of equipment bases, the top of interior curbs, and other surfaces designated on the drawings. Perform troweling after the second floating when the surface has hardened sufficiently to prevent an excess of fines from being drawn to the surface. Produce a dense, smooth, uniform surface free from blemishes and trowel marks.

6. Apply liquid or shake-on floor hardener to all interior concrete floors which are subject to foot or equipment traffic and are not required to be covered with resilient floor coverings or seamless flooring. Prior to application, thoroughly clean the floor of all dirt, grease, and other foreign matter. Do not apply curing compounds to floors scheduled to receive floor hardener unless compatibility with the hardener is demonstrated in manufacturer's data.

7. Do not apply additional surface water. The Engineer may permit adding water, but it must be applied by fog spray only. Use of a film forming evaporation retardant, following the manufacturer’s directions, is permitted.

3.7 CURING

A. Cure meeting Section 03310, STRUCTURAL CONCRETE requirements.

3.8 JOINTS

A. Extend isolation joints the full depth of the concrete and fill using ½-inch (12 mm) thick, pre-formed expansion joint filler material as specified in Section 02529.3.3. Place isolation joints meeting this requirement where new concrete abuts existing concrete. Form isolation joints around all appurtenances, such as manholes, utility poles, etc. extending into and through the concrete.

B. Install pre-formed joint filler between concrete and any fixed structure, such as a building or bridge. Assure all expansion joint materials extend the full depth of the concrete. Place isolation joints at radius points, junctions with existing concrete, and opposite to or at expansion joints in adjacent concrete. Form cold joints at unions of consecutive pours as shown on the plans or directed by the Engineer. Assure the cold joint is vertical, the full depth of the concrete, and tooled to a ¼-inch (6.5 mm) radius.

C. Divide sidewalk into sections using contraction joints formed by a jointing tool or other approved methods. Extend the contraction joints into the concrete for at least 25% of its depth and be approximately 1/8-inch (3 mm) wide. Unless otherwise directed, space contraction joints at maximum 10-foot (3 m) intervals or at a distance equal to the sidewalk width, whichever is less. In continuous sidewalk runs, install isolation joints every fifth contraction joint. For machine-placed sidewalk, install expansion joints with a maximum spacing of 150 feet.

3.9 BACKFILL

A. In areas adjacent to existing lawns, backfill the top 4 inches (100 mm) using black loam or good topsoil suitable for lawn growth. Place it out from the sidewalk or driveway to replace turf or lawn removed during installation. Place the backfill level with the top of the curb, immediately adjacent to the curb, graded and blended to match the existing undisturbed lawn area.

B. Where lawns do not exist, backfill the top 4 inches (100 mm) with impervious dirt and place to meet the typical sections shown on the plans.

C. Compact backfill to prevent settlement and level the surface to a neat appearing and free draining surface within 4 days after concrete is placed. Where required by the contract, topsoil shall be placed to the lines and grades of the work. The addition of topsoil, seed, and/or sod and all finish grading work shall be completed and ready for inspection within 6 days of concrete placement.

3.10 TOLERANCES

A. Assure all items of construction covered by this section present clean, uniform surfaces and lines free of irregularities and distortions. Plane surfaces and vertical tangent lines are tested with a 10-foot straightedge and cannot deviate more than ¼-inch (6.5 mm) from the straightedge.

3.11 MISCELLANEOUS NEW CONCRETE CONSTRUCTION

A. Construct new street monuments, new street light bases, and other miscellaneous concrete construction in accordance with detail drawings, or as directed by the Engineer.

B. New concrete construction required to maintain or restore existing structures will be considered incidental to the cost of pipe installation and no additional payments made. Include the concrete costs associated with thrust blocks with the unit costs bid for the valve, fittings, or appurtenance requiring the thrust block. New concrete work not included above, or specifically called out on the drawings, must first be approved by Engineer.

C. Construct all curb ramps with detectable warning surfaces in conformance with the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG). Detectable warning surfaces shall be considered deficient and subject to replacement by the Contractor if more than 5% of the truncated domes on a ramp surface are missing or damaged, if the detectable warning product has lost any adhesion to the concrete, or if the detectable warning product is cracked or shows other signs of distress, at the end of the two-year warranty period. Detectable warning plates shall be either cast iron or ductile iron.

END OF SECTION

SECTION 02581

PAVEMENT MARKINGS AND MARKERS (PRE-FORMED PLASTIC, PAINTS AND ENAMELS)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is painting pavement lines, words and symbols, or applying plastic lines, words, symbols, channelization buttons, and other reflective markers meeting these specifications, the standard drawings, and in reasonably close conformity with the lines and dimensions shown in the contract documents or established by the Engineer.

PART 2 - PRODUCT

2.1 PRE-FORMED PLASTIC PAVEMENT MARKING MATERIAL

A. Furnish plastic pavement markings and legends consisting of reflectorized, pre-fabricated, homogeneous, thermoplastic ribbon of the specified thickness. Assure the plastic contains reflective glass spheres uniformly distributed throughout its cross section and is capable of being affixed to bituminous or Portland Cement concrete pavements using a liquid contact cement or pre-coated, pressure-sensitive adhesive. Furnish white and yellow meeting standard highway colors. Assure the white plastic material is non-yellowing, and the yellow plastic material is non-fading for their expected useful life.

B. For strip line widths of 6 inches (150 mm) or less, furnish plastic pavement striping material in a single manufactured width equal to the specified width. For specified stripe line widths exceeding 6 inches (150 mm), furnish plastic pavement striping material in a single manufactured width equal to the specified width or in two or more widths totaling the specified width.

C. Cut the plastic marking material edges clean and true. Use at least 0.09-inch (2.25 mm) thick plastic material for inlaying into new asphaltic surfaces. Use at least 0.06-inch (1.50 mm) thick plastic material for application to existing surfaces or to hardened new surfaces.

D. Assure plastic pavement markings for inlay into new asphaltic surfaces are capable of being applied just before the final rolling of the new surface and can be rolled into place with conventional pavement rollers. For inlay applications, assure the plastic and adhesive are not damaged by pavement temperatures exceeding 175° F (79° C) or by water on roller drums.

E. Assure the plastic pavement marking material and its adhesive are tack free to provide easy handling without using a protective backing and can be repositioned on the surface before being permanently fixed in position. Pre-coated adhesive must be uniformly distributed over the entire contact surface of the plastic material.

F. Furnish plastic pavement marking material capable of molding itself to pavement contours, breaks, and other surface irregularities under traffic at normal pavement temperatures. Assure the plastic material will fuse with itself and with previously applied markings of the same composition under normal use conditions.

G. Assure pavement legends and symbols meet the applicable shapes and sizes specified by the "Manual on Uniform Traffic Control Devices" as adopted bythe FHWA.

H. Assure product agents or distributors furnish the manufacturer's specifications showing that the material furnished meets or exceeds these requirements and submit evidence of successful product use over a one-year period under similar climatic conditions. Plastic pavement marking material not meeting this use requirement will be rejected.

I. Submit a 4-inch (100 mm) by 1-foot (300 mm) sample from each lot of plastic material proposed for use on the project to the Engineer for approval. Use only approved plastic pavement marking material on the project.

1. Composition Requirements
    a. Furnish pre-formed plastic pavement marking material consisting of plasticizers, pigments, and graded glass spheres combined and proportioned to meet the following requirements.
        1) Pigments: Minimum 20 percent titanium dioxide of total pigment for white marking material; minimum 18 percent medium chrome yellow of total pigment for yellow marking material. Use graded glass spheres that are clean, transparent, and meet the requirements of Section 02581.2.02.A.1. Assure the glass spheres are uniformly distributed throughout the entire material.
2. Physical Requirements
    a. Tensile Strength
        1) Assure the plastic material has a minimum tensile strength of 40 psi (270 kPa) of cross section when tested under ASTM D638. The break resistance is based on an average of at least three (3) samples tested at a temperature of 70° – 80° F (22° – 27° C) using a jaw speed of 0.25 inches (6.25 mm) per minute.

    b. Plastic Pull Test
        1) A 1"-6" (25 mm – 150 mm) sample of the plastic material must support a dead weight of 0.66 lb per 0.01 inch (.28 kg per 2.5 0 mm) of material thickness for at least 5 minutes at 70° –80° F (22°-27° C).

    c. Bend Test
        1) The plastic material must be flexible so that at 80° F (27° C), a 3" by 6" (75 mm by 150 mm) sample of the material can be bent over a 1" (25 mm) diameter mandrel until the end faces are parallel and 1" (25 mm) apart without showing any fracture lines in the uppermost surface under unassisted visual inspection.

d. Skid Resistance

1) The surface friction of the plastic cannot be less than 35 BPN when tested under ASTM E303.

e. Reseal Test

1) The plastic must reseal to itself without adhesives when tested as follows: Overlap 2 1-inch by 3-inch (25 mm by 75 mm) piece face-to-face so that they form a single 1-inch (25 mm) by 5-inch (125 mm) with a 1 square inch (25 square mm) overlap in the center.

2) Place the piece on a hard surface with a 1000-gram weight resting uniformly on the entire overlap area and maintain at 140° to 190° F (60°-88° C) for 2 hours. The actual temperature to be maintained depends on the material being tested but must be within the specified range. After cooling to room temperature, the pieces must not separate without tearing.

f. Reflectivity

1) Furnish reflective pavement marking material having reflective values not less than those listed in the table below. Reflective values are measured under Federal Specifications L-S-300C. The reflective values must be measured on a 2 by 2-1/2 foot (.6 m by .75 m) panel at 85° incidence and be expressed as average candlepower per foot (meter)-candle per 5 square feet (1.5 m 2) of material.

Divergence Angle	White	Yellow
0.2 Degrees	0.20	0.15
0.5 Degrees	0.15	0.10

2.2 WATERBORNE PAVEMENT MARKING PAINT

A. Waterborne Pavement Marking Paint

1. Furnish acrylic latex white and lead-free yellow waterborne pavement marking paint meeting the following requirements.

a. Composition – The exact composition is at the manufacturer's discretion except that the vehicle is to be 100 percent acrylic polymer and the paint is not to contain any ingredient listed below.

1) Lead or chromate compounds; mercury; lead; chromate compounds; chlorinated solvents; hydrolysable chlorine derivatives; ethylene-based glycol ethers and their acetates.

2) Meet the following requirements:

	White	Yellow
Pigment, % solids ASTM D-3723	68 max	68 max
Total Solids, % by weight ASTM D-2369	75 min	75 min
Titanium Dioxide, lbs./gal. ASTM D-4563 & D-1394	1 lb. min.	0.15 lb. min
% Non-volatile vehicle of total vehicle weight ASTM D-2697	41 min.	41 min.
VOC content, maximum EPA Method 24	150 g/L	150 g/L
pH, min.	9.6	9.6

ASTM E-70

	White	Yellow
Viscosity (Krebs Stormer), K.U., ASTM D-562 @ 77°F, (25° C)	80-95	80-95
Grind, Hegman, min. ASTM D-1210	2	2
Deviation in percent weight per gallon, max. (from manufacturer specified weight)	±.30	±.30
Daylight[1] Reflectance, min. ASTM D-2805	85	59.1[2]
Contrast Ratio, 15 mils wet min., ASTM D-2805	0.92	0.88

[1]The Y-Tristimulus value (luminance) is obtained using a standardized Tristimulus colorimeter using a C illuminant at a two- degree observation angle. The paint sample is drawn to a 15-mil wet film thickness over a white substrate. The department uses a Hunter Lab

Miniscan XE Colorimeter and Leneta Corporation Form 5C opacity charts to determine this value.

[2]Color to match the V+ color on the Hale color chart ±6%.

ASTM TEST	WHITE AND YELLOW
D 711 mod.[1]	Dry Time, 15 mil wet film, 65% RH, minutes, max. 10
D1640 mod.[2]	Dry Through @ 90% RH, 15 mil wet film, minutes, max. 130

ASTM TEST	WHITE AND YELLOW
D 2243[3]	Freeze-Thaw, White and Yellow Pass
D 2486	Scrub Resistance, cycles min.....600
D-969	Bleeding Ratio, min.....0.95

[1]Use a wet film thickness of 15 plus or minus 1 mil. Immediately place in a humidity chamber controlled at 65± 3% relative humidity and 72.5° F ± 2.5° F (22.5°C ± 1.4° C) with minimal airflow.

[2]Apply a 15± 1 mil thick film to a non-absorbent substrate and place in a humidity chamber controlled at 85±5% R.H. and 72.5°F ± 2.5°F (22.5°C ± 1.4°C). Determine dry through time under ASTM D 1640 exerting the minimum pressure needed to maintain contact with the thumb and film.

[3]See B(7), Freeze-Thaw Stability.

3) Titanium. Use Titanium Dioxide meeting ASTM D-476, Type I or II.

b. Characteristics

1) Flexibility and adhesion. Apply 15 mil wet film thickness to a 3” by 5” (75 mm by 130 mm) tin panel. Dry at 77°F (25°C) for 24 hours followed by two hours at 122°F (50°C). Bend sample over a ½-inch (13 mm) mandrel. Paint to adhere firmly without showing cracking or flaking.

2) Water resistance. Apply 15 mil wet film thickness to a 4" by 8" (102 mm by 203 mm) glass plate. Dry at 77°F (25°C) for 72 hours. Immerse in distilled water at 77°F (25°C) for 24 hours. Air dry for two hours on a flat surface. Paint to not show blistering or adhesion loss.

3) Skinning and lumps. Fill a pint (0.473 L) container ¾ full of paint and seal tightly. After 72 hours, strain paint through a 100 mesh screen. No lumps or skin retained on the screen is permissible.

4) Settling. Fill a centrifuge tube with paint and revolve for two hours at 1112 Newtons (250 ft/lbs). Separation from top of vehicle to top of pigment not to exceed 13 mm (1/2- inch).

5) Skinning. Fill ½ pint (0.236 L) container half full of paint and seal. Let stand for 24 hours. No skinning to be visible.

6) Bleeding. When tested under ASTM D-969, paint to not show perceptible bleeding when painted on a bituminous surface.

7) Freeze-thaw stability. When tested under ASTM D-2243, paint to not show coagulation or viscosity change exceeding 10 Krebs units.

8) Static heat stability. Pour paint into a pint (473 mL) within 0.25 inches (6.4 mm) of the top, put the lid on and seal with tape, and place the container in an oven heated to 60°C ± 1°C (140°F ± 2°F) for seven days. Equilibrate the paint at standard conditions and thoroughly mix by stirring for at least five minutes. Ensure the paint does not show signs of livering, hard settling, coagulation, lumps or course particles. Perform a consistency test meeting ASTM D-562 at 25°C (77°F). Paint viscosity to not vary 10 K.U. from the original viscosity measured at 25°C (77°F).

c. Packaging and Marking. Meet subsection 714.04.9 requirements.

d. Sampling and Acceptance. Draw three samples meeting subsection 714.04.8 requirements.

e. Retro-reflective Glass Beads. Use silene-coated moisture resistant glass beads meeting subsection 714.05 requirements.

f. Application. Follow the manufacturer's requirements for pavement cleaning and traffic paint application or as follows, whichever is more restrictive.

1) Apply to a dry surface.

2) Clean the pavement of all loose rock, dirt, and debris immediately before applying the traffic paint.

3) Do not heat the traffic paint to exceed 110°F (43.3°C) before and during application.

4) Apply the traffic paint when the ambient temperature is 50°F (10°C) and rising. Stop application when the temperature is 50°F (10°C) and dropping and when rain or other weather adverse to the traffic paint during its drying time is imminent.

5) Apply traffic paint at 15 mils (0.38 mm) wet thickness in a single application meeting subsection 620.03.3(A).

6) Remove and replace all defective pavement marking damaged by weather at Contractor expense.

7) Re-paint, at Contractor expense, all striping represented by paint samples where any specified property is outside 20 percent of the specified value.

g. Reflective Glass Beads

1) Glass beads for use in reflectorizing traffic paint markings on pavement by the drop-on method must be spherical and transparent with smooth, lustrous surfaces. The beads, as delivered, must be spherical and transparent with smooth, lustrous surfaces. The beads, as delivered, must be free from extraneous material and clumps of beads that cannot be broken up easily when applying to the stripe.

2) Imperfections – The glass beads cannot include more than 25 percent irregularly shaped particles when tested under ASTM D1155. Assure the beads are free of scratches, pits, milkiness, dark particles, and excessive air bubbles.

3) Color – The glass beads must be colorless to the extent that they do not impart a noticeable daytime hue to white pavement markings.

4) Chemical Stability – The beads must withstand refluxing in distilled water in a Soxhlet extractor for 90 hours without noticeable dulling of surface luster and not more than 2.5 percent loss in weight.

5) Index of refraction – The glass from which the beads are made must have an index of refraction of at least 1.50 by the immersion method using tungsten light.

6) Gradation – Assure the glass beads meet the following gradation requirements when tested under the Standard Method of Test for Sieve Analysis of Glass Spheres, ASTM D1214.

Sieve No.	Total Percent Passing
20	100%
30	75-95%
50	15-35%
100	0-5%

7) Packaging and Marking – Furnish glass beads in bags containing 50 lb. (26 kg) net. Assure the shipping bags are moisture proof, paper-lined burlap bags meeting specification ICC-36-C under Interstate Commerce Commission Regulation Section 78-234. Mark each bag with the name of contents, manufacturer of beads, and net weight.

8) Certification – Submit certification from a testing laboratory approved by the Engineer certifying the beads meet these expectations.

PART 3 - EXECUTION

3.1 APPLICATION OF PLASTIC PAVEMENT MARKING MATERIAL.

A. Apply plastic pavement marking materials only to clean, dry surfaces free of paint, dirt, and foreign matter. On newly constructed surfaces to which a sealer has been applied, clean the surface receiving the plastic pavement marking to neutralize any acid and remove the sealer.

B. Apply following the manufacturer's recommended procedures. Apply plastic pavement marking materials only to surfaces at temperatures within the range specified by the manufacturer for optimum adhesion.

C. When activators are required for the adhesive or when various special coatings are required for different pavement surfaces, supply such information to the Engineer, indicating special application procedures.

D. Assure the width and layout of stripes or the area of application of plastic pavement markings and legends meet the dimensions shown in thecontract documents or standard drawings.

E. Before applying the plastic striping material, the Engineer will establish control points on the roadway for striping alignment. The Engineer will establish control points every 100 feet (30 meters) on tangent, at least every 100 feet (30 meters) on curves of 2 degrees or less, and at 50-foot (15 meters) intervals for curves over 2 degrees. The Engineer will also designate other pavement striping locations such as stop bars, crosswalks, and the like. Maintain all lines within 2" (50 mm) of established lines.

F. Place asphaltic surfacing on the roadway just before final compaction and roll into the new surface during final completion. Assure pavement markings or legends are flush with the finished surface.

3.2 PAINTING TRAFFIC LINES

A. Clean the surface to be painted for dirt, rocks, gravel and any other foreign matter. Apply the paint by hand or mechanical means consistent with the scope of the job. Assure the width and layout of stripes or the area to be painted meets the plans or standard drawings.

B. Paint the top and traffic side of curbs at those locations where parking is to be restricted, as shown in the contract documents or in the pavement marking manual. Paint the top and traffic sides of all island curbs, median curb, and other specified curb. Paint by uniformly applying one (1) coat of yellow traffic line paint meeting the requirements of Section 02581.2.2.A.1 as applicable. Paint the curb after it has cured at least 30 days after being cast. Apply the paint at a rate that the curb surface is completely covered and hidden. Assure surfaces to be painted are clean and free of all foreign matter before painting.

C. Before applying paint, mark the roadway between control points established by the Engineer. The Engineer will establish such control points on tangent every 100 feet (30 meters) and on curves at least every 100 feet (30 meters) for under 2- degree curves and at 50-foot (15 meters) intervals on curves over 2-degree curvature. Maintain the line within 2" (50 mm) of the established lines. The Engineer will also designate other pavement striping locations such as stop bars, crosswalks, and the like.

D. Apply highway traffic striping during daylight hours when the air and pavement temperatures are 40° F (4° C) or higher, the pavement surface is dry and the weather is not foggy, rainy, or stormy.

E. Apply paint and glass beads with equipment manufactured specifically for that purpose and using workmen experienced in operating such equipment. Locate the bead applicator directly behind and synchronized with the paint applicator. Assure both devices are shielded to avoid spraying of paint or loss of beads outside of the designated width of line. Assure the equipment is also capable of painting a stripe or stripes of the specified width with a tolerance of plus or minus ¼ inch (6.25 mm). In "no passing zones", the machine must be able to paint three (3) stripes simultaneously. For centerline painting, assure the machine is equipped with an automatic skip control giving the specified broken-line pattern within a tolerance of 6 inches (150 mm) over each cycle.

F. Use hand-operated equipment to stripe stop bars, crosswalks, and other areas not readily accessible to the pavement striping machine.

G. Apply the pavement striping paint at the following rates per gallon (liter):

1. Four-inch stripe (100 mm) – at least 250 but not more than 275 linear feet (meters) per gallon (liter).

2. Four-inch (100 mm) dashed stripe (9 foot [2.8 meter] stripe-15 foot [4.6 meter] gap) – at least 665 but not more than 735 linear feet (meters) per gallon (liter).

3. Four-inch (100 mm) dashed stripe (10 foot [3 meter] – 30 foot [9 meter] gap) at least 1000 but not more than 1100 linear feet (meters) per gallon (liter).

H. Apply beads at the rate of 6 pounds (kg) per gallon (liter) of paint, plus orminus 0.1 pound.

I. For quality control, the Engineer will check the application at the beginning of each day's paint striping and as often as considered necessary. If equipment settings fail to produce quality striping within the limits specified, stop striping work until corrected.

J. Protect all markings until dry by placing approved guarding or warning devices as necessary. Correct all markings smeared or otherwise damaged at no expense to the owner.

K. Sufficient quantities of paint have been included in the contract to provide for an interim application and a final application of traffic line paint. The need for applying an interim application will be determined by the Engineer.

L. When plastic pavement markings are specified, use paint for the interim markings of the specified color and apply as specified in the contract documents. The final application must be plastic.

M. Apply two (2) full applications of the specified centerline and shoulder line striping on open graded friction course and seal coat pavement surfaces meeting the following table. Apply the second application a minimum of 30 days after the first application.

PAVEMENT STRIPING – OGFC AND SEAL COATED SURFACES

Pavement Surface Type		Number of Applications*	Striping Application – Direction of Travel	
			First Application	Second Application
OGFC and Seal Coated Surfaces	2 lane 2-way	2	Not specified	Apply in opposite direction of first application
	4-way	2	Apply in same direction as traffic flow	Apply in same directions as traffic flow

*All transverse lines must receive two (2) applications applied in opposite directions.

3.3 REMOVAL OF PAVEMENT MARKINGS

A. As shown in the contract documents or directed by the Engineer, remove temporary pavement markings or markings that are no longer appropriate to the roadway.

B. Approved methods of removing markings include sand blasting with air or water; high pressure water; steam or superheated water; mechanical grinders, sanders, scrapers, brushes, burning, and the like.

C. Choose, subject to Engineer approval, the removal method best suited to the existing condition of the paint and pavement surface.

D. No other methods of removal other than those specified here will be allowed. The contractor may make written request to the Engineer for approval to use other methods, materials, or equipment. The Engineer may subsequently disapprove any prior approved method should it prove detrimental to the pavement surface or inadequate in removing the markings.

E. Remove sand or other material deposited on the pavement resulting from removing traffic markings as the work progresses. If the striping removal results in light or discolored lines on the roadway, cover the areas with a thin asphalt fog coat. Repair all damage to the pavement or surfacing caused by pavement marking removal at no cost to the owner.

END OF SECTION

SECTION 02582

REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work is furnishing and applying hot thermoplastic pavement lines, words and symbols in accordance with these specifications, the standard drawings, and meeting the lines and dimensions shown in the Project Plans.

B. Hot thermoplastic is typically applied by 3 different methods.
   1. Spraying the material onto the pavement surface.
   2. Extruding the material onto the pavement surface.
   3. Extruding the material into a groove either cut or ground into the pavement surface.

C. Method or methods of application required on the project will be specified in the contract documents.

D. Furnish thermoplastic material that is either hydrocarbon or alkyd based as specified in the contract documents. The Contractor may furnish one or the other at his option if the type is not specified. However, only one type may be used on a particular project.

1.2 REFERENCES

AASHTO M 249	Standard Specification for White and Yellow Reflective Thermoplastic Striping Material

1.3 MATERIAL ACCEPTANCE

A. Before delivering thermoplastic material to the project, furnish the Engineer copies of the manufacturer's product specification data. Material for which the manufacturer's product specification data does not meet all specified requirements will not be approved for use.

B. The Engineer may at any time request a manufacturer's sample or may take field samples at the point of application for testing purposes. The Engineer will test samples for one or any combination of specified requirements. Remove and replace material represented by a sample for which one or more test results fail to meet specified requirements.

C. Furnish the Engineer all instructions from the thermoplastic manufacturer for preparation of the surface and application of material proposed for use before application. Instructions must include, as a minimum, types of equipment, approved work methods and procedures, material application temperatures, ambient temperature and weather limitations, precautions, and all other requirements necessary for successful installation and satisfactory performance. Do not place material for which manufacturer's installation instructions are not complete or are not available.

PART 2 - PRODUCT

2.1 GENERAL

A. Furnish white and yellow thermoplastic striping material meeting the requirements of AASHTO M249 except as modified and supplemented herein.

B. Color

1. Assure the color yellow marking is reasonably close to color chip 33538 of Federal Standard No. 595A, Table 5. Quantity and type of yellow pigment is at the option of the manufacturer, providing all other requirements of this specification and AASHTO M249 are met.

2. Use yellow pigment which is heat-resistant and capable of maintaining the specified color characteristics after being heated to manufacturer's recommended application temperature.

3. Assure the color of white marking material is reasonably close to color chip 37875 of Federal Standard No. 595A, Table 9. White material cannot have any tint or coloration after weathering.

C. Glass Beads

1. Use striping material containing at least 24% by weight glass beads meeting requirements of Section 02582.2.2.A. Submit certification from the manufacturer stating this requirement is met for each batch of material used on the project.

D. Spraying Consistency

1. If the material specified on the plans is to be hot applied by spraying methods, assure the consistency of the thermoplastic material allows for excellent spraying characteristics while meeting the specified reflectivity, durability, color, chemical composition and properties, line and edge quality, tolerance, thickness, and bonding requirements as specified by the manufacturer.

2.2 HYDROCARBON BASED

A. Furnish hydrocarbon based thermoplastic striping material meeting the requirements of AASHTO M249 except as modified and supplemented herein.

B. Specific Gravity

1. Specific gravity cannot exceed 2.15. Actual specific gravity of material, as determined by test on samples, cannot vary from manufacturer's product specification by more than 0.5.

C. Composition

1. AASHTMO M249, Table 1, composition is replaced with the following:

Component	White	Yellow
Binder, Hydrocarbon Base	16.0% min.	16.0% min.
Glass Beads	24% min.	24% min.
Titanium Dioxide	a) Anatase 5.0% min.	b) Rutile 5.0% min.
Calcium Carbonate & Inert Fillers	42% max.	See note.
Yellow Pigments		See note.

a. Note: Quantity of yellow pigments and calcium carbonate and inert fillers is at the option of the manufacturer, providing all other requirements of this specification are met. Yellow pigment must be heat resistant and color stable at recommended application temperature.

b. Have the manufacturer furnish certification to the Owner that the titanium dioxide contains a minimum of 5.0% each of anatase and rutile for all batches of material used on the project.

D. Physical Characteristics

1. The following modifications are made to Section 4.3 of AASHTO M249:

a. 4.3.1 Change "2180+2C (4250+3F)" to "manufacturer's recommended application temperature".

b. 4.3.2 Change "2110+7C(412.50+12.5F)" to "manufacturer's recommended application temperature".

c. 4.3.3 Change "218C (425F)" to "manufacturer's recommended application temperature".

d. 4.3.4 Change "2180+2C(4250+3F)" to "manufacturer's recommended application temperature". Change "- 9.40+13C(1543F)" to "–20C(-40F)". Add to last sentence: "after being exposed to ambient room temperature of 20-23C (690-740F) after cooling".

e. 4.3.5. Change "2180+2C(4250+3F)" to "manufacturer's recommended application temperature".

f. 4.3.6 Softening point – After heating the thermoplastic material for four hours 0+5 min. at 2180+2C(4250+3F) and testing in accordance with ASTM D36, the materials shall have a softening point of 102.50+9.5C(2150+15F).

g. 4.3.7 Change “2180+2C(4250+3F)” to “manufacturer’s recommended application temperature”.

h. 4.3-9 Rescind this article.

i. Change “21147C(412-5412.5F)” to “manufacturer’s recommended application temperature”.

j. Change “21147C(412.50+12.5F)” to “manufacturer’s recommended application temperature” in subsection 6.1.

PART 3 - EXECUTION

3.1 GENERAL

A. Applicable requirements of Section 02581.3.2 “PAVEMENT MARKINGS AND MARKERS” apply to installation of thermoplastic striping material.

B. Perform surface preparation and material application following the manufacturer’s detailed instructions. Furnish the Engineer a copy of the manufacturer’s detailed instructions before starting work.

C. When thermoplastic markings are to be applied to existing asphalt pavement, which is open to use by traffic, place a primer or tack coat before applying thermoplastic material. Use a thin asphaltic tack completely over the surfaces of depressions or finished pavement surfaces the thermoplastic pavement markings are to be applied.

3.2 SURFACE AND TEMPERATURE REQUIREMENTS

A. Apply thermoplastic material only during optimal weather conditions, as recommended by the manufacturer.

B. The following requirements for air temperature and surface conditions apply unless otherwise recommended by the manufacturer.

C. Minimum allowable ambient air temperature required for application is 60°F (15°C). Assure the pavement surface is dry (exhibiting absolutely no dampness by the inspector’s sight/touch inspection) during application.

3.3 TEMPERATURE MONITORING

A. Assure all equipment used to melt or apply thermoplastic material has permanently attached thermometers providing a true temperature of thermoplastic contained therein. Assure monitoring devices are easily accessible and readable using a dial or other indication of the material temperature on a continuous basis.

B. When using heating equipment to pre-melt or apply thermoplastic of the oil bath heating type, provide indirect heat application to thermoplastic material that reduces risk of overheating and provides a more consistent application temperature. Assure a rotating agitator is an integral feature of pre-melt kettles to provide stirring of thermoplastic material.

3.4 APPLICATION

A. Use the method of application for thermoplastic striping material whether sprayed, top applied extruded, or inlaid extruded as recommended by the manufacturer. Finish lines, words, and symbols to meet the requirements specified herein for width, length, thickness, and edge quality.

1. Extruded (Inlaid)

a. Install thermoplastic striping material specified to be extruded and inlaid into pavement surface by sawing or grinding grooves into the finished pavement surface to dimensions and shapes specified. Assure the edges of thermoplastic markings are straight, uniform, and free of gaps between asphalt and thermoplastic that could allow water to enter beneath markings. To facilitate edge sealing, depressions for lines may be of a slightly reduced width. Assure finished extruded lines are wider than grooved widths by a ¼ inch (6.25 mm) minimum at each edge within ranges shown by the following table.

ALLOWABLE MARKING/GROOVE TOLERANCE RANGE		
Specified Width	Groove Width	Line Width
4” (100 mm)	3-3/4” – 4” (93.75mm-100mm)	4” – 4-1/2”(100mm-112.5mm)
8” (200 mm)	7-1/2” – 4” (190mm-200mm)	8” – 8-1/2” (200mm-212.5mm)
24” (600mm)	23-1/2” – 24” (590mm-600mm)	24” – 25-1/2” (600mm-638mm)

b. Groove widths as close to the plan specified widths as extrusion shoes or other devices used will produce within ranges indicated. Groove line lengths as specified in the plans and standards. Assure grooved configurations for words and symbols match those shown in FHWA’s “Standard Alphabets” manual within a tolerance of ¼” (6.25 mm) per 4 inches (100 mm) of width required at any point of the configuration but larger than depressions (using this same tolerance range for application of thermoplastic) to obtain the required edge sealing. Cover and seal all grooved edges with the thermoplastic. Sweep and blow out with compressed air all depressions or wash them clean and free of dirt, rocks, gravel, and all other foreign matter before placing the thermoplastic material. Fill grooves with thermoplastic within 24 hours after being cut into the pavement. Keep traffic off the grooves and re-clean grooves before applying the thermoplastic.

c. Groove the pavement surface and apply the thermoplastic in accordance with the manufacturer’s detailed instructions.

B. Spraying

1. Spray the thermoplastic material specified in accordance with the manufacturer’s detailed instructions.

C. Glass Bead Application

1. Immediately after application of thermoplastic material, apply an additional quantity of glass beads by drop-on methods at 6 lbs. (2.7ko) minimum per 100 sq. ft. (30 sq. mtrs.) of thermoplastic material applied.

2. Increase the bead application rate as directed by the Engineer.

D. Protection of Markings

1. Protect newly applied pavement markings from tracking during the setting period specified in Article 4.3.2 of AASHTO M249 using traffic control devices.

3.5 DIMENSIONAL TOLERANCES

A. Finish the markings to have a uniform cross section of the thickness specified. Thickness specified in the contract documents is minimum hardened thickness. Assure lines have a sharp cutoff on both sides at each end and at all edges for words and symbols. Assure lateral widths to be used for lines are within the ranges shown by the Allowable Marking/Groove Tolerance Range table in Section 02582 of these specifications. Once actual widths to be used are selected, assure they are consistent and uniform throughout the project for each width used. Lateral tolerance cannot be greater than ¼ inch (6.25 mm) of actual widths selected for use by the Contractor and approved by the Engineer. Assure specified broken line patterns have a linear tolerance of 6 inches (150 mm) over each cycle.

3.6 PLASTIC PAVEMENT MARKING JOINTS

A. Apply hot extruded thermoplastic to provide the minimum number of joints possible.

B. Transverse markings can have a minimum of one joint per line.

C. Apply words and symbols without joints within each symbol or letter of the word except those letters made with one or more straight lines (A,L,N,T etc.) and combination arrows (through and right or through and left, etc.). Those letters may be applied with one pass per leg. Combination arrows may be applied with one pass for each arrowhead of the marking.

D. Place longitudinal lines of 4-inch (100 mm) and 8-inch (200 mm) width (generally those approximately parallel to the road centerline) in one pass without longitudinal or cross-joints. Cross joints are acceptable only if lines exceed 100 feet (30 meters) in length, or for shorter lines which require a change of direction necessitating an adjustment for the path of application equipment.

E. Extrude all lines of 24-inch (600 mm) width with one pass of application equipment, without longitudinal joints, and with a maximum of one transverse joint unless directed otherwise by the Engineer.

F. If joints are necessary, make them have a neat professional appearance without gaps or unevenness and completely seal the joints from moisture penetration.

3.7 PATCHING

A. Areas of markings requiring repair or patching may have thermoplastic from that same batch used for original application applied either mechanically or by hand and beads reapplied. Assure the finished appearance matches the original extrusions and is within the shape of markings specified.

3.8 CLEANING AND TRIMMING OF MARKINGS

A. Irregularities of markings may be removed by methods that do not chip, crack, or otherwise damage the marking itself or cause de-lamination of the thermoplastic. Use the methods recommended by the manufacturer without damaging the asphalt or thermoplastic.

END OF SECTION

SECTION 02660

WATER DISTRIBUTION

1.4 STANDARD DRAWINGS

Delete: Standard Drawing No. 02660-3, Thrust Blocking for Water Main Valves
Delete: Standard Drawing No. 02660-4, Fire Hydrant Setting
Delete: Standard Drawing No. 02660-5, Hydrant Location Detail
Delete: Standard Drawing No. 02660-6, Water Service Line
Delete: Standard Drawing No. 02660-7, Blowoff Valve
Add: City of Bozeman Standard Drawing No. 02660-3, Thrust Blocking for Water Main Valves
Add: City of Bozeman Standard Drawing No. 02660-4, Fire Hydrant
Add: City of Bozeman Standard Drawing No. 02660-5, Hydrant Location Detail
Add: City of Bozeman Standard Drawing No. 02660-6, Water Service Line
Add: City of Bozeman Standard Drawing No. 02660-7, Typical Blowoff
Add: City of Bozeman Standard Drawing No. 02660-8, Hydrant Barrier Posts
Add: City of Bozeman Standard Drawing No. 02660-10, Typical Valve/Tee Restraint
Add: City of Bozeman Standard Drawing No. 02660-11, Water Main Crossing Below Existing Sewer Main
Add: City of Bozeman Standard Drawing No. 02660-12, Water Service Line, 4" and Larger
Add: City of Bozeman Standard Drawing No. 02660-12A, Typical Riser Configuration
Add: City of Bozeman Standard Drawing No. 02660-13, Standard Fire Service Line Installation, Class I, II, and III Systems
Add: City of Bozeman Standard Drawing No. 02660-14, Standard Fire Service Line Installation, Class IV and V Systems
Add: City of Bozeman Standard Drawing No. 02660-15, Water Service Line from Curb Stop to Building (Lines 2" and Smaller)
Add: City of Bozeman Standard Drawing No. 02660-16, Water and Sewer Main and Services Location Standards
Add: City of Bozeman Standard Drawing No. 02660-17, Water Service Interior Clearances
Add: City of Bozeman Standard Drawing No. 02660-18, Irrigation Meter Pit, ¾" or 1"
Add: City of Bozeman Standard Drawing No. 02660-19, Irrigation Meter Pit, 1 ½" or 2"

2.2 PIPE MATERIALS

B. Ductile Iron Pipe

1. ***Revise as follows:*** Furnish Class 51 wall thickness meeting AWWA C151, American National Standard for Ductile Iron Pipe for 12" diameter pipe and smaller. For pipe sizes greater than 12", furnish as specified in the contract documents.

2. ***Revise as follows:*** Use underground pipe having mechanical or push-on joints meeting AWWA C111. Use underground fittings having mechanical joints meeting

AWWA C111. Use restrained joint pipe for all stream crossings and for pipe installed in casings. If restrained joints at fittings are required, use Megalug mechanical joint restraint or Megaflange restrained flange adapter, manufactured by EBBA Iron Sales, or Uni-flange Series 1400 retainer glands, manufactured by Ford Meter Box Company, MJ Field Lok® Series DI, manufactured by US Pipe, Field Lok® 350 Gaskets for push-on joints, manufactured by US Pipe, Sigma One-Lok Series SLD manufactured by Sigma Corporation, or approved equal.

4. Fittings ***Delete the use of gray-iron fittings, add the following requirements:***

All fittings must be manufactured in accordance with applicable AWWA standards at ISO 9001-2000 approved manufacturing facilities. These manufacturing facilities must be covered under periodic audits by third party accreditation bodies for evaluations. These evaluations shall include manufacturing processes, quality control, corrective and preventative actions, and document control. In addition, distribution centers must be audited by Third Party Approval Agencies for periodic confirmation tests and surveillance audits. These periodic confirmation tests and surveillance audits shall document continuation of product approvals by auditing the entire quality systems including design, infrastructure, system implementation, distribution, training, quality control and assurance, and document control. All fittings must be manufactured in accordance with NSF 61.

5. Joints

a. ***Revise as follows***: Assure the fitting interior is cement mortar lined meeting AWWA C104, or fusion-bonded epoxy lined meeting ANSI/AWWA C116/A21.16. Assure the fitting exterior is bituminous tar coated 1 mil thick or fusion-bonded epoxy lined meeting ANSI/AWWA C116/A21.16. Use compact fittings having a rated working pressure of 350 psi following manufacturer recommended laying lengths.

6. Couplings ***Delete the use of cast iron or gray iron sleeves. Add the following requirements:***

a. 4) Furnish one of the following copper to copper compression connection couplings: Mueller H15403; Ford C44-xx-Q style; or AY McDonald 4758Q for 3/4", 1", 3/4" x 1", and 1" x 1 1/2". No connection couplings are permitted from the corporation stop to the curb stop for ¾" and 1" services.
5) Hymax® couplings shall not be used.

C. Polyvinyl Chloride (PVC) Pressure Pipe ***Delete the use of this pipe material for water lines***

D. Concrete Cylinder Pipe ***Delete the use of this pipe material for water lines***

E. Water Service Pipe ***Revise this section as follows:***

1. Use copper or ductile iron pipe in water service line construction as specified in the contract documents and meeting the following specifications.

   a. Furnish service pipe of the size or sizes specified. A water line is designated a service line or water main based on its use, not its size. Generally, a line serving a single building or facility is considered a service line; a line serving more than one building, or intended to serve more than one building or facility is generally designated a water main. The standard sizes of services are 3/4", 1", 1½", 2", 4", 6", or 8". The minimum size of a fire service is 1".

   b. Unless otherwise shown on the plans, furnish and install the service pipe from the main to 8 feet past the property line with a curb stop and curb box installed 8 feet past the property line. Install the water service lines in accordance with City of Bozeman Standard Drawings 02660-6 and 02660-12 and where applicable with "City of Bozeman Fire Service Line Standard", City of Bozeman Standard Drawings 02660-13 and 02660-14.

   c. Copper Service Pipe

      1) Use copper, type K annealed, meeting AWWA Standard C800. Use straight lengths for 1.5” and 2” services.

   d. Polyethylene Service Pipe ***Delete the use of this pipe material for permanent water lines.***

   e. Ductile Iron Pipe

      1) Use ductile iron pipe for water service lines that are 4" in diameter or larger. Furnish ductile iron pipe which conforms to the requirements of Section 02660.

2.3 TAPPING SLEEVES AND VALVES: ***Revise this section as follows:***

A. Tapping sleeves shall be ductile iron or stainless steel, split-sleeve, mechanical joint type with end and side gaskets. They shall have a Class 125, ANSI B16.1 outlet flange. They shall be rated for a minimum of 200 psi working pressure and shall contain a threaded plug for testing purposes on the neck or body of the tapping sleeve. Gaskets shall be manufacturers' standard suitable for use in potable water systems. Bolts and nuts shall be Cor-Ten, Dura-Bolt, or stainless steel. The sleeve shall be as manufactured by Mueller Company, Model H-615 or H-304, or as manufactured by Romac Industries, “SST” Stainless Steel Tapping Sleeve with ductile iron flanged outlet; unless otherwise approved by the City of Bozeman.

B. Tapping valves shall be as specified in Section 02660 2.8 A. 3, with flanged inlets compatible with the flange of the tapping sleeve and mechanical joint outlet. Tapping valves shall be iron body, bronze mounted gate valves with non-rising stems with design, construction and pressure rating conforming to AWWA Specification C509. Stem seals shall be double "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure in full open position.

C. The tapping sleeve and valve shall be furnished and installed by the Contractor and the wet tap made by the City of Bozeman Water Department with the cost paid by the Contractor. The Contractor shall excavate the existing main at the location to be tapped to confirm the appropriate pipe dimensions prior to ordering the fittings. The tapping sleeve shall be installed with the outlet set on the horizontal plane. A concrete thrust block shall be installed behind the tee.

2.4 CORPORATION STOPS ***Revise this section as follows:***

1. Furnish 300 psig ball valve brass corporation stops with inlet end to suit tapping requirements and conductive compression connection outlet for type K copper tubing. Furnish either Mueller B25008, Ford FB1000-x-Q, or A.Y. McDonald 4701BQ corporation stops.

2.5 SERVICE CLAMPS ***Revise this section as follows:***

1. Furnish flat, double strap, bronze metal service clamps (service saddles) with Neoprene gaskets and corporation stop threads. Use Mueller BR 2 B Series, Ford 202B, or AY McDonald 3825.

2.6 CURB STOPS ***Revise this section as follows:***

1. Furnish curb stops with ball type curb valves with Minneapolis pattern screw box mounts for 3/4", 1", 1½", and 2" services, with 90º open to close operation. Furnish curb stops that conform to the following:

Service Size	Curb Valve and Curb Stop
3/4"	Ford Ball Valve Curb Stop B44-333-M-Q 1½" Minneapolis Thread, Mueller B-25155 1½" Minneapolis Thread, or A.Y. McDonald 6104Q, part number 4182-035
1"	Ford Ball Valve Curb Stop B44-444-M-Q 1½" Minneapolis Thread, Mueller B-25155 1½" Minneapolis Thread, or A.Y. McDonald 6104Q, part number 4182-192
1½"	Ford Ball Valve Curb Stop B44-666-M-Q 2" Minneapolis Thread, Mueller B-25155 2" Minneapolis Thread, or A.Y. McDonald 6104Q, part number 4182-137

2" Ford Ball Valve Curb Stop B44-777-M-Q 2" Minneapolis Thread, Mueller B-25155 2" Minneapolis Thread, or A.Y. McDonald 6104Q, part number 4182-081

2.7 CURB BOXES ***Revise this section as follows:***

1. Furnish Minneapolis pattern base, extension type curb boxes having 7 foot extended lengths. Provide 5-foot stationary rods in all curb boxes. Use the following curb boxes:

   ¾" and 1" Curb Stops:
   Mueller H10388 curb box 1 ¼" top with a 2 ½" base tapping (with a 2 ½" x 1 ½" standard black hex bushing a 5/8" stationary rod)
   Ford EM2-70-58 curb box 1 ¼" top with a 2 ½" base tapping (with a 2 ½" x 1 ½" standard black hex bushing a 9/16" stationary rod)

   1 ½" and 2" Curb Stops:
   Mueller H10304 curb box 2" top with 3" base tapping (with a 3" x 2" standard black hex bushing and ¾" stationary rod that fits with 2" top section) or A.Y. McDonald Model 5624

2. Center and place the top section of a valve box with lid over all curb boxes that fall within asphalt pavement.

2.8 VALVES

A. Gate Valves ***Revise this section as follows:***

3. Gate valves shall be used for all lines from 4" up to and including 20". Furnish gate valves for underground installation equipped with a 2-inch square operating nut for key operation. All valves are to open counterclockwise. Valves are to be equipped with mechanical joints for pipe connections. Furnish Mueller 2360 valves or American Flow Control Series 2500 Ductile Iron Resilient Wedge Gate valves for sizes 12" and smaller, and Mueller 2361 or American Flow Control Series 2500 Ductile Iron Resilient Wedge Gate valves for sizes 14" to 20", or American AVK Series 65 Ductile Iron Resilient Wedge Gate Valves for sizes 4" through 12", Series 45 for 14" and 16" valves, and Series 55 for 18" and 20" valves, or Kennedy 8572/8571 for 12" and smaller and 7572/7571 for 14" to 20". Bolts and nuts for the stuffing box, wrench nut cap screw, and bonnet shall be Type 304 stainless steel.

B. Butterfly Valves ***Revise this section as follows:***

1. Furnish Class 250, rubber seated, butterfly valves for water distribution systems sized 24" and larger, meeting AWWA C504 requirements. Valves to

be equipped with mechanical joint ends and lubricated screw type operators designed for underground service. Furnish butterfly valves by Mueller, Kennedy, ValMatic Series 2000, or M&H. All fasteners shall be Type 304 stainless steel.

Add the following section:

C. OS & Y Valves

1. For service lines 4" and larger, furnish a UL listed flanged Kennedy, American Flow Control, or Mueller OS & Y valve as the first fitting inside the building. For fire service lines 2" and smaller, furnish a NIBCO T-104-0 OS & Y valve as the first fitting inside the building. Bolts and nuts for the stuffing box, wrench nut cap screw, and bonnet shall be Type 304 stainless steel.

2.9 VALVE BOXES ***Add the following requirement:***

B. Valve boxes shall be East Jordan Iron Works 8560 series. Valve box lids for fire service lines shall be East Jordon Iron Works Product Number 06800029 or approved equal.

2.10 FIRE HYDRANTS ***Revise this section as follows:***

B. Furnish hydrants with 5¼" valve openings, flanged inlet, one 5" storz connection and two 2½" hose connections. Storz connectors to be by Harrington Company. Assure hose nozzle threads meet ASA Specification B26 for National Standard Fire Hose Coupling Screw Threads, 7½ threads per inch. Furnish National Standard operating nut. Furnish hydrants opening counterclockwise and having an arrow on the hydrant top designating the opening direction.

D. Paint the hydrant portion above the ground line red. Furnish hydrants so that there is a minimum of 6½' of cover over the hydrant lead unless specified otherwise on the approved plans. Furnish Mueller Super Centurion 250 model hydrants or Waterous 5 ¼" Pacer model hydrants per Water Department specifications, or American AVK Series 2780 Nostalgic Fire Hydrant, or Kennedy K81D hydrant. Furnish Mueller Defender Security Device, with locks keyed to City of Bozeman Standard, for each hydrant installed.

Add the following section:

2.13 METER PITS

A. Meter pit installations may be allowed for certain service lines such as for irrigation systems. The use of meter pits must be specifically approved by the Water Superintendent. If the use of a meter pit is allowed, the following Manufacturers are approved: Mueller, AY Mc Donald, and Ford. The Meter

Department shall approve specific models proposed for use on a case-by-case basis.

Add the following sections:

2.14 "NO-LEAD" BRASS

A. Brass components of waterworks materials in contact with potable water shall be of No-Lead Alloy (UNS/CDA No. C89833). Components that do not come in contact with potable water shall be UNS/CDA No. C83600-85-5-5-5 and shall conform to AWWA Standard C800 (ASTM B-62 and ASTM B-584).

2.15 INSULATION

A. Insulation for water pipelines shall be expanded polystyrene rigid board foam plastic with a compressive strength of 60 psi at 10% deformation, minimum.

3.2 PIPE INSTALLATION FOR WATER MAINS

C. Laying of Pipe ***Revise as follows:***

10. Construct reaction or thrust blocks at all tees, tapping tees, plugs, valves (except tapping valves and hydrant auxiliary valves that are part of a hydrant assembly), reducers, caps, vertical bends, and at horizontal bends deflecting 22½° or more. Limit using metal rods or straps for thrust restraint to those specified on the plans, or where the use of concrete thrust blocks would be impractical. Do not use metal rods or straps unless specifically approved by the City of Bozeman. Construct reaction blocks from concrete having a minimum compressive strength of 3,000 pounds per square inch at 28 days. Place blocking between undisturbed ground and the fitting to be anchored, as shown on Standard Drawing 02660-1. The size of thrust (gravity) blocks for vertical bends will be as designed by the Engineer. Place the blocking so that pipe and fitting joints are accessible for repair.

    In lieu of concrete thrust blocks, thrust restraint may be provided utilizing Megalug® , Uni-Flange™ , MJ Field Lok® Series DI, Field Lok® 350 Gaskets for push-on joints, manufactured by US Pipe, Sigma One Lok Series SLD manufactured by Sigma Corporation, or approved equal joint restraints, for all fittings that require thrust restraint, except for cut-in or tapping tees (for mains or services) and bends on service lines inside building foundations, unless specifically prohibited by the City of Bozeman. Install the mechanical restraints in accordance with manufacturer's specifications and at all joints as specified by the Engineer.

D. Pipe Jointing

1. Rubber Gasket, “Push-On” Joints ***Add the following requirement:***

b. All sections of newly installed water main shall provide continuity for electrical current. In order to provide continuity, insert a minimum of three brass or bronze conductive wedges in the joints of ductile iron pipe. Insert a copper wedge between cast iron and ductile iron pipe joints in accordance with manufacturer's recommendations. Conduct a continuity test of new mains when required by the Engineer or City of Bozeman.

3. Connections to Existing Mains ***Add the following requirements:***

c. All wet taps to water mains in use shall be made by the City of Bozeman Water Department at the expense of the Contractor. All dry taps or connections shall be made by the Contractor. Any new or existing valve which controls water in the municipal system shall be operated by City of Bozeman personnel only. The Contractor shall pressure test tapping tees prior to tapping by the Water Department. The tapping tees shall be hydrostatically pressurized to a minimum pressure of 200 psi, and the testing apparatus shall be in place for verification by the Water Department tapping personnel.

d. The Contractor is responsible for 24 hour advance notification, in writing, to all affected customers of a water main shut-down. The written notification is to include the date, time and estimated duration of interrupted service. The written notification is also to include the name and phone number of the Contractor's representative who is coordinating the shut-down as well as the phone number of the City of Bozeman Water Department. All commercial customers affected by the water main shut-down must sign a notification sheet acknowledging that they have been informed of the date and time of the shut-down. The City of Bozeman reserves the right to determine the likely duration of the main shut-down based on the proposed work and Contractor experience, and require the installation of temporary water services by the Contractor.

e. Clean and disinfect temporary water systems in accordance with the requirements for cleaning and disinfecting new water mains. Do not connect existing services to the temporary system until bacteriological tests show successful disinfection. Provide backflow protection at the point of connection of the temporary system to the municipal system, and at each point of connection of the temporary water system to the individual services.

f. Remove any existing blow-offs or temporary flushing hydrants upon completion of the connection to the existing main, and install a brass plug upon removal of the corporation stop.

Add the following section:

D. Pipe insulation

1. If the Water Superintendent has allowed water pipe to be installed with less than 6.5 feet of cover, provide insulation as directed by the Engineer.

2. Provide insulation as directed by the Engineer where water pipes cross any storm drains or culverts.

3.3 POLYETHYLENE ENCASEMENT

A. ***Revise this section as follows***: Polyethylene encasement or other corrosion protection is not required unless corrosive soils are encountered or anticipated. When specified for corrosion protection, wrap all direct bury cast or ductile iron pipe and fittings including hydrants, valve boxes, curb boxes, and all other metal parts and surfaces, in polyethylene encasement.

B. Polyethylene encasement for use with ductile iron pipe shall meet all the requirements for ANSI/AWWA C105/A21.5, *Polyethylene encasement for Ductile Iron Pipe Systems*, and shall be V-Bio™ Enhanced Polyethylene Encasement.

C. The polyethylene encasement shall be overlapped one foot in each direction at joints and secured in place around the pipe, and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

Add the following new section:

3.3.5 DETECTABLE BURIED WARNING TAPE

A. Install detectable warning tape centered over all water mains, service lines, and hydrant leads. Install tape a minimum of 18” and maximum of 24” below finish grade.

3.4 TESTING, CLEANING & DISINFECTING WATER MAINS, VALVES & FITTINGS

A. Hydrostatic and Leakage Testing

1. ***Add the following:*** The required minimum hydrostatic pressure for any test is 200 psi.

2. ***Add the following:*** Assure that the testing gauge is marked in increments no greater than 10 psi.

4. ***Revise this section as follows:*** Conduct the leakage test concurrently with the hydrostatic pressure test for 2 hours. Leakage is defined as (1) the quantity of water supplied into the pipe, or any valved section thereof, necessary to maintain pressure within 5 PSI of the specified test pressure (after the pipe has been filled with water and purged of air) for the duration of the 2 hour test period, and (2) the quantity of water supplied into the pipe, or any valved section thereof, required to return the pressure to the specified test pressure at the end of the 2 hour test period.

Add the following requirements:

11. Chlorination, testing, and sampling shall comply with AWWA Standard C651-92. There shall be no allowable leakage for resilient seat gate valves. At least 24 hours prior to beginning water main tests, a testing schedule shall be submitted by the Contractor to the City Engineering Office for approval. The schedule shall specify the proposed sequence of testing and the methods and procedures which will be used to complete the tests. Hydrostatic and leakage testing shall not be conducted concurrently with chlorination of water mains. All heavily chlorinated water must be flushed from the system prior to pressurizing the new mains.

12. Any existing or new water main valves which are used to take water from the City of Bozeman distribution system for the purpose of filling, testing, chlorination or flushing, shall be operated by the City of Bozeman Water Department personnel only, with the Contractor requesting such operation at least 24 hours in advance. All existing water main valves are to be operated only by City of Bozeman Water Department personnel.

13. Allow five days after placement of concrete for thrust blocks before performing hydrostatic or leakage testing. If high-early strength concrete is used, allow two days after placement of concrete before performing hydrostatic or leakage testing. Provide adequate cold blocking as required for all thrust blocks that will not have the necessary curing time prior to testing.

14. For sections of mains that cannot be hydrostatically tested, assure that all joints are visually inspected for leakage under line working pressure by City of Bozeman representative prior to backfilling.

B. Cleaning Water Mains ***Add the following requirements:***

5. Prior to any main flushing the City of Bozeman Engineering Office shall be notified and provided with a flushing schedule and plan a minimum of 24 hours in advance of any main flushing. The City of Bozeman Fire Department shall be allowed adequate access to conduct pressure and flow testing of fire hydrants during the flushing process.

6. Any existing or new water main valves which are used to take water from the City of Bozeman distribution system for the purpose of filling, testing, chlorination or flushing, shall be operated by the City of Bozeman Water Department personnel only with the Contractor requesting such operation at least 24 hours in advance. All existing water main valves are to be operated only by City of Bozeman Water Department personnel.

7. Install an adequately-sized corporation stop on all main stubs longer than 10 feet to allow for the flushing of the stubs (see Table 1 MPW Section 02660). Following completion of all tests, remove corporation stops, install brass plugs, and assure plugs do not leak after main has been charged. A representative from the City of Bozeman must witness this work.

C. Disinfecting Water Mains

3. Methods of Chlorination

a. 1) Tablet Method ***Revise this section as follows:***

a) The tablet method consists of placing calcium hypochlorite granules (tablets shall not be used) in the water main as it is being installed and then filling the main with potable water when installation is completed. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

b) Placing of calcium hypochlorite granules. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-foot intervals. The quantity of granules shall be as shown in Table 2.

c) Warning: This procedure must not be used on solvent welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

d) When installation has been completed, fill the main

with water at a velocity not exceeding 1 fps. Take precautions to assure that air pockets are eliminated. Leave this water in the pipe for at least 24 hours. If the water temperature is less than 41°, leave the water in the pipe for at least 48 hours. Position valves so that the chlorine solution in the main being treated will not flow into water mains in active service.

TABLE 2
OUNCES OF CALCIUM HYPOCHLORITE GRANULES TO BE PLACED AT BEGINNING OF MAIN AND AT EACH 500-FT INTERVAL

Pipe Diameter (d) (in.)	Calcium Hypochlorite Granules (oz.)
4	1.7
6	3.8
8	6.7
10	10.5
12	15.1
14 and larger	D^2 x 15.1

Where D is the inside pipe diameter in feet D = d/12

D. Bacteriological Tests

1. ***Revise this section as follows:*** After final flushing and before the water main is placed in service, test a sample, or samples, collected from the main(s) for turbidity and organisms. Collect at least one sample for every 1200 feet of new main and from each branch.

   a. Once the water main has been flushed following the successful completion of chlorination and pressure testing, the water line must be refilled with water and allowed to sit a minimum of 24 hours prior to the collection of samples for bacteriological tests. A second set of samples is to be taken a minimum of 24 hours after the first set of samples. Samples shall be taken in accordance with AWWA Standard C651-92. New water mains shall be placed in service by City of Bozeman personnel only.

   b. Collect samples from new water mains out of service lines or temporary taps. Samples may only be taken out of fire hydrants or flushing hydrants if approved in advance by the City of Bozeman. If hydrants are approved as sample locations, operate hydrants using the auxiliary valves or curb stops to prevent groundwater from entering hydrant. Assure that hydrants are kept from freezing during testing.

   c. Following the completion of bacteriological tests, assure that all

temporary piping has been removed, and all temporary corporation stops have been removed and replaced with brass plugs.

3.6 VALVES

A. ***Add the following requirement:*** For butterfly valves, set the operating nut on the west side of mains that run north-south, and on the north side of mains that run east-west.

C. Valve Thrust Blocks

1. ***Revise this section as follows:*** Install valves with thrust blocks and anchor rods meeting City of Bozeman Standard Drawing 02660-3 requirements. Thrust blocks are required on all valves size 6" and larger, except for tapping valves and hydrant auxiliary valves attached to the hydrant shoe flange. In lieu of concrete thrust blocks, thrust restraint may be provided utilizing Megalug®, Uni-Flange™, MJ Field Lok® Series DI, or approved equal joint restraints.

3.7 FIRE HYDRANTS

B. ***Revise this section as follows:*** Provide drainage at the hydrant base by placing clean gravel under and around it. Place gravel at least 1 foot on all sides from the base of the hydrant to at least 6 inches above the drain opening. Brace the hydrant against undisturbed earth at the trench end with concrete backing as detailed on the plans. In lieu of concrete thrust blocks, thrust restraint may be provided utilizing Megalug® , Uni-Flange™ , or approved equal joint restraints. Furnish hydrants with the specified gate valves. Install hydrants meeting City of Bozeman Standard Drawings 02660-4 and 02660-5. Where no curb exists or the minimum distance of three feet behind the curb cannot be met or there is no other adequate protection, install protective barrier posts in accordance with City of Bozeman Standard Drawing 02660-8 when required by the Water Superintendent. Protect the hydrant from damage during installation and backfilling operations. Hydrants may be subject to replacement by the Contractor if any of the protective paint coating is damaged during installation. If hydrant extensions are required, only one coupler will be allowed on the operating rod.

3.8 SERVICE LINE INSTALLATION ***Revise this section as follows:***

A. Provide all work and materials for the complete service line installation, including trench excavation and backfill; making the water main tap; furnishing and installing the corporation stop, curb stop and box, service clamp where necessary, and service line with fittings as required to make the connections to the stops. Provide a minimum of 6½ feet and a maximum of 8 feet of cover measured as noted on City of Bozeman Standard Drawing No. 02660-6. Use compression fittings for all service line fittings. Do not use sweat or solder fittings. Use a continuous length of pipe with no couplings between the corporation stop and the curb stop for 3/4" and 1"

services.

B. Mark the water service line stub end using a steel fence post painted blue, 6.5 feet long, buried 2.5 feet in the ground. Set post 1' from curb box. After bacteriological tests have passed and the test results have been submitted to the Water Department, open all curb stops in the presence of the Engineer to assure the service lines are flushed and all corporation stops are open. All main line valves are to be operated by Water Department personnel only.

C. Service line installation from the end of the stub into the building shall be as per City of Bozeman Standard Drawings 02660-12 or 02660-15. Service lines shall not be installed from the end of the stub into the building until the main line has been accepted by the City and placed into service. The water service line from the stub into the building may be reduced in size, however the size reduction must be made within 18" of the curb stop or outside valve. Connections to existing stubs (either for domestic or fire service) that have remained dormant or unused longer than 6 months may require re-flushing or disinfection at the discretion of the Water Superintendent prior to being placed into service. The Water Superintendent may require bacteriological testing to assure that the dormant line has not become contaminated.

3.9 TAPPING ***Revise this section as follows:***

A. Tap the newly installed water mains unless specified otherwise. Provide a minimum distance of 18" between service taps. The City of Bozeman Water Department will tap any existing water mains. For taps on existing mains, the Contractor is responsible for scheduling and coordinating with the Water Department. The Contractor will be charged a fee for each tap made by the Water Department. All taps on existing mains require tapping saddles and corporation stops to be supplied and installed by the Contractor prior to tapping of the main by the Water Department.

B. Perform tapping using an approved tapping machine using clean, sharp drill taps and/or shell cutters. 3/4-inch and 1-inch taps may be made directly into the barrel of ductile iron pipe without using service saddles. Direct tap into the pipe barrel to the depth exposing a maximum three threads of the corporation stop. Taps greater than 1" on a 6" line require the use of saddle clamps. Taps 4" and larger to existing water mains which are 4" and larger require the use of a tapping sleeve and valve.

SECTION 02661

HORIZONTAL DIRECTIONAL DRILLING

Part 1 – General

1.1 DESCRIPTION AND BACKGROUND

This specification section describes the requirements for the installation of one Ductile Iron carrier pipe as shown on the construction drawings using the trenchless construction process called Horizontal Directional Drilling (HDD). The Contractor shall provide all labor, machinery, construction equipment, and materials to perform in a good workmanlike manner all items herein specified. The purpose of the direction drilling is to avoid impacts to existing tree roots. The actual configuration and required length will be determined during construction and coordinated with the Contractor, MSU and the Engineer.

Work to be done by the Contractor shall include, but not be limited to, the following items:

1. Comply with all other requirements of the Plans, Specifications, and Contract Documents.
2. Transport all equipment, labor, consumables, and materials to and from the job site; Prepare the site including drive and reception areas as defined on the drawings and specified herein;
3. Supply, installation, and testing of Horizontal Directional Drilling Methods approximately on the bore path shown on the attached plan and profile drawing. The actual length of pipe shall be shortened or extended, as necessary to complete the temporary above ground end extensions used for installation and testing. Perform Horizontal Directional Drilling operations including the drilling of pilot hole, reaming of pilot hole to a suitable diameter for the installation of the casing pipe as specified on the drawings, and pull-back of the welded steel casing pipe. The carrier pipe and casing spacers will then be threaded though the casing pipe.
4. Supply and install all other pipeline section using traditional open-trench methods.
5. Utility Locate and exposure during HDD drilling as required.

1.2 SCHEDULE OF WORK

a) The Contractor shall grade the boring pad and surrounding area to provide a foundation for the drilling equipment and drill mud collection area. Erosion control measures will also be installed.
b) A temporary pipe launcher/roller system (or equal) and pipe launching equipment will be laid out and constructed by the Contractor.
c) The Contractor will string out casing pipe in a line south of the pipe entrance point. The pipe segments will be field welded. Pipe will be supported on rollers or other acceptable support devices to prevent scraping and gouging of the pipe as it is installed.
d) After drilling the pilot bore and reaming the bore out to the necessary diameter, the casing pipe will be pulled back into the bore hole to the beginning end of the installation. Once pipe pullback operation has begun, it will be continued until completion without stopping.
e) After the casing pipe is placed, the carrier pipe and casing spacers will be pulled though the casing pipe and end sections will be installed.
f) Cleanup and demobilize drilling equipment from the site.
g) Complete pipeline installation work at either end of the newly installed casing pipe.

1.3 QUALIFICATIONS

The Contractor's project manager, superintendent and driller operator assigned to this project must be experienced in work of this nature and must have successfully completed similar pressure pipeline projects using Horizontal Directional Drilling. These personnel must have completed at least three (3) projects of similar difficulty and magnitude to the proposed work.

The steel Welder shall be certified by a CWI for each process or procedure performed. The welding equipment, welding monitoring, and testing devices shall each have been recently calibrated, and evidence of such calibrations shall be provided to the Engineer for review and approval.

1.4 GENERAL REQUIREMENTS

Horizontal Directional Drilling is a trenchless excavation technique for installing pipelines and conduits in two phases. The first phase consists of drilling a small diameter pilot hole along a designed directional path. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the pipe or conduit, and pulling the pipe or conduit into the enlarged hole. The method is accomplished using a surface launched horizontal directional drilling rig and ancillary tools and equipment.

The drill string shall create a pilot bore hole in an essentially horizontal path which shall subsequently be enlarged to a larger diameter during a secondary operation. Subsequent operations could include multiple hole enlargements in steps and pullback of the product pipe. Tracking of the initial bore path shall be accomplished by an electronic guidance system located in the drill head and transmitting location information through a wire to the drill operator's console. A manually operated overhead receiver shall not be considered as an acceptable alternative for this installation. Steering shall be achieved by controlling the orientation of the drill head which has a directional bias and pushing the drill string forward, without rotation, with the drill head oriented in the desired direction. Continuous rotation of the drill string shall allow the drill head to drill a straight path. The procedure shall use fluid jets or mechanical cutting or both with a low, controlled flow rate of drilling fluid to minimize the creation of voids during the pilot hole drilling and back reaming operations. The drilling fluid shall consist of bentonite clay and water mixture, or approved alternative, which shall stabilize the drilled hole, remove cuttings, cool the drill bit and electronics, and lubricate the hole for the drill bit, drill string and product pipe. The resultant slurry shall surround the pipe, filling the annulus between the pipe and the drilled hole.

The Contractor shall assume all responsibility for his methods of construction, the stability and accuracy of the drilled and reamed hole and pits constructed by him, and all costs for damages resulting from any failure thereof. The Contractor shall be solely responsible for the safety of the pits and related structures, and personnel engaged in underground construction throughout the duration of the work.

The Contractor's methods and schedule shall consider the overall project requirements, anticipated ground condition, and water conditions. The Contractor selection of inadequate, inappropriate, or inefficient equipment and methods shall not be cause for adjustments to the Contract Price or Contract Time.

The general dimensions, arrangement, and details for the drilled hole to be constructed shall be as indicated on the Contract Drawings. Methods of excavation, equipment and procedures for the horizontal directional drilling operation and pits shall be selected by the Contractor to provide adequate working space and clearances for the work to be performed. Pit excavation methods, ground water control and pit support techniques shall be selected by the Contractor. The Contractor shall be responsible for cleanup and disposal of all remaining imported or excavated spoils, trash, and debris to a legally acceptable disposal location, as approved by the Engineer.

1.5 UTILITIES

Contractor shall be required to locate all utilities prior to start of excavation or drilling. All utilities crossed or approached within 24 inches in a lateral direction must be exposed to verify location. In addition, visual verification shall be required that the drill, reamer, or product pipe has missed the utility as it passes in accordance with Montana State law. Damage to utilities shown on the drawings shall be the responsibility of the Contractor.

Utility lines and structures indicated on the Drawings shall remain in service at all times and shall be protected by the Contractor from any damage as a result of his operations. Where utility lines or structures not shown on the Drawings are encountered, the Contractor shall report them to the owner before proceeding with the Work. The Contractor shall bear the cost of repair or replacement of any utility lines or structures which are broken or damaged by his operations.

All Utilities in close proximity to the drill pilot bore, back ream or product pipe installation must be exposed through a "pot-hole" or other opening, in accordance with appropriate utility locating laws and regulations, to ensure, through visual inspection, that the drill, reamer or product pipe has caused no damage to the utility and maintains adequate clearance.

All underground utilities within 10 feet of the HDD drill path shall be pot-holed after ONE-CALL LOCATES mark-out and prior to pilot hole drilling. Any utility that conflicts with the proposed design shall immediately be brought to the attention of the Engineer.

There may be extensive overhead power lines in the area of work. Contractor shall visit the site prior to bidding and include the cost and effort of coordination around, or temporary relocation in accordance with Northwestern Energy requirements of any interfering power lines.

Contractor shall coordinate with and follow all requirements of Northwestern Energy to avoid damage to gas lines. Contractor shall include the cost of temporary or permanent gas line relocation in the bid amount without further cost to the owner, if required to complete the installation.

Contractor shall take the following steps prior to commencing drilling operations in a location which might contain underground facilities:

1. Contact the utility or utility location/notification service, through One-Call Locates at 1-800-424-5555 (or 811) for markout of all utilities.

2. Positively locate and stake all existing lines, cables, or other underground facilities including exposing any facilities which are located within 10ft. of the designed drilled path and any other utilities as required by the owner of those utilities.

3. Modify drilling practices and downhole assemblies to prevent damage to existing facilities.

1.6 TRAFFIC CONTROL PLAN

Contractor shall provide traffic control plans in accordance with the Montana Public Works Standard Specifications, Seventh Edition, April 2021, Shop Drawing Submittals, to the owner and Engineer, as necessary.

1.7 STAGING AREA AND EASEMENTS

Contractor shall submit an equipment staging plan to the Engineer for review with approval prior to start of construction. The contractor shall comply with all requirements of the approved traffic control plan. If any work will be conducted on property not owned by the project Owner, a written agreement or temporary easement shall be established with signed documentation provided to the Owner and Engineer prior to the start of construction.

1.8 REFERENCES

Work in conjunction with this Contract shall conform to the requirements of the MPWSS latest edition.

1.9 SAFETY, CODES, AND REGULATIONS

The Contractor shall carry out his operations in strict accordance with equipment manufacturer's safety requirements. It shall be the responsibility of the Contractor to ensure that the appropriate items of personnel protective equipment necessary for the various working conditions are available and utilized by staff and its subcontractors.

Horizontal Directional Drilling Equipment machine safety requirements will include a common grounding system to prevent electrical shock in the event of high voltage underground cable strike. The grounding system will connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats and any other interconnected equipment to a common ground. The drill will be equipped with an "electrical strike" lie and visual warning system that will notify the system operators of an electrical strike. Operators of the drill shall wear electrical shock protection equipment and operate from common ed mats as required.

All work covered by this section shall be performed in accordance with the applicable federal and state codes and laws which pertain to such work and supplemental regulations which are contained in these specifications. In case of conflict between these specifications and any federal or state laws, the most stringent shall govern.

The Contractor shall familiarize himself with, and shall at all times conform to all applicable regulations including, but not limited to:

1. The "Trenching and Excavation Safety" OSHA Document
2. Confined space entry requirements of the State of Montana and the Federal Government;
3. Other applicable laws, codes, and regulations.

1.10 SUBMITTALS

The Contractor shall submit reviewed and approved documents requested in this section for review by the Engineer. The Engineer will review all submittals for compliance with the requirements for this project. Such review does not relieve the Contractor in any way of his responsibilities under the Contract. Contractor shall not commence work on any Part or Subpart requiring a prior submission until his submittals have been reviewed and approved by the Contractor and Engineer.

A. Preconstruction Submittals

After completing a review and approval and before initiating construction, the Contractor shall conduct and/or submit the following to the Engineer for review and approval:

1. Contractor shall arrange and conduct at least one project kick-off meeting with the Engineer, subcontractors, Contractors of adjacent work, the owners of all utilities being crossed, and the Owner prior to initiation of the project.
2. Contractor shall ensure all downhole drilling components are appropriate for the work to be performed. Contractor shall provide descriptions for all downhole components prior to initiation of the project.
3. Contractor shall provide verification of downhole surveying equipment calibration prior to initiation of the project.
4. Contractor shall provide a copy of Daily Log for records to be included with the 'As-Builts' for the project.

B. Documentation During and After Construction

1. Daily Logs

Contractor shall maintain a complete set of project records. Contractor shall maintain a daily activity log during Horizontal Directional Drilling operations. A copy of the log shall be submitted to the Engineer for record purposes on a daily basis. These documents shall include but not be limited to:

a. Start and finish time of each section of drill pipe for pilot hole drilling and reaming.
b. For pilot hole drilling, drill bit location at least every 30 ft. along the drill path. Contractor will mark the as-built drawings on a daily basis with drilling progress.
c. General description for each ground condition drilled.
d. Details and perceived reasons for delays greater than one hour other than normal breaks and shift changes.
e. Details of any unusual conditions or events.

2. Record Drawings.

Contractor shall keep and maintain at construction site a complete set of field drawings for recording of as-built conditions. Upon completion of construction, Contractor shall be required to provide an as built drawing in the form of a plot of the pipe installation with reference dimensions to locations on the contract drawings. The Contractor shall sign the as-built drawings and provide to the Engineer at the end of construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drilling Fluids

The Contractor shall use a high-quality bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling and hole lubrication to reduce drag on the drill pipe and the casing pipe. Oil based drilling fluids or fluids containing additives that can contaminate the soil or ground water shall not be considered acceptable substitutes. Composition of the fluid shall comply with all federal and local environmental regulations.

Drilling fluids shall be mixed with potable water to ensure no contamination is introduced into the soil ring the drilling, reaming, or the pipe installation process.

Disposal of drilling fluids shall be the responsibility of the Contractor and shall be conducted in compliance with all relative environmental regulations, right-of-way and workspace agreements and its requirements.

Drilling fluid returns can be collected in the entrance pit, exit pit or spoils recovery pit. The Contractor shall immediately clean up any inadvertent spills or overflows from these pits.

B. Water

Contractor is responsible for obtaining, transporting, and storing water required for drilling fluids.

C. Carrier Pipe:

Furnish ductile iron carrier pipe as indicated on the plans. The carrier pipe is to be installed within the specified casing shall be equipped with restrained joint connections.

D. Casing Pipe:

Casing Pipe installed by horizontal directional drill shall be welded steel pipe conforming to ASTM A139, Grade B, 35,000 PSI minimum yield. Minimum casing pipe sizes shall be as follows based on Carrier Pipe sizing. Pipe sizes may need to exceed the minimum as necessary based on field conditions.

Carrier Pipe Size	**Casing Pipe Size (Minimum)**
4”	10”
6”	12”
8”	16”
10”	20”
12”	20”
16”	24”

E. Casing Spacers and End Seals

The HDD Contractor shall supply and deliver casing spacers and end seals. Upon installation completion of the steel casing pipe, the contractor shall furnish and install casing spacers on the carrier pipe. Casing spacers shall be spaced a maximum of 8 feet apart along the length of the carrier pipe with on casing spacer within two (2) feet of each side of a pipe joint and the rest evenly spaced. Wood skids are not an acceptable method of supporting the carrier pipe. After insertion of the carrier pipe into the casing, the ends of the casing shall be closed by installing synthetic rubber end seals.

F. Tracer Wire

Installation of tracer wire shall conform to the requirements set forth in the contract documents. Where tracer wire cannot be installed through the casing with the carrier pipe, the wire shall be welded to the casing ends to allow wire continuity.

G. Backfill Soil

Pit and "pot hole" backfill material shall comply with the MPWSS.

PART 3 - EXECUTION

3.1 MOBILIZATION AND SITE PREPARATION

The Contractor shall mobilize all necessary personnel, equipment, and materials to construct an entry area for drilling operations and exit area for drilling operations as shown on the drawings.

Contractor shall maintain safe working conditions; ensure stability of the entry, exit, settlement, and containment pits; and shall minimize loosening, deterioration and disturbance of the surrounding ground.

A. Riq Side of Crossing

The contractor shall set up his temporary work area in the staging areas designated by the Engineer.

Contractor shall develop and submit a drilling mud control plan to Engineer for approval as to how the contractor will contain and drain or pump drilling spoils from the pipe entry point for disposal or reuse. The site shall be restored to finish grade as shown the on the design drawings at the completion of the work.

B. Exit/Pipe Side of Crossing

Contractor shall not allow the uncontrolled drainage or runoff of drilling mud (slurry or bentonite etc.) to the vicinity of the pipe side exit. Contractor shall develop and submit a drilling mud control plan to Engineer for approval as to how the contractor will contain and drain or pump drilling spoils from the pipe exit point for disposal or reuse.

Collection, transport and disposal of all drilling mud and spoils shall be provided by contractor either retrieved at the drill side, pipe side, or location of any inadvertent returns and shall be completed in a manner submitted for review and after approval of the Engineer. Drilling mud and spoils shall apply be disposed of in a legal manner complying with the laws and regulations governing such disposal.

The string shall be supported off the ground on rollers or on some other non-abrasive surface such as sand bags. Pipe gouges or scrapes exceeding .01 inches in depth in the pipe shall be subject to removal from the pipe string at no additional expense to the owner.

3.2 HORIZONTAL DIRECTIONAL DRILLING

A. Directional Drilling Alignment and Profile

The plan and profile for the horizontal directional drilling operation shall be in accordance with the drawings, unless otherwise approved by the Engineer.

Contractor may submit an alternate alignment profile for consideration by the Engineer. The proposed profile must stay within the specified right of way, maintain minimum ground cover to ensure no drilling fluid breakout, maintain a minimum vertical depth beneath the terrain as shown on contract drawings.

B. Drill Entrance and Exit Angle

The ground entry point on the east end of the project shall be *at* such an angle to allow excavation and continuation of the pipeline with *a* minimum cover of 6.5-feet. Contractor may submit alternative entry method and location *for* review and approval by Engineer.

C. Pilot Hole

A smooth pilot hole shall follow the designated centerline of the pipe profile *as* shown on the contract drawings. The directional tolerance of the hole will be *as* follows:

1. Vertical tolerances - Plus or minus three (3) inches *from* the invert elevation of the pipe, *as* shown on the contract drawings.

2. Horizontal tolerances - Plus or minus six (6) inches *from* the centerline of the p pipe, *as* shown on the contract drawings.

3. Entry point location - The pilot hole shall enter the ground *from* the drive pit, *as* shown on the contract drawings.

D. Instrumentation

The Contractor shall provide downhole wireline magnetic steering equipment *for* this project with the ability to track pitch, roll, depth, and azimuth information *for real* time monitoring, tracking and surveying of the drill head. An above ground magnetic grid tracking system shall also be used to verify the downhole survey *at* minimum intervals equal to the length of one drill string segment. Engineer shall

have *access* to these instruments, readings and written output *at* all times. Surveyed as-built plan and profile shall be provided to the Owner *as* part of the work.

Contractor shall provide all conventional ground surveying required to define the above ground projected drill path and depth to required profile.

E. Reaming Operations

Reaming operation to the required hole size shall be submitted by the Contractor to the Engineer for review and approval prior to initiation of construction. Contractor shall supply to Engineer an estimate of drilling fluids to be utilized for each reaming cycle.

3.3 ENVIRONMENTAL REQUIREMENTS

The Horizontal Directional Drilling operation will be a closed system to eliminate the discharge of water, drilling mud and/or cuttings to nearby land areas involved in the construction process. Contractor shall provide equipment and procedures to maximize the recirculation of drilling mud and to minimize waste. Contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

Waste cuttings and drilling mud shall be dewatered and dried by Contractor to the extent necessary for disposal in offsite land fills acceptable to the Engineer. Water from the dewatering process shall be treated by Contractor to result in 100 percent of solids passing a No.100 sieve with subsequent discharge of the water. Contractor shall sample and test the cuttings and water for disposal daily, or more often if required by the Engineer due to failed tests.

'Blow holes' or 'breakouts' of drilling fluid to the surface must be cleaned up immediately and the surface area washed and returned to original condition. All drilling fluids, spoils and separated materials will be disposed of in compliance of local environmental regulations. If the amount of surface returns exceeds which can be contained and collected using small sumps, drilling operations shall be discontinued until surface return volumes can be brought under control. Equipment and materials for cleanup and contingencies shall be provided by Contractor and stored at the rig side of the crossing.

Construction-related activities involving fuels and lubricants such as vehicle refueling and equipment maintenance, including the draining and pumping of lubricants shall be conducted at sufficient distance from the water channel to eliminate contamination in case of a spill. Any fuels or lubricants spilled shall be cleaned up immediately to the satisfaction of the Engineer.
Immediately upon completion of work, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean, and acceptable condition.

3.4 PIPELINE ASSEMBLY AND INSTALLATION

The Contractor shall supply all necessary materials, equipment, and services to perform the pipeline assembly and installation.

A. Pipe Handling and Storage

All pipe and fittings shall be prepared for standard commercial shipment. Care shall be taken during shipment, delivery, and storage to prevent cuts, scratches, and other damage. All piping used on the project shall be delivered to the jobsite in good condition free from cuts and scrapes, and gouges. The pipe shall be supported on wooden skids or racks and shall be restrained from significant or damaging movement during shipment.

All piping used on the project shall be lifted using fabric slings of sufficient strength and width to safely pick up the pipe without strap failure and without causing scrapes or cuts damage to the pipe.

Lifting with cable or chain shall not be allowed. Lifting one end of the pipe and dragging the pipe into position shall not be allowed. The pipe shall at all times including installation be protected from impact and abrasion. Pipe shall be stored on supports and rollers as appropriate during conduct of the work to prevent damage.

A temporary pipe storage site shall be determined by the Contractor and approved by the Engineer. The Contractor shall provide the necessary skids and padding to protect pipe, and prevent the pipe from contacting the ground.

The Contractor shall provide, assemble, and pretest the pipe for installation in the drilled hole as specified on the Drawings. Contractor shall supply all necessary materials, equipment, and services to perform the pipeline assembly, pretest, and installation.

B. Pipe Support and Rollers

Contractor shall provide adequate supports and rollers along the laydown space to support the casing and carrier pipe during the installation.

C. Testing of Product Pipe

After the carrier pipe has been installed in place, the Contractor shall perform a pressure test. The test pressure shall be per the contract documents. Contractor is responsible for providing all equipment for this test. Pressure shall be monitored and recorded with certified instruments during the test.

A hydrostatic pretest may be conducted in lieu of the air pretest at the Contractor's option. However, the Contractor shall be responsible for providing water to the site and disposal of the test water after testing.

D. Welding of Product Pipe

The steel pipe welding shall be in accordance with Montana Department of Transportation Standards Specifications for Road and Bridge Construction (2014) Section 624 Welding.

Field welds shall be visually inspected by certified weld inspector. The inspector shall verify fit-up and final visual of the welds. Any of the weld defects identified by visual inspection shall be cause for rejection, and the deficient weld shall be repaired or replaced. The acceptance criteria for field welds shall meet the requirements of AWS D1.1.

E. Pipeline Installation

During the pipeline installation and pullback operation, the Contractor shall monitor the pipe roller system and use of sideboom equipment to control damage to the pipes. Contractor shall cease installation operations if damage to the pipes or coating occurs. Damage to the pipes may require removal of damaged portions of the pipeline and rewelding, as necessary. Pulling operations may not resume until the pipe is repaired.

3.5 SITE RESTORATION/DEMOBILIZATION

Immediately upon completion of work of this Section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition. The HDD Subcontractor shall restore the general work areas, right-of-way and all other construction areas shall be graded to their original contours or as shown on the project plans. Contractor shall repair all paved and graveled subgrades and surfaces, removed or disturbed during construction.

"Blow holes" or "breakouts" of drilling fluid to the surface must be cleaned up immediately and the surface area washed and returned to original condition. All drilling fluids, spoils and separated material will be disposed of in compliance with federal and local environmental regulations.

END OF SECTION 02661

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. Cast-in-place concrete includes the following:

1. Sidewalks.
2. Curb and gutter.
3. Retaining walls and planters.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 2 Section “Concrete Sidewalks” for concrete walks.
2. Division 2 Section “Curbs and Gutters’ for concrete curbs and gutters.

1.03 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, finish materials, and others if requested by Engineer.

C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete.

D. Samples of materials as requested by Engineer, including names, sources, and descriptions for materials requested.

E. Laboratory test reports for concrete materials and mix design test.

F. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Testing Service: Engage a testing agency acceptable to Engineer to perform material evaluation tests and to design concrete mixes.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Testing shall be accomplished in accordance with Division I Section “Quality Control”.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B Concrete Form) Plywood," Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not

bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Use wire bar-type supports complying with CRSI specifications.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type I-II.

1. Use one brand of cement throughout project unless otherwise acceptable to Engineer.

B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.

C. Water: Potable.

D. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than 3/4 inch long, 1.5 lb. per cu. yd.

1 . Products: Subject to compliance with requirements, provide one of the following:
Durafiber, Durafiber Corp.

Fiberstrand 100, Euclid Chemical Co.
Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.
or approved equal

E. Admixtures, General: Provide concrete admixtures that contain not more than 0.05 percent chloride ions. The use of calcium chloride as an admixture is expressly prohibited on this project.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1 . Products: Subject to compliance with requirements, provide one of the following:
Air-Tite, Cormix Construction Chemicals.
Air-Mix or Perma-Air, Euclid Chemical Co.
Darex AEA or Daravair, W.R. Grace & Co.
MB-VR or Micro-Air, Master Builders, Inc.
Sealtight AEA, W.R. Meadows, Inc.
Sika AER, Sika Corp.

G. Water-Reducing Admixture: ASTM C 494, Type A.

1 . Products: Subject to compliance with requirements, provide one of the following:
Chemtard, ChemMasters Corp.
PSI N, Cormix Construction Chemicals.
Eucon WR-75, Euclid Chemical Co.
WRDA, W.R. Grace & Co.

Pozzolith Normal or Polyheed, Master Builders, Inc.
Prokrete-N, Prokrete Industries.
Plastocrete 161, Sika Corp.

H. High-Range Water-Reducing Admixture: ASTM C 494, Type G.

1 . Products: Subject to compliance with requirements, provide one of the following:
Rheobuild or Polyheed, Master Builders, Inc.
PSPL, Prokrete Industries.
Sikament 300, Sika Corp.

2.04 RELATED MATERIALS

A . Products: Subject to compliance with requirements, provide the following:

Lithochrome Chemstain, L.M. Scofield Company.

Cementone Clear Sealer, L.M. Scofield Company.

B. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type 1, Class B.

1. Products: Subject to compliance with requirements, provide one of the following:
Safe Cure and Seal, Dayton Superior Corp.
Aqua-Cure, Euclid Chemical Co.
Dress & Seal WB, L&M Construction Chemicals, Inc.
Vocomp-20, W.R. Meadows, Inc.

C. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of the following:
Eucobar, Euclid Chemical Co.
E-Con, L&M Construction Chemicals, Inc.
Confilm, Master Builders, Inc.

2.05 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by laboratory trial batch method as specified in ACI 301. Use an independent testing Agency acceptable to Engineer for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality control testing.

B. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. Retaining walls, exterior equipment pads and bases, sidewalks, curbs & gutters: 4500 - psi, 28-day compressive strength; W/C ratio, 0.45 maximum (air-entrained). Cement content: not less than 7 sacks per cubic yard.

D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
2. Other concrete: Not more than 4 inches.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work. No water may be added at the job site without prior approval.

F. Fiber Reinforcement: Add at manufacture's recommended rate but not less than 1.5 lb per cu. yd.

1. Add fiber reinforcement to concrete for all sidewalks and other exterior concrete flatwork.

2.06 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use high-range water-reducing admixture in pumped concrete, and concrete with water-cement ratios below 0.50.

C. Use air-entraining admixture in concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing:

a. 5.5 percent (severe exposure) for 1-1/2-inch maximum.
b. 6.0 percent (severe exposure) for 3/4-inch maximum aggregate.

2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

D. Use admixtures for water reduction in strict compliance with manufacturer's directions.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when

air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL

Coordinate the installation of joint materials, vapor retarder, and other related materials with placement of forms and reinforcing steel.

3.02 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, regrets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.03 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel lnstitute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Off set laps of adjoining widths to prevent continuous laps in either direction.

F. Heating of reinforcing is not permitted. Welding of reinforcing is not permitted unless specifically shown otherwise on the drawings. Fabricate all bars in the shop and do no cutting or bending on the job of grade 60 bars.

G. No bars, including dowels, are to be placed by shoving into already placed fresh concrete.

H. Cover: Except where shown, otherwise on drawings or where shown in center of section, provide the following concrete over reinforcing:

1. To bottom of footings: 3 inches.
2. Formed or finished surfaces in contact with dirt: 1-1/2 inches.
3. Interior-formed surfaces not in contact with dirt except beams and columns: 3/4 inches.
4. Exterior-formed surfaces not in contact with dirt except beams and columns: 1-1/2 inches.
5. Interior-formed surfaces of beams and columns: 1-1/2 inches.

I. Footings and structural slabs on grade: Support bars on precast concrete blocks or chairs at intervals adequate to keep reinforcing at required height during the concrete work. Support welded wire fabric on #4 continuous bars at 4'-O" maximum spacing in addition to reinforcing shown. Locate WWF in center of slab.

J. Elevated Slabs: Support WWF on continuous #4 bars at 4'-O' in addition to reinforcing shown. Support bars on noncorroding chairs. Except where shown otherwise, place WWF in center of slab.

K. Corner bars: Provide bars of same size and spacing to lap with all horizontal reinforcing.

L. Tolerances: Conform to "Fabricating and Placing Tolerances" of ACI 301.

M. Location Adjustment: Move bars within allowable tolerances to avoid interference with other reinforcing steel, conduit, or embedded items. Do not move bars beyond allowable tolerances without concurrence of Engineer.

3.04 JOINTS

A. Construction Joints (CSJ): Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer. Make no construction joints not shown on the drawings unless approved by Engineer.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Control Joints: provide weakened-plane control joints sectioning the paving into areas no larger than 15-ft square or as shown on the drawings. Control joints in sidewalks shall be placed no longer than the width of the sidewalk. Joints in paving will be saw cut to a depth equal to ¼ of the concrete thickness and sealed. Joints in sidewalks will be tooled and left unsealed.

1. Sawed Joints: Form control joints using power saws equipped with shatter proof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action. Soft-Cut system control joints shall be installed within 2 hours after final finish. Saw-cut control joints shall be cut within 12 hours after final finish.
2. Toole Joints: Form control joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

F. Joint Fillers: At both construction and expansion joints install joint fillers in one-piece lengths wherever possible. Where more than one length is required, lase or slip joint filler sections together. Make sure that joint filler is set straight and at an elevation that will allow the top of the cap seal once installed to be slightly below the surrounding surface of the concrete paving. Install the appropriate model Greenstreak (or approved equal) cap seal over the joint filler. The top of the cap seal shall be slightly below the adjacent surface of the concrete.

G. Sealant: All sawn contraction joints shall be filled with sealant appropriate for the location and usage. All tooled joints and joints with cap seal will not require sealant.

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously,

provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1 . When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
b. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

F. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C).

Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total

amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

3.06 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

B. Light Broom Finish: All paving, sidewalks and loading dock slabs shall be given a light broom finish. Finish shall be given a light traverse texture by drawing a broom across the surface and will not be trowelled.

3.07 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacture's instructions after screeding and bull floating, but before power floating and troweling.

1 . Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

B. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

C. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place

absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

D. Provide moisture-retaining cover curing to all concrete slabs to be color-stained, as follows:

1 . Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

E. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

F. Curing Formed Surfaces:

Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

G. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

H. Final cure concrete surfaces to receive liquid floor hardener or finish flooring with a moisture-retaining cover, unless otherwise directed.

3.08 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Backfilling is not permitted until concrete has attained design strength and until concrete floors are in place.

3.09 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.10 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

B. Mix dry-pack mortar, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1 . Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1 . Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1 . Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.

3.11 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143.
2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete.
3. Concrete Temperature: ASTM C 1064.
4. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test.
5. Compressive-Strength Tests: ASTM C 39; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

D. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

E. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for all such tests required.

3.12 REJECTIONS

A. Alignment: Where concrete slabs or walls do not meet the alignment requirements, the Contractor must grind off irregularities until they comply. However, if such removal leaves less concrete section than indicated, the Engineer may reject concrete if he feels the remaining section would not be adequate.

B. Flatwork: Finished flatwork exceeding the tolerances of these specifications shall be repaired or replaced so that strength or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled in with a patching compound, or other remedial measures performed as permitted by the Engineer.

C. Appearance: Concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired, if possible. If, in the opinion of the Engineer, the defects cannot be repaired to equal the specified finish, the concrete shall be rejected.

D. Misplaced Members: Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or misplaced items interfere with other construction.

E. Rejected Concrete: Rejected concrete shall be removed and replaced. Limits of removal shall be as directed by the Engineer to accomplish a structure equal in strength, service ability, and appearance, to that which would have been achieved by acceptable concrete.

F. Expense of Repairs: The cost of all repairs, removal, replacement, etc., required by the provisions of this Article shall be borne by the Contractor.

END OF SECTION 03300