

APPENDIX 2-A – STANDARD MODIFICATIONS TO MPWSS

Foreword

The City of Missoula has unique requirements that are not addressed in the *Montana Public Works Standard Specifications* (MPWSS), Seventh Edition, April 2021. This appendix addresses those specific requirements that are either not addressed in the MPWSS or are modified from the MPWSS. All projects within City of Missoula right-of-way and public easements shall be completed in accordance with MPWSS and the City of Missoula Modifications to MPWSS.

Work is to be completed in accordance with the appropriate MPWSS section if a City of Missoula modification to MPWSS does not exist. When a City of Missoula modification to the MPWSS does exist, the requirements of that modification **supersede** the related MPWSS requirements. The same is true for City of Missoula Standard Drawings. However, there are some Standard Drawings that are additional drawings created specifically for the City of Missoula.

Each section of the MPWSS that has been modified is listed in the table of contents. The entire section from the MPWSS has not been rewritten for these modifications. Instead, modifications are provided for a specific section, subsection, paragraph, sentence, or drawing. Also, this document includes several sections and forms that are not in the MPWSS but are to be used for all projects as applicable.

Appendix 2-B contains a list of MPWSS standard drawings followed by “Active,” “Replaced,” or “Deleted.” “Active” means that the drawing is to be used as shown in MPWSS, “Replaced” indicates that the drawing has been replaced by a City of Missoula Standard Drawing, and “Deleted” indicates the drawing is not to be used.

Specifications within MPWSS or modifications made by the City of Missoula specifications, standard drawings, or sections of this Manual may contain product or manufacturer information that includes “OR EQUAL,” “OR APPROVED EQUAL,” “EQUIVALENT,” or other variations, in addition to the preferred product. Approved equals will be evaluated on a case-by-case basis and shall be first reviewed by the engineer of record before forwarding to the City Engineer for a decision. This evaluation must include all relevant product specifications, testing information, and recommendation. Product specifications and testing must meet or exceed MPWSS specifications (or City of Missoula modifications). A Qualified Products List (QPL) shall be maintained for approved products at the following [LINK](#). This list will be updated periodically as product submittals are received and approved. Approved products will be evaluated for inclusion in future revisions to the City of Missoula modifications to MPWSS. The use of this list is informational only and does not eliminate the requirement to adhere to the plans and specifications used in the bidding process or contained in the contract documents.

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SECTION 00810 SC- 5.04 CONTRACTOR’S LIABILITY INSURANCE (MPWSS, as amended)

SC- 5.04.B.4 CONTRACTOR’S CONTRACTUAL LIABILITY

Coverage required by Paragraph 5.4 of the General Conditions may be satisfied by primary insurance or a combination of primary and excess or umbrella insurance. Primary occurrence limit cannot be less than \$1,000,000.00. The deductible, if any, may not exceed \$5,000.00 per occurrence. Contractor shall provide coverage for not less than the amounts required by the contract for General Liability as follows:

- | | | |
|----|--|----------------|
| a. | General Aggregate Per Project | \$3,000,000.00 |
| b. | Each Occurrence
(Bodily Injury and Property Damage) | \$1,000,000.00 |

SC- 5.04.B.5 CANCELLATION NOTICE

Amend paragraph 5.04.B.4 of the General Conditions by striking out the words “30 days” and replacing them with the words “45 days” and as so amended paragraph 5.04.B.5 remains in effect. The cancellation notice shall contain substantially the following statement:

“Should any of the above-described policies be cancelled before the expiration date thereof, the issuing company will mail written notice to the certificate holder 45 days prior to cancellation.”

Add the following paragraph following 5.04.B.5:

C. COVERAGE AMOUNTS. The limits of liability for the insurance required by Paragraph 5.04 of these General Conditions shall provide coverages for not less than the following amounts or greater where required by Law or Regulations:

- | | | |
|----|---|-----------------------|
| 1. | <u>Workers’ Compensation and Related Coverages</u> under subparagraphs 5.04.A.1 and 5.04.A.2 of the General Conditions: | |
| a. | State | <u>Statutory</u> |
| b. | Applicable Federal | <u>Statutory</u> |
| c. | Employer’s Liability | <u>\$1,000,000.00</u> |

2. General Liability under subparagraphs 5.04.A.3 through 5.04.A.6: The General Aggregate Limit shall apply separately to each of the Contractor's projects.

- a. General Aggregate per project \$3,000,000.00
- b. Products- Completed Operations (Aggregate) \$3,000,000.00
- c. Personal and Advertising Injury \$1,000,000.00
- d. Bodily Injury and Property Damage \$1,000,000.00
(Each Occurrence)
- e. Coverage will include:
 - (1) Premises - Operations
 - (2) Operations of Independent Contractor
 - (3) Contractual Liability
 - (4) Personal Injury
 - (5) Products and Completed Operations
 - (6) Broad Form Property Damage (to include explosion, collapse, blasting and underground where applicable.
 - (7) Per Project Aggregate Endorsement.
- f. Contractor's Liability Insurance under 5.04.A.3 through 5.04.A.6 may be satisfied by primary insurance or a combination of primary and excess or umbrella insurance. Primary occurrence limit cannot be less than \$1,000,000.00. The deductible, if any, may not exceed \$5,000 per occurrence
- g. If CONTRACTOR is aware that the General Aggregate Limit may be diminished by an amount of \$500,000 or greater due to injury or damages caused by any activity associated with the work which may result in a claim(s) ("potential claims"), the CONTRACTOR shall provide notice to OWNER of the potential claims, and the City may require that CONTRACTOR obtain additional aggregate insurance coverage for the remainder of the work. CONTRACTOR shall again provide such notice for each subsequent event creating potential claims where the General Aggregate Limit may again be diminished by an amount of \$500,000 or greater.

3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions:

- a. Combined Single Limit (bodily injury and property damage)
Each Accident \$1,000,000.00
- b. Coverage to Include:
 - (1) All Owned
 - (2) Hired
 - (3) Non-Owned
- c. Contractor's Automobile Liability Insurance under Paragraph 5.04.A.6 must be satisfied by primary insurance of \$1,000,000.00. The deductible, if any, may not exceed \$5,000.00 per occurrence.

SC- 5.06 PROPERTY INSURANCE ON THE WORK - PURCHASED BY CONTRACTOR

- A. Before commencement of the work, the Contractor shall submit written evidence that he has obtained, from companies lawfully authorized to do business in the State of Montana with minimum "A.M. Best Rating" of A-,VI, for the period of the Contract, property insurance upon the work at the site in the amount of the original Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles.
- B. This policy shall be written on an "All-Risk" or open peril or special causes of loss policy form and include Completed Value Insurance coverage upon the entire project that is the subject of this Contract and including completed work and work in progress. At a minimum, this insurance shall cover physical loss and damage to the Work itself, to temporary buildings or structures, and to materials and equipment in care, custody, control or in transit before and during installation, from at least the following perils or causes of loss: fire (with extended coverage), lightning, theft, vandalism and malicious mischief, earthquake, flood, water damage, windstorm, collapse, testing and startup, and debris removal including demolition occasioned by enforcement of Laws and Regulations, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.
- C. Such insurance shall be maintained in effect until final payment is made or until no person or entity other than the Owner has an insurable interest in the property required by this paragraph to be covered, whichever is later, unless otherwise agreed to in writing by Owner. Such insurance shall include as Additional Named Insured: The Owner; the Contractor, Subcontractors and their subcontractors, the Architect, the Engineer, and their consultants; and each of

their officers; employees and agents; and any other persons with an insurable interest designated by the Owner as an Additional Named Insured.

- D. The Owner will not carry separate insurance for this project. All required insurance coverage shall be purchased and maintained by the Contractor. Certificates of Insurance reflecting all required coverage shall be provided to Owner prior to issuance of the Notice to Proceed.

END OF SECTION

SECTION 01400 CONTRACTOR QUALITY CONTROL AND OWNER QUALITY ASSURANCE (*MPWSS, as amended*)

PART 1: GENERAL

Add the following paragraphs:

“1.3 LABORATORY TESTS

- A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified laboratory testing of materials and equipment where the technical specifications specifically obligate the Contractor to provide the services.
- B. Unless otherwise indicated, the Owner will employ and pay for the services of an independent testing laboratory to perform soils, concrete, and asphalt testing for determining compliance with the specifications. The Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

1.4 CONTRACTOR’S RESPONSIBILITIES

- A. Cooperate with laboratory personnel and provide access to work.
- B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and that require testing.
- C. Provide to the Engineer the preliminary mix proposed to be used for concrete, asphalt, and other material mixes that require control by the testing laboratory.
- D. Provide samples of materials proposed to be used for backfill of structures or piping for determination of moisture density relationship.
- E. Furnish copies of product test reports as required.
- F. Furnish incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the Project site or at the source of the product to be tested.

- 3. To facilitate inspections and tests.
- 4. For storage and curing of test samples.
- G. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
- H. Coordinate testing services with laboratory and the Owner/Engineer. Understand all requirements of project testing and ensure all testing complete prior to completion of the Project.
- I. Excavating test holes into compacted backfill to allow for testing below the surface of any layers covered without inspection shall not be allowed. Areas that are not tested shall be fully re-excavated, backfilled appropriately and tested at the appropriate intervals.”

PART 3: EXECUTION

3.1 GENERAL

Add the following paragraphs:

- “E. The Owner shall provide (and the Contractor shall ensure all required testing has been scheduled) nuclear density testing for trench backfill and surfacing materials (i.e., all base gravels, asphaltic concrete, or gravel surfacing). The Contractor will provide the Owner with all the necessary moisture/density curves for all the density testing on the project for imported materials. The Contractor will be required to utilize the services of an independent and certified testing laboratory for all proctors. The Contractor shall reimburse the Owner the cost of the testing for each failed “trench backfill and/or surface” density test.
- F. The Contractor shall work with the Engineer to schedule all field testing. The Contractor shall notify laboratory representative and the Engineer as to the dates and times of all testing, providing a minimum of 24-hours notification. The Contractor shall coordinate with the Engineer the requirements of the Project and ensure all testing is complete to meet Project Specifications. The Contractor shall provide all required materials, labor, equipment, water, and power required for testing. Contractor shall review and understand the minimum testing requirements of the City of Missoula and ensure all required testing has been performed.
- H. The following minimum testing frequencies shall be required:

ASPHALT CONCRETE PAVEMENT

Test Type	Test Method Reference	Minimum Required Frequency
Mix Design	02510 Part 2.5.A	1 submittal per project no older than one year
Marshall or Gyratory Test	02510 Part 2.5.B	1 test/1000 feet of roadway
Core Density and Thickness	02510 Part 3.9.A 02510 Part 3.28.B	1 core sample for every 400 feet of street with a minimum of two samples per project. 1 out of every 4 core samples shall be on a longitudinal joint with a minimum of one longitudinal joint per project (if applicable).

PORTLAND CEMENT CONCRETE

Test Type	Test Method Reference	Minimum Required Frequency
Mix Design	03310 Part 2.3.A (ACI 301)	1 submittal per project no older than one year
Field Acceptance Testing	03310 Part 3.6	1 test per project, or per day's placement, over 5 cy for Every 50 cy

EARTHWORKS – TRENCH EXCAVATION

Test Type	Test Method Reference	Minimum Required Frequency
Trench Backfill	Moisture-Density (02221 Part 1.4.B.1)	1 submittal per soil type and borrow source
Trench Compaction (shallow)	In-Place Density (02221 Part 1.4.A.2)	<u>4 feet to surface of trench</u> Every 200 feet, 2 feet from edge of structures, appurtenances, and as material changes: -4-foot depth -2-foot depth -surface of trench
Trench Compaction (deep)	Method Specification/ Test Trench Maximum Density (MPWSS as amended 02221 Part 1.4.A.2.5)	<u>5 foot and deeper trenches and subgrade below pipe:</u> Every 200 feet or daily observation, whichever is greater
Pipe Bedding	Type 1 Bedding (MPWSS as amended 02221 Part 2.1.A) Type 2 Bedding (02221 Part 2.1.B)	1 submittal per project
Pipe Bedding Compaction	Type 1 Bedding (MPWSS as amended 02221 Part 2.1.A.3) Type 2 Bedding (MPWSS as amended 02221 Part 2.1.C.4)	Every 200 feet below pipe or daily observation, whichever is greater Every 200 feet below pipe or daily observation, whichever is greater

EARTHWORKS – STREET EXCAVATION

Test Type	Test Method Reference	Minimum Required Frequency
Subgrade	Moisture-Density (02230 Part 1.3.B.1) Gradation for sub-excavation/replacement (02230 Part 1.3.C)	1 Submittal per soil type and borrow source
Subgrade Compaction under Curbs, Gutters	In-Place Density (02230 Part 1.3.A.2)	Every 200 feet and as material changes: Top 8 inches of subgrade
Subgrade Compaction under Roadways	In-Place Density (02230 Part 1.3.A.2)	Every 200 feet and as material changes: Top 8 inches of subgrade

Subgrade Compaction under Sidewalks	In-Place Density (02230 Part 1.3.A.2)	Every 200 feet and as material changes: Top 8 inches of subgrade
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EARTHWORKS – SUB-BASE AND BASE COURSE

Test Type	Test Method Reference	Minimum Required Frequency
Material	Gradation, Moisture-Density, Fractured Faces, L.A Abrasion, Plasticity, CBR for RAP Sub-base (02234 Part 2) Base (02235 Part 2)	1 submittal per project and borrow source
Compaction under Roadways	In-Place Density : Sub-base (02234 Part 1.3.A.2) Base (02235 Part 1.3.A.2)	1 test/lift/200 lf
Compaction under Curbs and Gutters	In-Place Density: Sub-base (02234 Part 1.3.A.2) Base (02235 Part 1.3.A.2)	1 test/lift/200 lf
Compaction under Sidewalks	In-Place Density Base (02235 Part 1.3.A.2)	1 test/lift/200 lf

WATER DISTRIBUTION

Test Type	Test Method Reference	Minimum Required Frequency
Bacteriological Test	02660 Part 3.4.D	2 samples collected 24 hours apart per main or branch
Hydrostatic and Leakage Test	02660 Part 3.4.D	All new sections of water main including services to the curb stop or valve

SANITARY SEWER

Test Type	Test Method Reference	Minimum Required Frequency
Light Test	02730 Part 3.4.B	1 test between each set of manholes
Leakage Test – Air Test	02730 Part 3.4.C, E.	Entire length of main
TV Inspection	02730 Part 3.4.G	Entire length of main
Deflection Test	02730 Part 3.4.H	Entire length of main
Hydrostatic and Leakage Test	02730 Part 3.4.J	1 test per valved section of pipe as applicable for force mains
Manhole Leakage Test	02730 Part 3.4.K	1 test per manhole

STORM SEWER

Test Type	Test Method Reference	Minimum Required Frequency
Light Test	02720 Part 3.5.A	1 test between each set of manholes
Deflection Test	02730 Part 3.4.C	At Engineer Discretion
TV Inspection	02730 Part 3.4.D	Entire length of main

BOULEVARD LANDSCAPING

Test Type	Test Method Reference	Minimum Required Frequency
Topsoil Parameter	02900 Part 2.1.B.1.b	1 test per project and borrow source
Topsoil Texture	02900 Part 2.1.B.1.c	1 test per project and borrow source

- I. Related requirements specified elsewhere:
 - 1. Inspection and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities: Conditions of the Contract.
 - 2. Certification of products: The respective section of Specifications.
 - 3. Test, adjust, and balance equipment: The respective sections of Specifications.
 - 4. Field tests required and standards for testing: The respective Specification sections.
- J. All tests shall be performed in the presence of the Engineer or designee.
- K. Repair all materials that fail during testing at Contractor's expense."

END OF SECTION

SECTION 01570 CONSTRUCTION TRAFFIC CONTROL (*replaced section*)

PART 1: GENERAL

1.1 SUMMARY

- A. The Contractor shall schedule construction operations in a manner that will ensure the safety and convenience of all transportation users, businesses, and residents and the safety of construction workers and the general public are adequately met at all times.
- B. The Contractor or certified traffic control company shall be responsible for the development and submittal of all traffic control plans and procedures associated with the project. Contractor or certified traffic control company shall work closely with the Consultant Engineer and City of Missoula in the development of their traffic control plans and procedures and shall follow all local, state, and federal standards, as applicable based on jurisdiction of the street.
- C. The Contractor or certified traffic control company shall be responsible for maintaining safe travel corridors for all modes of transportation as part of the approved traffic control plan.

1.2 TRAFFIC CONTROL PLANS AND PROCEDURES

- A. The traffic control plan shall include traffic routing, detailed pedestrian routes, barricading, signing, haul routes, detouring, and securing the project area.
- B. Traffic control plans shall be submitted to the City of Missoula for review and approval. Contractor or certified traffic control company shall allow a minimum 2-week review time for all traffic control plans prior to sending notice or actual work.
- C. The City of Missoula may direct the Contractor or certified traffic control company to provide additional items at no additional compensation if, in the City's estimation, the proposed plan does not adequately address the safety and convenience of the public or does not conform to the required standards.
- D. No work shall commence or advance until the related traffic control plan is approved. Therefore, the initial plan must be submitted prior to issuance of the Notice to Proceed.

- E. All traffic control plans with ~~street~~ closures ~~for~~ on arterials and collectors must be designed, maintained, and executed by persons trained and certified by an accredited traffic control certification agency.
- F. Traffic control plans and procedures shall conform to the current version/revision of the Manual on Uniform Traffic Control Devices (MUTCD) and local and state requirements, if applicable.
- G. The traffic control plan for streets designated as “State Route”, as defined in the [City of Missoula Street Functional Classification Map](#) shall be approved by the Montana Department of Transportation (MDT) prior to approval from the City. The MDT permit must be submitted to the City when applying for the City Permit.
- H. Construction impacts to the transportation system, users, and private property owners vary depending on the type of closure and street classification.
- I. Generally, a closure is any or all of the specific closures as listed below.
 - 1. Street closure – closure of one or more vehicular and/or bicycle lanes or the entire street within the city limits.
 - 2. Lane closure – closure of one more driving lanes and/or turn lanes.
 - 3. Alley closure – closure or partial closure of an alley within the city limits.
 - 4. Sidewalk/Pedestrian closure – closure of a sidewalk/trail/shared use path within the city limits.
 - 5. Parking closure – closure or blockage of an on-street parking lane within the city limits, including the utilization of the parking lane for vehicular and/or bicycle lane shift into the parking lane.
 - 6. Access closure – closure of a driveway to private property.
- J. Notice requirements:
 - 1. No notice – Mobile and temporary operations (less than four hours) for maintenance activities or any emergency utility repairs or connections.
 - 2. Two-business-day notice requirements:
 - a. ~~All closures~~ For closures on streets classified as “local” as defined in the [City of Missoula Street Functional Classification Map, as well as residential alleys](#).
 - b. Private driveway closures.
 - c. This notice is in addition to the 5-calendar-day tow notice requirements, if applicable.
 - d. This notice is in addition to the 14-calendar-day notice requirements, if applicable.
 - e. Written and delivered by mail or flyer to all property owners, tenants, and businesses adjacent to and with the limits of the

- closure.
 - f. Written and delivered by mail or flyer to all property owners, tenants, and businesses within the limits of the detour route(s).
 - g. This notice may not be received by property owners, tenants, and businesses earlier than 5 business days before the closure date.
 - h. Pertinent information related to working outside of regular construction work hours, if applicable.
 - i. It shall be the Contractor's responsibility to notify emergency services, transportation services, and media 2 business days before the closure, including all closures planned in phases.
3. Five-calendar-day tow notice requirements:
- a. Applies to all parking closures.
 - b. Written description of the parking closure area and included within the 14-calendar-day notice.
 - c. Temporary signs stating, "No Parking, Tow Zone" and closure date(s) placed on street where the parking closure is to occur.
 - d. These temporary signs may not be placed earlier than 10 calendar days prior to the closure.
 - e. These temporary signs must be placed 5 calendar days prior to the closure.
 - f. Temporary sign placement shall occur at the following locations:
 - i. Every 200 feet, with a minimum of two signs per block, in the adjacent boulevard.
 - ii. At the beginning and ending of each block when no adjacent boulevard exists.
 - g. It shall be unlawful for anybody other than a police officer to order a vehicle to be towed to an impound lot. Event organizers, construction workers, etc. may order a vehicle to be towed no more than two blocks away, at their own expense, if the 5-calendar-day tow notice has been provided.
4. Fourteen-calendar-day notice requirements:
- a. For closures on streets classified as "collectors" or "arterials", as defined in the [City of Missoula Street Functional Classification Map](#).
 - b. For closures on streets in business/commercial/industrial areas.
 - c. For closures on streets in which a loss of access (ingress/egress) to private property occurs.
 - d. For closures of alleys in business/commercial/industrial areas where alley deliveries could be expected.
 - e. Loss of driveway access on streets classified as "collectors" or "arterials."

- f. Written and delivered by mail or flyer to all property owners, tenants, and businesses adjacent to and within the limits of the closure.
 - g. Written and delivered by mail or flyer to all property owners, tenants, and businesses within the limits of the detour route(s).
 - h. The notice may be provided at any time in advance of the project, but no earlier than 28 calendar days before the closure date.
 - i. Additional information to be included in the notice:
 - i. Language describing 2-business-day notice will be delivered prior to the actual closure.
 - ii. Language describing 5-calendar-day tow notice, if applicable.
 - j. The City Engineer has the authority to waive the 14-calendar-day notice if, in his/her opinion, it would be in the public interest to do so.
- 5. Information to be included in the notice:
 - a. Street name(s) or area description if an alley is part of the closure.
 - b. Date for the start of closure. If the exact start date of the closure is unknown, or if the closure is planned in phases, the notice shall contain the approximate date the closure is expected to begin.
 - c. Duration of closure. If the exact duration of the closure is not known, then the notice shall contain the approximate duration of the closure.
 - d. Detour route(s), if applicable.
 - e. Contractor name and phone number.
- 6. Proof of Notice: The applicant for any closure shall be required to prove that the 2-business-day and 14-calendar-day, as applicable, notice has been completed by providing the City Engineer copies or logs of such notices and dates of delivery, prior to issuance of the permit. A City of Missoula form, [Appendix 2-D, Street and Alley Closure Templates](#), may be used for logging and evidence of the notice and includes a sample notice, which may be used instead of a contractor-designed form.
- K. Use of Message Boards or Other Information Signs: Minimum 3 business days in advance of the closure. These must be placed in a location as shown on the approved traffic control plan and must stay in place until the actual construction takes place unless otherwise required to remain in place through the entire project per the approved traffic control plan.
 - 1. Message boards or other information signs shall be required for street closures with an Arterial classification and on streets that serve large

- areas for which a closure will result in long detours that will cause significant delay and inconvenience for the traveling public (e.g., Lower Miller Creek Road).
2. Message boards or other information signs may be required by the City Engineer for the following:
 - a. For detours that require alternate routes that intersect before the actual street closure (e.g., closure of Hillview Way between Woodbine Place and 55th may require an information sign on Hillview Way west of 23rd for eastbound vehicles)
 - b. For operations, such as paving or chip seal, that can cause significant delays and have flaggers present and on streets that have high volumes and lack alternative routes (e.g., Grant Creek Drive and Lincoln Hills Drive).
- L. Closures affecting emergency vehicle access to Community Medical Center or Saint Patrick Hospital may require additional signage, detours, or other devices. Traffic control plans affecting emergency vehicle access shall be designed in consultation with the affected hospital.
1. Street closures on the following street segments require consultation with the affected hospital.
 - a. Saint Patrick Hospital
 - i. Orange Street between South 3rd Street West and Interstate 90.
 - ii. West Broadway between Orange Street and May Street.
 - iii. McCormick Street between West Broadway and West Spruce Street.
 - iv. West Spruce Street between Orange Street and May Street.
 - v. Owen Street between West Broadway and West Spruce Street.
 - vi. West Pine Street between Orange Street and Owen Street.
 - b. Community Medical Center
 - i. Reserve Street – South Avenue intersection.
 - ii. South Avenue between Reserve Street and 31st Avenue.
 - iii. Fort Missoula Road between Reserve Street and Post Siding Road.
 - iv. Old Fort Road between South Avenue and Fort Missoula Road.
- M. Haul routes shall be included in the Traffic Control Plan. The City reserves the right to require modification to previously approved haul routes during construction. Haul routes will need to be videoed prior to and after completion

of construction. These videos shall be submitted to the City as part of the closeout process to determine if mitigation of impacts is necessary.

1.3 PEDESTRIAN ACCESSABILITY REQUIREMENTS

- A. All persons engaged in the construction or repairing of right-of-way improvements that close sidewalk/pedestrian facilities shall construct and maintain temporary pedestrian facilities on arterial and collector streets. In addition, this same provision for temporary pedestrian facilities may be required when so ordered by the City Engineer.
- B. The temporary pedestrian facility shall be constructed to the requirements stated on City standard drawings with a hard, durable, non-slip all-weather surface, not less than 4-feet in width extending from sidewalk to sidewalk, around such sections of sidewalk or alley approach under construction or repair.
- C. All temporary pedestrian facilities shall conform to standards contained in the Americans with Disabilities Act.
- D. Such temporary pedestrian facilities shall be constructed before any work whatsoever is commenced on the permanent sidewalk or alley approach and shall not be removed until the permanent sidewalk or alley approach is open to pedestrian traffic.
- E. Where a traffic hazard exists, the City Engineer may require additional protective structures be placed adjacent to the temporary pedestrian facility.
- F. A right-of-way occupancy or use permit may also be required per City Code.
- G. Where overhead hazards exist the City staff may require protective structures be placed over the permanent and/or temporary pedestrian facility. These structures must be approved by the City and in place prior to opening the pedestrian facility.

PART 2: PRODUCTS

2.1 GENERAL

- A. The Contractor or certified traffic control company is solely responsible for construction traffic control devices, and the material, use, and types of all traffic control devices. All products used for traffic control shall meet the requirements of the current version/revision of OSHA, MUTCD (Manual of Uniform Traffic Control Devices for Streets and Highways), local and state standards.

PART 3: EXECUTION

3.1. SUMMARY

- A. Traffic control devices shall be installed in accordance with an approved traffic control plan prior to starting work or new phase of the construction operations and shall be properly maintained and operated until vehicle, bike, and/or pedestrian surfaces have been paved and during the entire time that the need exists. They shall remain in place only so long as they are needed and shall be immediately removed thereafter.
- B. When construction operations are conducted along streets, the Contractor shall have proper signs and barricades in place at each side of the street. All public thoroughfares that are closed to transportation use shall be protected by means of effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting street on each side of the blocked section. All barricades and obstructions shall be illuminated by means of warning lights and signs at night. All lights used for this purpose shall be kept illuminated from sunset to sunrise.
- C. Materials stored upon or alongside streets shall be so placed, and the work at all times shall be so conducted, as to cause the minimum obstruction and inconvenience to the traveling public. Weeds, tree shrubbery, construction materials, equipment, spoil piles, etc., shall not obscure any traffic control device or create a site visibility obstruction as defined in the [Missoula City Public Works Standards & Specifications Manual](#).
- D. All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction there over.
- E. For temporary tow signs applications. After the required parking closure notification, any vehicles remaining within the parking closure area at the time the work begins can be towed at the Contractor's expense with written notice from the Contractor to the Missoula Police Department.
 - 1. The Contractor and/or towing company will not be reimbursed for towing expenses.
 - 2. The City shall not be held financially responsible for costs incurred with towing.
 - 3. The City shall not be held financially responsible for construction delays caused by parked vehicles within the parking closure.

- F. When it is necessary for the Contractor to leave a section of trench open, materials stockpiled or equipment parked alongside the street at the end of a workday, or prior to weekends or holidays, the Contractor shall, with the approval of the City of Missoula, install adequate barricades, vertical panels, sign, and lights at the work site so that adequate protection is provided to the public. Trenches across private driveways shall be backfilled immediately after installing pipe.
- G. When trenching operations disturb the edge of the paved street so as to create a traffic hazard, vertical panels or delineators shall be placed, as approved by the City of Missoula, until the street is repaired. All signs and barricades shall be attached to portable mounts.
- H. All private access shall be open at the end of each workday and on weekends and holidays.
- I. Where operations are performed in stages, there shall be in place only those devices that apply to the present conditions. Devices or signs that do not apply to existing conditions shall be removed.
- J. The Contractor shall provide safe and continuous passage for pedestrians at all times in those areas where designated pedestrian routes exist and are in use.
- K. Prior to the start of each workday, the Contractor, or a certified traffic control company, as applicable, shall inspect the devices for conformance to the approved traffic control plan. The Contractor or a certified traffic control company, as applicable, shall create a daily log of these inspections and provide copies of these daily logs to the Engineer and City at the end of each week.
- L. The Contractor shall have an emergency contact available during all working and non-working hours, to include weekends and holidays, for notification of replacement, re-erection, or corrections to traffic control devices.

3.2 NOTIFICATION OF CONSTRUCTION

- A. The Contractor shall be responsible for notifications as stated above, including all State, County, City, local or private services, departments, agencies, or organizations whose normal or emergency services may be affected by the construction activity. Immediately after the applicable construction activity has been completed, the notified department, agencies, or organizations shall be contacted and informed that the affected street, alley, sidewalk/pedestrian, parking area or access is open for normal transportation operations.

3.3 EMERGENCY SERVICES

- A. Full-time access to and from fire stations and other locations where emergency vehicles are housed shall be provided. It shall be the Contractor's responsibility to coordinate with local emergency providers to determine emergency vehicle locations.

PART 4: MEASUREMENT AND PAYMENT – NOT USED

END OF SECTION

SECTION 01600 WEEKLY CONSTRUCTION PHOTO DOCUMENTATION ***(added section)***

PART 1: GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for project photo documentation and submittal requirements during active construction. Active construction is defined as the period when public infrastructure is being installed. The required construction photos shall be provided to the Engineer to be uploaded to the City of Missoula.

PART 2: PRODUCT – NOT USED

PART 3: EXECUTION

3.1 SUBMITTAL FREQUENCY AND DEADLINE

- A. Construction photos shall be uploaded to the Engineer and shall be received no later than noon on Monday for the previous week's work.

3.1 REQUIRED PHOTOGRAPHS

- A. Construction photographs shall be required for sanitary sewer, stormwater, and water main installations and surface infrastructure for acceptance of the system by the City of Missoula.
- B. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station, and items(s) pictured.
- C. Sanitary Sewer
 - 1. At a minimum, construction photos shall be taken at all fittings and valves for pressure sewer main installations and for underground pipe connections to manholes and junction structures for gravity sewer main and storm drain.
 - 2. Photos shall be taken before fittings are wrapped to create a record of the connections and after the tie downs and thrust blocks are in place for

future reference as to size and construction for pressure sewer main installations.

3. Photographs of connections at manholes shall be provided for all sewer main structures. Pictures shall be taken before and after the annular void of the penetration is completed. Photos must show the manhole number as designated on the plans and designate invert “in” or “out” as required. This shall be done by visible markings on the manhole barrel that are clearly shown in each photo.

D. Stormwater

1. Photographs of connections at inlet, manholes, and junction structures shall be provided for all stormwater main structures. Pictures shall be taken before and after the annular void of the penetration is completed. Photos must show the manhole number as designated on the plans and designate invert “in” or “out” as required. This shall be done by visible markings on the manhole barrel that are clearly shown in each photo.
2. Photographs of subgrade and barrel installation prior to backfill shall be provided for all dry wells. Pictures shall be taken showing the appropriate infiltrative layer at the base of the dry well installation prior to backfilling with sump rock and of the dry well barrel with sump rock and fabric. Photos must show the dry well number as designated on the plans. This shall be done with a whiteboard and with visible markings on the manhole barrel that are clearly shown in each photo.

E. Water

1. At a minimum, construction photos shall be taken at all fittings and valves for water installations.
2. Photos shall be taken before fittings are wrapped to create a record of the connections and after the tie downs and thrust blocks are in place for future reference as to size and construction.
3. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station, and item(s) pictured.

F. Surface Infrastructure

1. Photographs of compacted subgrade, subbase, base course, and surface course shall be provided at a minimum of every 200 feet. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station, and item(s) pictured.
- G. Additional photos shall be taken as necessary to document construction.
- H. If photographs for any items requiring photos are not furnished to the Engineer, the Contractor shall re-excavate the item to obtain photographs at contractor's expense.

PART 4: MEASUREMENT AND PAYMENT – NOT USED

END OF SECTION

SECTION 02110 GEOTEXTILES (*MPWSS, as amended*)

PART 2: PRODUCTS

2.4 MATERIALS

B. Separation Fabric

Add the following sentence:

- “2. Class 2 or 3 fabric may be approved if recommended by a project-specific geotechnical report meeting the requirements of the Missoula City Public Works Standards and Specifications Manual.”

C. Stabilization Fabric

Add the following sentence:

- “2. Class 2 or 3 fabric may be approved if recommended in a geotechnical report meeting the requirements of the Missoula City Public Works Standards and Specifications Manual.”

END OF SECTION

SECTION 02113 ADJUSTING EXISTING MANHOLES, LAMPHOLES, INLETS, WATER VALVE BOXES, WATER SERVICES, AND FIRE HYDRANTS TO GRADE (*MPWSS, as amended*)

PART 1: GENERAL

1.2 STANDARD DRAWINGS

Delete paragraph A. and add the following:

- “A. Refer to the most recent version of City of Missoula Standard Drawings, or the project details contained within the Drawings, for applicable details.”

PART 2: PRODUCTS

2.1 GENERAL

Add the following sentence to the end of paragraph A:

- “Composite tapered grade rings shall meet the requirements in Section 02730.”

PART 3: EXECUTION

3.1 GENERAL

Delete the last two sentences in paragraph A and replace with the following:

- “Ensure that all structures have a minimum of one 2-inch composite taper adjustment ring and one 2-inch concrete adjusting ring and a maximum of 12 inches of rings under the casting. Do not use brick, mortar, and/or wood shims for adjustment of castings.”

Delete paragraph B and replace with the following:

- “B. On manholes requiring steps, ensure that maximum spacing between steps is 12 inches and 18 inches is the maximum distance from the rim to the first step.”

END OF SECTION

SECTION 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES (*MPWSS, as amended*)

PART 1: GENERAL

1.3 STANDARD DRAWINGS

Delete paragraph A. and add the following:

- “A. Refer to the most recent versions of City of Missoula Standard Drawings, or the project details contained within the Drawings, for applicable details.”

1.4 TESTING

A. Field Density Testing

Delete paragraph 4 and replace with the following:

- “4. Refer to Section 01400 Section 1.4.I for information regarding areas that do not meet the testing frequency requirements.”

Add the following paragraph:

- “5. For trenches 5 feet and deeper, the following method specification may be used in lieu of nuclear gauge testing:
- a. Cut a short test trench 2 to 3 lengths longer than the compacting equipment’s footprint and 12 to 18 inches deep, this provides containment.
 - b. Complete 8 to 12 passes of compaction in the test trench. Verify test trench is at 95% of proctor, or alternatively, continue compaction effort until dry density does not increase by 1% after subsequent passes.
 - c. Place a lift in the test trench of the same material and thickness as what will be placed in the actual backfill process.
 - d. Complete 4 passes of compaction with the same equipment that will be used for compaction during actual backfill.

- e. Using a nuclear gauge, test near the center of the test trench. Spin the gauge 180 degrees and test the same pin hole. Document the average dry density of the two tests.
- f. Complete 2 to 4 more passes of compaction in the same location.
- g. Complete steps e and f until increase in dry density is less than 1%. If the material is not oversized per ASTM D698, verify this maximum dry density is greater than or equal to 95% of proctor value.
- h. Collect a moisture sample from pin hole location.
- i. Document the total number of passes, compaction equipment, lift thickness, material, maximum dry density, and moisture content.
- j. Assign this method specification to trench compaction of the same material."

PART 2: PRODUCTS

2.1 PIPE BEDDING MATERIALS

A. Type 1 Pipe Bedding

Delete paragraph 3. in its entirety and replace with the following:

"3. Provide Type 1 Bedding consisting of imported sand, sandy crushed gravel, or crushed gravel having a maximum 3/4-inch size (19mm), maximum 10% passing the #200 sieve, and a maximum plasticity index of 6, determined by AASHTO T89 and T90 or by ASTM D4318."

4. Change "50 percent" to "35 percent."

D. SEPARATION GEOTEXTILE

Delete paragraph 1 in its entirety and replace with the following:

"1. In locations where pipelines are installed below the groundwater level, or as directed by the Engineer, a non-woven geotextile pipe bedding wrap shall be installed around the entire pipe bedding. Where lapping is required and where edges are brought together at the top of the bedding, the geotextile fabric shall overlap a minimum of 2 feet. The

geotextile fabric for bedding wrap shall be a non-woven geotextile in accordance with AASHTO M288 Class 1, 2, or as specified by the Engineer and in conformance with specification Section 02110."

2.4 DETECTABLE WARNING TAPE

Delete paragraph A in its entirety and replace with the following:

- "A. Detectable buried warning tape shall be installed with all water, storm, and sanitary sewer mains and services. Detectable tape is to have a minimum 3-inch width and 5-mil 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 inches imprint, marked "Caution Water Line Buried Below", "Caution Sewer Line Buried Below", or "Caution Storm Drain Line Buried Below"."

Add the following paragraph:

"2.5 TRACER WIRE

- A. Contractor shall bury tracer wire with all water and sewer force main pipeline and service lines. Tracer wire shall be at minimum #14 solid copper direct bury wire and shall be blue color for water and green for sewer.
- B. Tracer wire shall be electrically continuous. If electrical test indicates a break in the coated wire exists at the time of installation, the break is to be repaired."

PART 3: EXECUTION

3.1 PROTECTION OF EXISTING PROPERTIES

E. Exploratory Excavations

Delete paragraphs 1 through 4 in their entirety and add the following:

- "1. The Contractor shall be responsible for locating all underground utilities associated with the Project. All costs associated with such exploratory excavations or "potholing" shall be at the Contractor's expense and shall be considered incidental to the work."

3.3 TRENCH EXCAVATION

A. General

Add the following:

- “10. After each pipe has been graded, aligned, and placed in final position on the bedding materials, and shoved home or jointed, sufficient pipe embedment material will be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations.
11. All granular fill material beneath the pipe will be spread and compacted to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by the withdrawal of pipe slings or other lifting tackle. No part of any bell or coupling will be in contact with the trench bottom, trench walls, or granular fill when the pipe is jointed.
12. Embedment material will be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement of the pipe. Bedding material shall be “knifed” under the pipe haunches using hand equipment to ensure no voids remain. Mechanical tampers may be used if results equal to hand tamping methods can be obtained. Material shall be placed in layers not exceeding 6 inches loose thickness before compaction.
13. Do not proceed with excavations unless materials are on hand for immediate installation.
14. Maintain excavations and warning barricades at all times to guard against and prevent injury to employees and the public in accordance with appropriate safety practices for utilities construction.
15. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Complete construction and backfill without delay. Any trenches left open overnight or when work is no longer being performed in or near the trench shall be protected in accordance with specification Section 01570 Traffic Control.”

B. Trench Dimensions

2. Width

Delete paragraph a. in its entirety and replace with the following:

- “a. Excavate to provide room to install, join, and bed pipe as specified. The minimum trench width is 3 foot-6 inches for outside pipe diameters of 18 inches or less. The minimum trench width is 3 feet-0 inches plus the outside diameter of the pipe for pipe sizes exceeding 18 inches. The trench shall be excavated so that a minimum clearance of 12 inches is maintained on each side of the pipe for proper compaction of the bedding and backfill material.”

3. Depth

Delete paragraph a. in its entirety and replace with the following:

- “a. Excavate the trench as required for the invert grade or pipe bury as specified in the contract documents, plus the depth under the pipe specified for Type 1 Pipe Bedding. If bedrock, boulders, or large stones are encountered at the bottom of the trench, excavate at least 8 inches below the bottom of the pipe for backfilling with Type 1 Pipe Bedding.”

Add the following paragraph:

“4. Excavation for Appurtenances

Excavation for manholes, valve pits, or similar structures shall be sufficient to leave ample room for work activities. Any over-excavation below specified grade shall be refilled with Type 2 Bedding as specified in Section 2.1.”

E. Pavement Damage Caused by Equipment

Delete paragraphs 2 and 3 in their entirety and replace with the following:

- “2. All pavement damaged during construction by the Contractor’s equipment or the use thereof shall be removed to at least a depth of 2 inches and replaced. Removal and replacement shall be over an area that is continuous with the asphalt restoration and as otherwise required by the Engineer to provide a smooth and durable patch. No compensation will be allowed for removal and replacement of damaged pavement outside of the pay limits for pavement restoration. Patches less than 2

inches in thickness will not be allowed. Work and materials shall be in accordance with the requirements for pavement restoration.

3. Damaged pavement outside of the replacement area may be subject to pavement damage assessment fees as required in Chapter 2 of the *Missoula City Public Works Standards & Specifications Manual*."

3.4 DEWATERING

A. General

Delete paragraph 2. in its entirety and replace with the following:

- "2. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed, and backfilled to the extent that no damage from hydrostatic pressure, flotation, contamination, or other cause will result. All excavations for pipelines and structures that extend down to or below static ground water elevations shall be dewatered by lowering and maintaining the ground water surface at the bottom of the excavation. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

Add the following section:

- "5. If dewatering is deemed necessary at the time of bidding, the Contractor shall consult a licensed professional engineer or certified professional hydrogeologist familiar with the local geologic, hydrogeologic, and geotechnical conditions as well as the construction practices pertaining to the Contractor's means and methods of dewatering and submit a dewatering and monitoring plan for review prior to commencing dewatering operations. The dewatering plan shall be designed and stamped by a licensed professional engineer or certified professional hydrogeologist."

3.6. TRENCH FILLING AND BACKFILLING

B. Pipe Bedding Placement

1. Type 1 Bedding:

Add the following to the end of paragraph b.:

- b. "Free draining, crushed, clean, granular bedding material with a maximum of 10% passing the #4 sieve shall be compacted with a minimum of two passes with vibratory compaction device. All other bedding material will be compacted to 95% of theoretical maximum proctor density as determined by ASTM D698."

2. Type 2 Pipe Bedding

Add the following to the end of paragraph a.:

- a. "Type 2 bedding shall be placed and compacted with a minimum of two passes with a vibratory compaction device."

C. TRENCH BACKFILL

1. After the pipe bedding materials are placed and compacted as specified, backfill the trench.

Delete paragraph b. in its entirety and replace with the following:

- "b. From the top of the Type 1 Pipe Bedding to 6 inches below the ground surface, or to the subgrade elevation, material containing rock up to 6 inches in the greatest dimension may be used. All larger material must be removed and hauled to waste."

2. Delete Paragraphs a., b., and c. in their entirety and replace with the following:

- "a. Type A Trench Backfill is compacted backfill and will be used for all work within the right of way.
- b. Type B Trench Backfill will not be used in the right of way unless approved by the Engineer.
- c. Type C Trench Backfill will not be used in the right of way unless approved by the Engineer."

Add the following section:

"G. Tracer Wire

1. Tracer wire shall be taped to the top center of the pipeline prior to backfilling.
2. Tracer wire connections and splices shall be made through the following soldering procedure.
 - a. Strip the tracer wire shielding no more than 2 inches in length.
 - b. Wrap the tracer wire around each other a minimum of 3 times making sure that the wraps are tight.
 - c. Use a butane or propane torch to heat the solder to a temperature that allows for an adequate joint. Cover the entire joint with solder to establish a sound connection. The soldering process should not take longer than 20 seconds. Verify the connection by pulling on the connection – the joint should not start to unwrap and solder should not crack or flake.
 - d. Apply a heat shield, (i.e., leathers) where performing this work near plastic pipe.
 - e. After allowing the wires to cool, apply one of the following covering methods on all sections of the exposed wire.
 - 1) Cover exposed wires with fusion bonded epoxy.
 - 2) Cover exposed wires with 3M Mastic wrapped completely with electrical tape.
 - 3) Apply DBY splice kit to exposed wires, including installing a wire nut by twisting clockwise and inserting the splice into the gel-filled insulator tube.
3. Tracer wire shall be brought to the surface at each valve or other appurtenance that is at the ground surface.
4. Small diameter PVC conduit shall be used in valve boxes to house the tracer wire brought to the surface.
5. Where new water service line transitions to existing galvanized service line, the new tracer wire should be attached to the galvanized pipe using

a Christy's or approved equal UL approved bronze grounding clamp suitable for direct burial."

3.9 TIME AND DISTANCE OF OPEN TRENCHES

Delete paragraph G. in its entirety and replace with the following:

"G. At the completion of each working day, fill all trenches and/or encircle with a minimum of six-foot tall chain-link fencing or other barricades required for public safety as approved by the Engineer or Owner. The cost will be considered incidental to the project."

3.10 DRAINAGE CROSSINGS

Add the following paragraph:

"C. Trench plugs are required at all locations where trenches cross irrigation canals, perennial streams, or other locations noted on project drawings. Refer to Section 02222 LOW PERMIABILITY TRENCH PLUGS for trench plug requirements."

Add the following paragraph:

"3.11. CONSTRUCTION PHOTOGRAPHS

A. Refer to Section 01600 WEEKLY CONSTRUCTION PHOTO DOCUMENTATION and Chapter 2 of the *Missoula City Public Works Standards and Specifications Manual* for construction photograph requirements."

END OF SECTION

SECTION 02222 LOW PERMEABILITY TRENCH BACKFILL PLUGS ***(MPWSS, as amended)***

PART 2: PRODUCTS

Add the following section:

"2.3 OPTION 3

- A. Plugs shall be constructed of flowable fill meeting the specifications in Section 02225 FLOWABLE FILL. Provide laboratory test results verifying that the slump, air content measurements are met."

END OF SECTION

SECTION 02230 STREET EXCAVATION, BACKFILL AND COMPACTION ***(MPWSS, as amended)***

PART 1 - GENERAL

1.3 DENSITY CONTROL TESTING

B. Field Density Testing

Delete paragraph 2 in its entirety.

END OF SECTION

SECTION 02234 SUB-BASE COURSE (*MPWSS, as amended*)

PART 2: PRODUCTS

2.1 GENERAL

Add the following parts:

- “B. Recycled asphalt pavement (RAP) sub-base course materials and construction shall meet the requirements of added Section 02236 – RECYCLED ASPHALT PAVEMENT (RAP) of these Standard Modifications to the MPWSS.
- C. Limit the use of recycled concrete in crushed sub-base course to maximum of 50% by weight. Recycled materials shall be all concrete, not a mixture of recycled materials. Recycled concrete shall be mechanically blended to ensure thorough mixing. Contractors are required to use a pug mill or other approved combining method to mix the virgin aggregate and recycled concrete prior to testing and placement.

Gradation of blended recycled concrete sub-base shall meet the associated virgin aggregate gradation specifications provided in this section.”

END OF SECTION

SECTION 02235 CRUSHED BASE COURSE (*MPWSS, as amended*)

PART 2: PRODUCTS

2.2 CRUSHED BASE MATERIAL

Add the following parts:

- “B. Recycled asphalt pavement (RAP) base course materials and construction shall meet the requirements of added Section 02236 – RECYCLED ASPHALT PAVEMENT (RAP) BASE AND SUB-BASE COURSE of these Standard Modifications to the MPWSS.

- C. Limit the use of recycled concrete in crushed base course to maximum of 50% by weight. Recycled materials shall be all concrete, not a mixture of recycled materials. Recycled concrete shall be mechanically blended to ensure thorough mixing. Contractors are required to use a pug mill or other approved combining method to mix the virgin aggregate and recycled concrete prior to testing and placement.

Gradation of blended recycled concrete base shall meet the associated virgin aggregate gradation specifications provided in this section.”

END OF SECTION

SECTION 02236 RECYCLED ASPHALT PAVEMENT (MPWSS, *as amended*)

PART 1: GENERAL

1.1 DESCRIPTION

- A. This work is the placing of one or more base courses composed of recycled asphalt pavement (RAP) meeting the gradation and other quality criteria specified herein.

1.2 REFERENCES

AASHTO T27 Sieve Analysis of Fine and Coarse Aggregates

AASHTO T96 Resistance to Degradation of Small-Size Coarse Aggregate By Abrasion and Impact in the Los Angeles Machine

AASHTO T99 Moisture-density Relations of Soils and Soil-Aggregate Mixtures (ASTM D698) 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 Density of Soil In-Place By Sand Cone Method (ASTM D1556)

AASHTO T310 In-Place density and water content of the soil and soil aggregate by (ASTM D6938) 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 per City of Missoula modification to MPWSS Section 01400.
 - 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, CBR test data, and other test results for sources to be used for RAP base materials prior to delivery to the site for approval by the Engineer.

PART 2: PRODUCTS

2.1 GENERAL

- A. Furnish RAP base material that is clean and free of contaminants or deleterious materials and meets applicable quality requirements.

2.2 RECYCLED ASPHALT PAVEMENT BASE MATERIAL

- A. Consists of both fine and coarse fragments of crushed recycled asphalt pavement. Where recycled materials are permitted, project specifications shall state the minimum required CBR value of 10 (design minimum) of the RAP Base Course.

2.3 GRADATION

- A. As determined by AASHTO Methods 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 below:

CLASSIFICATION FOR RECLAIMED ASPHALT PAVEMENT AGGREGATE BASE COURSE

Sieve Size	Mass Percent Passing Square Mesh Sieves
2 inches	100
1 inch	85-100
¾ inch	75-100
½ inch	55-90
No. 4	25 - 55
No. 16	5-25
No. 200	0 - 8

- 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 RAP is based on samples obtained during placement in the project within limits allowed in the table of gradations.

2.4 WATERING

- A. Use water from an approved source.

PART 3: EXECUTION

3.1 GENERAL

- A. Prepare the foundation by scarifying, blading, leveling, and rolling as required to provide the required grade, cross-section, and density. Shape and compact for the full width of the roadbed in advance of base laying operations for at least 300 feet or sufficient distance to allow visual inspection. Unless specified otherwise, uniformly compact the foundation to not less than the density for standard compaction of the material in the foundation. Maintain the foundation ahead of the base laying operations in a smooth condition and at not less than specified density. Remove ruts or surface irregularities. Correct soft or yielding areas, holes, or other defects before placing the base. Remove snow or ice from the foundation before placing base.
- B. Do not place base on foundations that are soft, spongy, or covered by ice or snow. Do not place base on frozen foundations unless the engineer approves otherwise. Water and rework or re-compact dry foundations as necessary to ensure proper compaction, or as the engineer directs.
- C. The engineer shall approve the grade before placement of the base. Approval of the grade shall be in accordance with applicable provisions of the standard specifications.

3.2 PLACEMENT AND SPREADING

- A. Mix and place the material in maximum 6-inch 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. Construct the base to the width and section the plans show. Shape and compact the base surface to within required surface tolerance.
- D. 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.
- E. Construct each layer meeting these requirements. Blade smooth and thoroughly compact each layer as specified before placing the succeeding layer.
 - 1. Use specialized pneumatic or vibratory compaction equipment or a combination of both types of machines. Do not use tamping rollers. The engineer may allow the contractor to compact the shoulder foreslopes with other equipment.
- F. 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.
- G. 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. Ensure the equipment used for watering is of the capacity and design to provide uniform water application.
- H. Apply water during the work to control dust and to maintain the RAP in a damp condition in accordance with Section 01500 under Dust Control.
 - 1. 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 equipment. 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.
- D. Develop a water and compaction procedure on a test strip with the owner or engineer present. Apply water to the uncompacted RAP and begin rolling the test strip. Test the dry density of the test strip after each roller pass to determine the maximum dry density. Utilize the approved water application and roller pattern for the duration of the project.
- E. If nuclear densometer testing is not available, use the procedure outlined in 3.3.D and owner or engineer will approve the water application rate and roller pattern. If this procedure is used, the owner and engineer reserve the right reject all or a portion of the work and require the contractor to remove and replace at the owner's expense.

3.4 SURFACE TOLERANCES

- A. 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 0.04 feet (1.2 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 0.04 feet (1.2 centimeters).
- B. For base course receiving asphalt concrete surfacing, the finished grade cannot deviate more than 0.04 feet (1.2 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 0.04 feet (1.2 centimeters).
- C. 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.

PART 4: MEASUREMENT AND PAYMENT

4.1 SQUARE YARD BASIS: RECYCLED ASPHALT PAVEMENT.

- A. This item is measured and paid for by the square yards (square meters) of recycled asphalt pavement base course surface area for furnishing recycled asphalt pavement base course of the thickness and gradations specified in the Contract documents, complete in place, at the contract unit price bid for Recycled Asphalt Pavement Crushed Base Course. Price and payment is full compensation for furnishing, crushing, loading, hauling, spreading, shaping, watering, and compacting the base course material and for all tools, labor, and incidentals necessary to complete this item.
- B. Payment is made under:
 - 1. ____" Thickness of Recycled Asphalt Pavement Base/Sub-base Course - per square yard (square meter).

END OF SECTION

SECTION 02510 ASPHALT CONCRETE PAVEMENT (*MPWSS, as amended*)

PART 2: PRODUCTS

2.2 PLANT MIX AGGREGATES

Add the following to the end of paragraph E.:

“The use of reclaimed asphalt pavement shall only be allowed with prior approval of the City and with a maximum 20% of reclaimed asphalt.”

2.5 COMPOSITION OF MIXES

A. General

Add the following:

“5. Current job mix is defined as a mix design done within the last 12 months in which no change in material sources or amounts has been made.”

Add the following section:

“2.6 ASPHALT PATCHING JOINT SEALANT MATERIAL

- A. Furnish sealant material that is a hot-poured rubber asphalt compound or thermoplastic rubber rated for cold temperatures in accordance with ASTM Type IV with a resilience within 30%-60%.
- B. Furnish the sealant material in one grade only.”

PART 3: EXECUTION

3.10 WEATHER LIMITATIONS

Delete paragraph B and replace with the following:

- C. Cold-Weather Placement: Generally, comply with MDT Standard Specification 401.03.18 (Surface Conditions, Weather Limitations, and Paving Dates), and 401.03.21 (Compaction, Compaction Control Testing, and Density Acceptance Testing) and as follows:

1. Plant mix paving is not allowed when the surface is saturated or ponding.
2. Complete compaction rolling within the temperature range recommended by the liquid asphalt manufacturer included in the hot mix design or before the mat temperature falls below 175°F for hot mix asphalt. Warm mix asphalt mixes are allowed to be paved in temperatures below 175°F, to be determined by the mix design and additives used for the mix, per manufacturers recommendations. During cold weather periods, or generally November 1 through April 15, the contractor must take all precautions as necessary to transport load with tarps, or otherwise, to maintain the minimum required compaction temperatures.
3. Compaction rolling after the mat temperature of hot mix falls below 175°F is cause to suspend paving operations. Compaction rolling is required in the vibratory mode. The Project Representative may adjust the minimum mat temperature if compaction damages the new pavement.
4. Any asphalt placed out of compliance will be deemed temporary and permanent asphalt replaced at a later date.

3.14 PATCHING

Add the following Section:

“D. Asphalt-to-asphalt joint sealing

1. Clean all joints so they are dry and free of dust, dirt, and/or other loose debris immediately prior to applying the sealant material.
2. Apply sealant material to all joints in accordance with the sealant manufacturer’s recommendations for handling, mixing, and application rate and temperature requirements.”

3.29 PAVEMENT AND MATERIAL TESTING REQUIREMENTS

Replace paragraphs E and F with the following:

- 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. If the core thickness is less than 75% of plan or less than

the required density, the material represented by the core will be removed and replaced.

- 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 10-foot (3.05 m) intervals parallel to the centerline in each 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 density or thickness and determine which areas warrant removal. The City has the right to reject all pavement that does not meet the minimum thickness or density requirements. Remove and replace the areas with asphaltic concrete of the density and thickness shown on the plans. Additional coring is considered as re-testing of failing areas.

PART 4: MEASUREMENT AND PAYMENT

4.4 PATCHING

Replace Paragraph 4. with the following:

- “4. Price and payment is full compensation for cleaning base or underlying course; for producing, furnishing, transporting, stockpiling, heating, drying, and screening of aggregate materials; for furnishing, handling, measuring, mixing, manipulating and placing of materials; for hauling, placing, shaping, compacting, and finishing of the paving mix; for asphalt-to-asphalt joint sealing, for improving unsatisfactory areas; for furnishing samples; for all materials (exclusive of asphalt and mineral filler), manipulation, labor, tools, equipment, and incidentals necessary to complete the work in full compliance with the plans and specifications.

END OF SECTION

SECTION 02528 CONCRETE CURB AND GUTTER (*MPWSS, as amended*)

PART 1: GENERAL

1.1 DESCRIPTION

Delete Paragraph B. in its entirety and replace with the following:

- “B. Refer to the most recent version of the Missoula City Public Works Standards & Specifications Manual Appendix 2-B for the City of Missoula Standard Drawings applicable to this section.”

PART 3: EXECUTION

3.3 FORMS

Add the following Section:

- “E. The Contractor shall verify that all sidewalk, laydowns, driveways, and miscellaneous concrete construction meet applicable Federal, State, and local ADA standards prior to pouring concrete.”

3.8 JOINTS

Replace paragraph B with the following:

- “B. Construct expansion joints at the following locations:
- construction joints,
 - junctions with existing concrete,
 - opposite to or at expansion joints in adjacent concrete,
 - points of curvature or tangency,
 - grade breaks,
 - changes in thickness,
 - four to ten feet on either side of drainage structures, and
 - at maximum 400-foot intervals in continuous runs of concrete being placed.

The expansion joint locations listed above, except for points of curvature or tangency, do not apply to extruded curb and gutter. Form all expansion joints using ½-inch thick, pre-formed expansion joint filler, as specified herein.”

3.9 CURB BACKFILL

: Replace this section in its entirety with the following:

- “A. Backfill using impervious dirt up to 6 inches below top of curb. Do not use sand or gravel backfill in this area.
- B. Place 6 inches of topsoil over the impervious backfill such that the finished grade is flush with the top back of curb or to the lines and grades specified in the Contract Documents.
- C. Extend the backfill section, with the finished grade surface at top back of curb elevation, a minimum of 1 foot beyond the back of curb prior to sloping to existing ground. Complete this work to the lines and grades specified in the Contract Documents.
- D. Compact backfill to prevent settlement and level the surface to have positive drainage. Complete all backfill within 3 days of adequate curing.”

3.11 TOLERANCES

Add the following:

- “B. Defective curb and gutter shall be removed and replaced at existing expansion or control joints (typically a 10-foot section).

Add the following section:

“3.12 CURB CUT RETROFITS

- A. Driveway saw cuts (or curb cuts) on existing curb and gutter is only permitted for approved residential driveways. Curb cannot be saw cut for commercial driveway openings or pedestrian curb ramps and must be removed and re-poured.”

END OF SECTION

SECTION 02529 CONCRETE SIDEWALKS, DRIVEWAYS, APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS, AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION (*MPWSS, as amended*)

PART 1: GENERAL

1.2 REFERENCES

Delete Paragraph A. in its entirety and replace with the following:

- “A. Refer to the most recent version of the Missoula City Public Works Standards & Specifications Manual Appendix 2-B for City of Missoula Standard Drawings applicable to this section.

PART 2: PRODUCTS

Add the following section:

“2.6 DETECTABLE WARNING SURFACES

- A. Furnish a detectable warning surface (DWS) at any new or repaired curb ramp or at other areas as designated in the Contract Documents.
- B. Furnish DWS in according with City of Missoula Standard Drawings and comprised of the following approved material, consistent throughout the project:
 - 1. Cast iron natural (rusting to red) domes”

PART 3: EXECUTION

3.1 GENERAL

Add the following sentence to paragraph C:

“The cold weather concreting plan must adhere to the guidelines and recommendations presented in ACI 306R-16 Guide to Cold Weather Concreting.”

3.2 FOUNDATION PREPARATION

SECTION 02529 CONCRETE SIDEWALKS, DRIVEWAYS, APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

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Delete paragraph B in its entirety and replace with the following:

- “B. Place and compact at least 4 inches of gravel base material compacted to 95% of ASTM D-698 and in accordance with STD-753 and STD-754 for sidewalk in the central business district. This requirement is waived for concrete if it is to be installed on street base course material exceeding 4 inches or more in thickness and is approved by the Engineer. Extend base course placement and compaction a minimum of 6 inches beyond concrete limits. The City Engineer may require additional base course thickness, depending on subgrade material..”

3.6 STRIPPING FORMS AND FINISHING

Add the following paragraph:

- “8. Stamp the edge of the finished concrete surface with an “S” at locations where underlying irrigation sleeves have been installed. Install the “S” stamp within 6 inches of the crossing irrigation sleeve alignment, to a depth of 1/8 to 1/4 inches, and with a letter height dimension of 2 to 3 inches.”

3.8 JOINTS

Replace the third sentence in paragraph B with the following:

“Place isolation joints at radius points, junctions with existing concrete, construction joints, changes in concrete thickness, grade breaks, and opposite to or at expansion joints in adjacent concrete.”

Replace the second sentence in paragraph C with the following:

“Unless otherwise directed, space contraction joints to create square sidewalk panels to the nearest extent feasible. Do not exceed 18 feet on any side of a sidewalk panel.”

3.9 BACKFILL

Replace the last sentence of paragraph C with the following:

“The addition of topsoil, seed, and/or sod and all finish grading work shall be completed and ready for inspection prior to opening the sidewalk for public use.”

END OF SECTION

SECTION 02581 PAVEMENT MARKINGS AND MARKERS (PRE-FORMED PLASTIC, PAINTS AND ENAMELS) (MPWSS, as amended)

PART 2: PRODUCT

2.1 PRE-FORMED PLASTIC PAVEMENT MARKING MATERIAL

Add the following to the end of paragraph A:

“Furnish green plastic material that meets MUTCD specifications for chromacity and is non-fading for its expected useful life.”

Add the following paragraph:

“J. All green and white bicycle crossing markings shall be pre-formed plastic meeting the material and execution specifications of this section.”

Add the following:

“2.3 EPOXY PAVEMENT MARKING PAINT

A. Furnish a two-component, 100-percent solids, epoxy material. No fillers or pigment extenders are permitted. Mixed pigment and epoxy resins with the curing agent shall be within $\pm 2.5\%$ of the manufacturer’s recommended mixing ratio. The components, when mixed, are not to contain or produce volatile solvents.

B. Composition Requirements

1. Pigment and Epoxy Resins

Provide materials meeting the following requirements:

Pigment	White	Yellow
TiO ₂ , meeting ASTM D 476, Type II	18-25	12-17
Organic Yellow	NA	7-9
Epoxy Resins	75-82	74-82

The acceptable weight per epoxy equivalent, on a pigment-free basis for both white and yellow, shall be within ± 50 of the manufacturer's target value per ASTM D 1652.

2. Curing Agents

The acceptable total amine value shall be within ± 50 of the manufacturer's target value per ASTM D 2074.

3. Glass Beads

Furnish glass beads meeting the requirements of the latest effective Montana Department of Transportation Standard and Supplemental Specifications for Road and Bridge Construction.

C. Physical Requirements

1. Hardness

Epoxy shall have a Shore D hardness between 75 and 100 per ASTM D 2240. Apply epoxy to a metal substrate.

2. Tensile Strength

Ensure the material has a minimum tensile strength of 6,000 psi (42 MPa) when tested per ASTM D 8638 with Type IV specimens cast in a mold not exceeding $\frac{1}{4}$ -inch thickness and at a pull rate of 0.25 inches per minute.

3. Compressive Strength

Ensure the material has a minimum compressive strength of 12,000 psi when tested per ASTM D 695 with a sample measuring 0.5 inches high by 0.5 inches in diameter at a maximum compression rate of 0.25 inches per minute.

4. Weather Resistance

Ensure epoxy is satisfactorily tested in an Environmental Test Chamber per ASTM G 53 with mixed, bead-less, epoxy samples applied at 15-mils (± 1 mil) thickness to 3-inch by 6-inch aluminum panels, conducted for 80 hours at 122°F with alternating 4-hour cycles of condensation and ultraviolet light. The tested epoxy shall meet the following requirements:

Specimen	Requirements
White Material	Directional reflectance is a minimum 80% of the initial value after exposure per ASTM E 1347.
Yellow Material	Initially conform to V+ to C+ limits when visually compared with the highway yellow color tolerance chart, PR #1 of June 1965. The exposed material color must be within V+, C+, and H+ limits when compared.

5. Laboratory Drying Time

Ensure material has a maximum no-tracking time of 15 minutes when tested per ASTM D 711 after applying 15 mils (± 1.5 mils) wet film thickness at 75°F ($\pm 2^\circ\text{F}$) with the specified glass bead application.

6. Viscosity

Ensure component viscosities are within 10% of each other at the manufacturer's recommended spray temperature and that the curing agent has a constant viscosity at the recommended spray temperature.

7. Material Acceptance

Furnish documentation consisting of a certified copy of a laboratory report providing the results of the specified testing requirements and certifying that the materials furnished meet these specifications. Refer to each applicable specification in the documentation. All certified testing shall have been performed in the manufacturer's laboratory or another qualified independent laboratory."

PART 3: EXECUTION

3.2 PAINTING TRAFFIC LINES

Replace paragraph L. with the following:

"When plastic pavement markings or epoxy pavement markings are specified, use waterborne paint for the interim markings of the specified color and apply as specified in the contract documents. The final application must be plastic or epoxy, as indicated in the contract documents."

Add the following paragraph:

"3.4 APPLICATION OF EPOXY PAVEMENT MARKING PAINT

A. General

The applicable requirements of the Montana Department of Transportation Standard and Supplemental Specifications for Road and Bridge Construction apply to the installation of all epoxy pavement marking materials. Provide the Engineer with the manufacturer's certification prior to the materials being delivered to the project site. Materials not meeting the manufacturer's product specifications will not be approved for use. The Engineer may request a manufacturer's sample or take field samples for testing. Use a sample weighing a minimum of 2 pounds. Remove from the work and replace material represented by samples failing one or more tests.

B. Packaging and Storage

Transport and store epoxy materials at the project in the manufacturer's original container before mixing components for application. Follow the manufacturer's instructions regarding material storage and handling. Mark each container identifying the color, batch or lot number, manufacturer's name and address, and date of manufacture.

C. Mixing

Mix components following all the manufacturer's recommendations.

D. Application Instructions

Provide the Engineer with a copy of the manufacturer's instructions for surface preparation and material application at least 24 hours before application work begins.

Include in the instructions:

1. Equipment requirements,
2. Approved work methods and procedures,
3. Material application range,
4. Ambient and surface temperature requirements,
5. Weather limitations,
6. Precautions, and

7. All other requirements for successful application and material performance.

Do not use materials with incomplete or without instructions.

E. Application

Apply mixed components following all the manufacturer's instructions. Apply a wet film thickness of 20 mils (± 2 mils) immediately followed by applying glass beads to the wet epoxy at 25 pounds per gallon. Match the existing markings configuration unless otherwise indicated in the Contract Documents or unless otherwise directed by the Engineer.

F. Surface Preparation

1. All Surfaces

Clean the substrate free of debris and deleterious material by high pressure air blast immediately ahead of the epoxy application.

2. Chip Seals, Friction Courses

Prepare surfaces with a tightly adhered single coat of traffic paint and surfaces with multiple coats of traffic paint by lightly grinding all lines on the roadway surface. Light grinding is defined as surface abrasion to a depth of 20 mils (± 10 mils) for the purpose of establishing a roughened surface, removal of loose paint chips, removal of loose seal aggregate, and removal of surface impurities, for the purpose of effective epoxy bonding. Depth of removal is measured vertically down from the bottom of a 3-foot or longer straight edge placed on the surface of the roadway to the ground surface. Immediately suspend surface removal if 30 mils depth is exceeded and take corrective action.

3. Concrete Surfaces

Treat concrete surfaces the same as asphalt surfaces by lightly grinding the surface to remove any foreign material and any curing compound.

4. Removals

Meet the limits of removal as follows:

- i. Not greater than 1 inch wider than the existing stripe,

- ii. No longer than 4 inches from the beginning or end of the stripe being removed, and
- iii. Any other removal deviating from items 1 and 2 above will be at the direction of the Engineer.

- 5. Collect and dispose of all removed material and new traffic marking materials spilled during the performance of this contract. Process, handle, transport, and dispose of these materials as solid waste in conformance with applicable laws and regulations.

G. Equipment

Ensure the epoxy application machine precisely meters the two components and produces and maintains the mixing head temperature all within the epoxy manufacturer's specifications. Equip the application machine with a high-pressure air blast device for cleaning the surface ahead of the marking application. In addition, equip the machine with a guide pointer to maintain an accurate line, with at least two spray guns operable separately or simultaneously, with an automatic device that produces broken lines at specified dimensions, and with automatic glass bead dispensers synchronized with the spray guns. Ensure the machine has a metering device to register the applied gallons for each gun.

H. Marking Protection

Assume responsibility for traffic control devices used to prevent tracking of new striping. These devices will not be paid for separately and payment will be included in other contract bid items."

END OF SECTION

SECTION 02585 STREET SIGNS (*added section*)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work involves providing and installing new street and traffic control signs as indicated in the Contract Documents and meeting City of Missoula standards.

PART 2 - PRODUCTS

2.1 STREET SIGNS

- A. Furnish signs in conformance with the Manual of Uniform Traffic Control Devices, latest edition (MUTCD) for chromacity, panel dimensions, and legend and background standards.
- B. Furnish signposts and bases in accordance with the Contract Documents and meeting City of Missoula standard drawing STD-720.
- C. Furnish signs meeting retro-reflectivity requirements indicated in the Contract Documents and meeting the minimum standards in the MUTCD.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install signs in locations designated in the Contract Documents, meeting the location standards in the MUTCD, and complying with City of Missoula standard drawing STD-722.
- B. Mount signs in accordance with City of Missoula standard drawing STD-720.
- C. Install accessible parking signs in accordance with 2009 ANSI A117.1: Accessible and Usable Buildings and Facilities and City of Missoula standard drawing STD-787.
- D. Verify all sign locations, including station/longitudinal location and offset from centerline, with the Engineer prior to placement and installation.

PART 4 - MEASUREMENT AND PAYMENT

4.1 SIGNS

- A. Street and traffic control signs shall be measured and paid for at the unit price listed in the bid schedule for "Street Sign." Payment at the unit price bid for each new sign installation includes all materials, labor, and equipment required to install the sign, including the foundation, post, mounting hardware, sign face(s), and mounting bracket(s). Additional payment will not be made for multiple sign faces included on a single sign assembly.

END OF SECTION

SECTION 02590 STREET LIGHTING (*added section*)

PART 1: GENERAL

1.1 DESCRIPTION

- A. Perform all work and furnish all equipment in accordance with the most recent edition of the Montana Department of Transportation (MDT) *Standard and Supplemental Specifications for Road and Bridge Construction* (Standard Specifications), the latest edition of the National Electrical Code, the National Electric Safety Code, and the Contract Documents.
- B. Consult with the Engineer and all affected utility companies about the schedule of street lighting related work prior to commencing the work. All streetlighting installations require a City of Missoula electrical permit prior to the start of work.
- C. Install all designated conduit (underground and above grade), connectors, fittings, splices, pull boxes, meter bases, poles, luminaires, switches, grounding rods, lugs, and conductors including all associated excavation and backfilling, concrete and concrete reinforcement, anchor bolts, and miscellaneous work and equipment required for a complete and operable lighting system in conformance with the Contract Documents and these specifications.
- D. Locate all underground public and private utilities in the area of the project prior to any excavation. Repair or replacement of damaged underground utilities resulting from this work is the responsibility of the Contractor.

1.2 EQUIPMENT LIST AND DRAWINGS

- A. Provide submittals in accordance with subsection 617.03.2 of the most recent edition of the MDT Standard Specifications.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Provide and install materials in conformance with Sections 616, 617, and 703 of the most recent edition of the MDT Standard Specifications.

Additions or modifications to the MDT Standard Specifications follow:

- B. Street Lighting

1. Submittals:

- a. Before any items are delivered to the job site, submit a complete list of all proposed materials. Show the manufacturer's name and catalog number for each item, furnish complete catalog cut-sheets and technical data, and furnish the manufacturer's recommendations as to method of installation. Provide a 10-year manufacturer warranty on street light poles and arms, and provide a 5-year manufacturer warranty on finish.

2. Products:

- a. The work of this section consists of all items necessary to provide and install street lighting at the locations shown in the Contract Documents complete with luminaire pole, luminaire arm, and luminaire as detailed in the Contract Documents. Installation of the foundation, conduit, conductors, meter, and control related to the decorative luminaires is covered elsewhere.
- b. Provide Excellence Opto Inc. SL3x M LED luminaire fixtures or an approved equal. Acceptable substitute fixtures must be LED modules each comprised of a removable LED board mounted to a low copper die-cast heat sink system. The LED board must be removable for serviceability or retrofitting in the future. The fixture is required to have an initial minimum lumen output of approximately 13,253 lumens, a minimum lumen efficiency of 105 LPW, a maximum color temperature of 3000K, CRI 70 min, full cut-off optics, and an IES Type 3 distribution pattern; and it must include a LED driver, Class 1, outdoor rating (IP66), operating at 120-277 VAC, 1050mA, 50-60 Hz auto-sensing with >2.5kV built in surge suppression, and programmable dimming using 0-10 V dimming control. Provide 7-pin photocell receptacle on all fixtures with shorting caps as necessary. All components included in the fixture must be manufactured by one manufacturer. Provide fixtures with a minimum lumen output of 70% at 70,000 hours at the Missoula, MT latitude with a 7-year warranty. Provide fixture surge suppression device rated at 10kV minimum. Paint all exposed metal black to match the color of the pole. The decorative look of the whole assembly must match associated detailed drawings in the Contract Documents.

c.

- d. Provide tapered steel pole on an anchor base. Provide pole 25 feet in height with a 4-foot luminaire arm and designed to have a minimum 13.5 EPA rating in a wind zone of 100 MPH with a gust factor of 1.3. Include a hand hole located approximately 18 inches up from the base of the pole and a decorative arm on the roadway side. Include two-piece ABS anchor bolt/plate cover. Provide a pole that is black in color to match the other painted components on the assembly. Match the pole type and style pole with the detail contained in the Contract Documents. Align luminaire arm perpendicular to centerline of roadway. When street light poles with banner bars are specified, provide poles with banner bars having a spread of 4 feet 10 inches.
- e. Provide a system controlled by a photo eye and contactor with an off/hand/auto switch mounted in a NEMA type III enclosure.

PART 3: EXECUTION

3.1 GENERAL

- A. Install materials meeting the specifications and details in the Contract Documents.
- B. The luminaire pole locations shown in the Contract Documents are based on numerous factors and constraints. Do not field adjust without the approval of the Engineer. Verify pole locations and positioning with the Engineer prior to installation.
- C. Mount the control photo eye on the luminaire nearest the street lighting electrical service.

PART 4: MEASUREMENT AND PAYMENT

4.1 GENERAL

- A. Measurement and payment for foundation concrete, electrical service, pull boxes, wiring, and conduits necessary to energize the in-place street lighting system are described with the MDT Standard Specifications. Items not specifically listed for payment on the Bid Form are incidental to the work. The Contractor is responsible for all permits, service applications, inspections, and incidentals necessary to complete the work as described herein.

- B. Payment for Streetlights will be per each and includes the luminaire fixture; pole and mast arm; base and anchor bolts; and all incidental accessories, equipment, and labor necessary to install the streetlight as shown in the plans and specified herein.

END OF SECTION

SECTION 02660 WATER DISTRIBUTION (*MPWSS, as amended*)

PART 1 - GENERAL

1.1 DESCRIPTION

Add the following Paragraph:

“D. The specifications contained herein are the latest adopted specifications by Missoula Water. The specifications are to be used in conjunction with Montana Department of Environmental Quality (MDEQ) and American Water Works Association (AWWA) standards for the design and installation of water works facilities.”

1.3 REFERENCES

Add the following:

“ASTM D2239	Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C600	Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C901-17	Polyethylene (PE) Pressure Pipe and Tubing, 3/4 in. through 3 in. for water service
AWWA M12	Simplified Procedures for Water Examination”

1.4 STANDARD DRAWINGS

Delete Paragraph A and replace with the following:

“A. Refer to the most recent versions of the City of Missoula Standard Drawings.”

PART 2 - PRODUCTS

2.1 GENERAL

Delete Paragraph A and replace with the following:

- "A. Furnish water main pipe and fittings as specified in the Contract Documents and meeting the material and testing requirements of this section. Water main pipe shall be ductile iron, unless other materials are approved by the City. Furnish fittings and service line piping of the same material and design as the water main pipe unless specified otherwise. Pipe strength classifications are listed in this standard modification. The specifications and detail drawings shall be made a part of the improvement plans, contract documents, and project manuals for construction of water mains and/or other appurtenance."

2.2 PIPE MATERIALS

B. Ductile Iron Pipe

Delete Paragraph 1 and replace with the following:

- "1. Pipe 12 inches and smaller shall be Class 350 Ductile Iron Pipe in accordance with AWWA C-151.
2. Pipe larger than 12 inches shall be Class 250 Ductile Iron Pipe in accordance with AWWA C-151."

Delete Paragraph 3 and replace with the following:

- "3. Mechanical joint fittings shall be ductile iron rated for 350 psi working pressure and meet the requirements of AWWA C153. All flanged fittings shall be ductile iron rated for 250 psi working pressure and meeting the requirements of AWWA C110 and shall utilize Full Face Flange TYTE Gaskets or approved equal."

4. Joints

Add the following section:

- "c. Restrained joint systems and mechanically restrained joint fittings shall be installed at all fittings, hydrant lead pipes, within 36 feet of a blow-off, and where specifically indicated in the drawings."

5. Couplings

Delete Paragraph a. and replace with the following:

“a. Use pipe couplings meeting one of the following:

- 1) Cast type with ductile iron sleeves and ductile iron flanges.
- 2) Ductile iron, mechanical joint solid sleeves, with a minimum 12-inch length.
- 3) Limit use of the first type to a maximum 16-inch diameter. Use the manufacturer’s standard gasket for use in potable water systems. Use stainless steel bolts and nuts. Coating to be “manufacturer’s standard”

C. Polyvinyl Chloride (PVC) Pressure Pipe

Change “Use DR 25 Class 165 pipe” to “Use DR 18 Class 235 pipe”.

Delete paragraph D. and replace with the following:

“D. Water Service Pipe

1. Service lines smaller than 4 inches shall be Polyethylene (PE) water service pipe. Polyethylene pipe shall be manufactured in accordance with AWWA C901-17 for sizes 1-1/4-inch thru 3-inch IPS diameters and to the requirements of ASTM D3035, and 2-inch and smaller water service pipe and tubing shall be manufactured in accordance with ASTM D2239 for inside diameter control IPS size.
2. Black PE materials used for the manufacture of polyethylene pipe, tube and fittings shall be PE 4710 high density polyethylene resin meeting ASTM D3350 cell classification 445574C, and shall be listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73°F. The material shall be listed and approved for potable water in accordance with NSF/ANSI 61.
3. The Dimension Ratio (DR), using Inside Diameter (ID) base dimensions shall be 7. The AWWA Pressure Class (PC) shall be 250 psi. Inspection, testing and marking of the PE shall be as specified in AWWA C901.
4. Ductile iron pipe or C900 PVC pipe meeting the requirements of applicable sections for water mains shall be used for service lines and fire

lines 4 inches in diameter or greater. All service lines and fire lines 4 inches and larger shall be properly restrained inside the building using threaded rod and/or engineered restraint devices.

5. Service line fittings may be connected with Mueller or Ford Pack Joint or compression-type couplers or approved equal. Mueller INSTA-TITE fittings are not allowed. All fittings and appurtenances to be buried shall be designed for direct burial applications.
6. In-line service tees for services 4 inches and greater shall use mechanical by swivel connections.
7. Tracer wire shall be installed in all water main and service line trenches and shall meet the requirements in Section 02221 "TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES."
8. If galvanized service pipe is repaired with polyethylene pipe, electrical continuity of the galvanized pipe shall be maintained by connecting #14 tracer wire to the galvanized pipe on both sides of the repair using LH Dottie DB25 bare ground clamps or equivalent direct bury-rated ground clamps."

Delete Section 2.3 TAPPING SLEEVES AND VALVES and replace with the following:

"2.3 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves for main connections larger than 2 inches shall be Romac SST stainless steel tapping sleeves with ductile iron flange or approved equal complying with AWWA C223 m. Use stainless steel nuts and bolts.
- B. Provide thrust blocking behind sleeve sized per thrust block detail in the drawings."

Delete Section 2.4 CORPORATION STOPS and add replace with the following:

"2.4 CORPORATION STOPS

- A. Corporation stops shall be Mueller 300 Series Ball Valves, Ford FB 400 Series, or approved equal with C.C. inlet and male I.P. outlet and shall be 1 inch minimum."

Delete Section 2.5 SERVICE CLAMPS and replace with the following:

“2.5 TAPPING SADDLES

- A. Tapping saddles for main connections 2 inches or smaller shall be C.C. threaded, stainless steel, and meet the requirements in Table 1.”

Table 1

Pipe Type	Required Tapping Saddle (or approved equal)
OD Steel Pipe	ROMAC – 101NS Style SMITH BLAIR - 315
Ductile Iron Pipe	ROMAC – 101NS Style FORD – FC101 Style SMITH BLAIR - 315
PVC C900 Pipe	ROMAC – 202NS Style FORD – FC202 Style SMITH BLAIR - 397

Delete Section 2.6 CURB STOPS and replace with the following:

“2.6 CURB STOPS

- A. Curb stops shall be Mueller 300 Series Ball Valve, Ford B Series, or approved equal.
- B. Contractor is advised that existing service lines may be galvanized iron piping or other pipe material, and that existing pipe material will have to be field verified. Have extra materials readily available to avoid delays as no time extension or extra compensation will be allowed for connections to non-standard service lines, regardless of material.”

Delete Section 2.7 CURB BOXES and replace with the following:

“2.7 CURB BOXES

- A. Curb box shall be extension type, stationary rod, Minneapolis pattern, 1 1/2-inch diameter and shall be Mueller H-10302 or approved equal. Curb box lids must have cast iron plugs. No plastic or brass plugs will be allowed.”

Delete Section 2.8 “VALVES” and replace with the following:

“2.8 VALVES

- A. Valves shall be flanged, mechanical joint, or a combination thereof as specified for the particular application.

B. All flanged valves shall utilize full Face Flange TYTE Gaskets or approved equal.

C. Gate Valves

1. Gate valves shall be used for applications 10 inches and smaller. Valves shall be rated for 350 psig maximum working pressure. Mueller, American Flow Control 2500 Resilient Wedge gate valve, Kennedy C509 Resilient Wedge gate valve or approved equal shall be used and shall meet or exceed AWWA C509.
2. Gate valves for underground installation equipped with a 2-inch square operation nut for key operation. All valves to open counterclockwise.

D. Butterfly Valves

1. Butterfly valves shall be used for applications 12 inches and larger. Valves shall be rated for 250 psig maximum working pressure. Mueller Linesal XP11, M&H 4500, Kennedy Valves Style 4500, or approved equal butterfly valves shall be used and shall meet or exceed AWWA C504.
2. Provide a 2-inch square operation nut and valve box for operating the valve. Valves to open counterclockwise. Furnish bonnet and gland bolts and nuts either fabricated from low-alloy steel for corrosion resistance or electroplated with zinc or cadmium. “

2.9 VALVE BOXES

Delete Paragraph A and replace with the following:

- “A. Valve boxes shall be cast iron, adjustable stem, marked with word “WATER” on lid. All valve boxes shall be 3-piece, screw type with 5-1/4-inch shaft compatible with the valve and shall not rest on the pipe. All boxes shall be set plumb and to the finish grade of surrounding material.”

Delete Section 2.10 FIRE HYDRANTS and replace with the following:

“2.10 FIRE HYDRANTS

SECTION 02660 WATER DISTRIBUTION

Appendix 2-A – Standard Mods to MPWSS

Missoula City Public Works Standards & Specifications Manual - January 2024

A. Fire hydrants shall be Mueller Super-Centurion or newer, American Flow Control Waterous Pacer WB67 16" top section, or approved equal meeting all requirements of AWWA Standard C502 and as follows:

1. Valve opening shall be minimum 5-1/4 inches.
2. Hydrant shall be three-way with two 2 1/2-inch hose nozzles (National Standard Thread) and one 4 1/2-inch pumper nozzle (National Standard Thread).
3. Pumper nozzle shall be equipped with a Storz adapter.
4. Hydrants shall have 1 1/2-inch pentagon operating nut, opening left.
5. Mechanical joint inlet connection shall be 6 inches diameter or greater.
6. The hydrant shall be of the breakaway type so that in case of barrel breakage, the main valve will remain closed.
7. Fire hydrants shall be painted yellow with hydrant manufacturer supplied paint.
8. The hydrant assembly shall be rated for working pressure 250 psig.
9. Fire hydrant tees shall use mechanical joint by swivel connections."

2.12 POLYETHYLENE ENCASEMENT

Delete Paragraph A. and replace with the following:

- "A. Encase all ductile iron pipe in 8-mil polyethylene wrap in accordance with AWWA C105, "Polyethylene Encasement for Ductile Iron Pipe Systems." The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight or watertight enclosure."

Delete Section 2.13 WATER MAIN INSULATION and replace with the following:

“2.13 WATER MAIN INSULATION

- A. Furnish insulation meeting the requirements in Specification Section 02724 INSULATION.”

Delete Sections 2.14 FLUSHING HYDRANTS, 2.15 YARD HYDRANTS, and 2.16 BLOWOFF HDYRANTS in their entirety.

Add the following Sections:

“2.14 BLOW-OFFS

- A. Blow-off valves shall be Mueller A-2360 or American Flow Control 2500 resilient wedge gate valve THD x THD with a 2-inch operating nut or approved equal. Valves shall meet or exceed AWWA C509.

2.15 METER PITS

- A. Meter pits for meters 1 inch and smaller shall be Mueller Thermacoil, Ford Coil Pit Setter, or AY McDonald Coil Type Pit Setter as shown in City of Missoula Standard Drawing 404A.
- B. Meter pits for irrigation meters larger than 1 inch can be installed in concrete pits as shown in City of Missoula Standard Drawing 413.”

PART 3 – EXECUTION

3.2 PIPE INSTALLATION FOR WATER MAINS

- A. General

Delete paragraph 1 and replace with the following:

- “1. Installation shall be in accordance with AWWA C600. Bury depth should typically be less than 7.5 feet from finished grade to top of pipe, except

where otherwise indicated on the plans. All water lines shall be buried a minimum depth of 6 feet unless otherwise approved by the City Utility Engineer.

- a. Where minimum bury depth cannot be maintained insulation, shall be installed meeting Section 02724 INSULATION.”

C. Laying of Pipe

9. “Change Standard Drawing 02660-1 to City of Missoula Standard Drawing 407.”

Add the following sentences to the end of Paragraph 9:

“Thrust restraints shall consist of restrained joints and thrust blocking at all fittings. Thrust blocking shall be in accordance with design criteria contained herein and in accordance with other approved pipe manufacturer’s recommendations. Steel tie backs and welds must be in accordance with pipe manufacturer’s recommendations. All thrust restraints must be approved by the Engineer prior to backfilling.”

- “11. Change Standard Drawing 02660-1 to City of Missoula Standard Drawing 407.”

Add the following Paragraphs:

- “12. Install detectable warning tape and trace wire meeting Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES.

13. Where existing water mains are to be abandoned in place, contractor shall install a watertight cap or plug.”

D. Pipe Jointing

2. Mechanical Joints

Delete Paragraph c. and replace with the following:

- “c. All bolts shall be torqued according to the manufacturer’s specifications.”

Add the following Paragraph:

- “f. Deflections at fittings and couplings shall not exceed 60% of the pipe manufacturer’s recommendations.”

3. Connections to Existing Mains

Delete Paragraph b. and add the following:

- “b. Notice shall be provided with an appropriate door hanger tag a minimum of 24 hours prior to a shutdown of a residential water service and 48 hours prior to a shutdown of a commercial water service. Notifications of customers shall be coordinated with Missoula Water personnel.
- c. Any construction work causing disturbance of backfill materials beneath cast iron or asbestos cement (AC) water mains shall be backfilled up to the bottom of the water main with flowable fill in accordance with Section 02225 FLOWABLE FILL.
- d. Any construction work causing steel water mains to be exposed shall require installation of 32-pound magnesium sacrificial anodes on the steel mains. Missoula Water will provide the anodes and will perform the cad welding to install the anodes at the request of the contractor. The Contractor shall provide 48 hours’ notice prior to the time the anodes will need to be installed. The contractor shall provide all required safety devices prior to Missoula Water personnel entering a trench.
- e. Only Missoula Water personnel are allowed to operate water main valves. The contractor shall protect and/or replace tracer wire along mains.

- f. Valve boxes shall be left flush with the street surface final grade. Any water valves covered or paved over should be uncovered within 24 hours.
- g. Notice shall be provided with an appropriate door hanger tag a minimum of 24 hours prior to a shutdown of a residential water service and 48 hours prior to a shutdown of a commercial water service. Notification of customers shall be coordinated with Missoula Water personnel.
- h. All activities involving asbestos cement pipe, related fixtures containing asbestos pipe materials, and steel pipe with wraps potentially containing asbestos shall be performed in accordance with all local, state, and federal regulations. A licensed, bonded and accredited in Montana asbestos abatement contractor shall be used to perform the required work including the transport and disposal of any asbestos-containing waste materials.”

3.3 POLYETHYLENE ENCASEMENT

Add the following section:

- “C. During installation, soil or embedment material shall not be trapped between the pipe and the polyethylene. Cuts, tears, punctures, or other damage to the polyethylene shall be repaired with adhesive tape or a short length of polyethylene wrapped around the pipe to cover the damage area and secured in place in accordance with AWWA C105.”

Delete Section 3.4 TESTING, CLEANING, & DISINFECTING WATER MAINS, VALVES & FITTINGS and replace with the following:

“3.4 TESTING, CLEANING & DISINFECTING WATER MAINS, VALVES & FITTINGS

A. Cleaning Water Mains

- 1. Contractor shall prevent contaminating materials from entering the water main during storage, construction, or repair.

a. Keeping Pipe Clean and Dry

- 1) Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination.
- 2) Pipe delivered for construction shall be laid out to minimize entrance of foreign material.
- 3) All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons such as rest breaks or meal periods.
- 4) Rodent-proof plugs may be used where it is determined that watertight plugs are not practicable and where thorough cleaning will be performed by flushing or other means.
- 5) Delay in placement of delivered pipe invites contamination.
- 6) The more closely the rate of delivery is correlated to the rate of pipe laying, the less likelihood of contamination.

b. Gaskets

- 1) All gaskets and lubricants shall meet NSF Standard 61 for water contact materials.
- 2) Gaskets shall be handled in a manner which avoids contamination.
- 3) The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water.
- 4) It shall be delivered to the job in closed containers and shall be kept clean.

c. Cleaning and Swabbing

- 1) If dirt enters the pipe that, in the opinion of the City Utility Engineer or inspector, will not be removed by the flushing operation, the interior of the pipe shall be cleaned by

mechanical means and then shall be swabbed with a 1% hypochlorite disinfecting solution.

d. Wet-Trench Construction

- 1) If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to ensure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/L.
- 2) This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench or by treating the trench with hypochlorite tablets.

e. Flooding by Storm, Accident, or Other Cause during Construction

- 1) If the main is flooded during construction, it shall be cleared of the flood water by draining and by flushing with potable water until clean.
- 2) The section exposed to the flood water shall then be filled with chlorinated potable water which at the end of the 24-hour holding period will have a free chlorine residual of not less than 25 mg/L.
- 3) The chlorinated water may then be drained or flushed from the main.

2. Contractor shall remove by flushing or other means those materials that may have entered the water main.

B. Disinfecting Water Mains

1. General

- a. Disinfect the water mains subject to the Engineer's approval in accordance with AWWA C651, "Disinfecting Water Mains" and these specifications before hydrostatic and leakage testing. Keep

the interior of all pipe, fittings, and appurtenances free from dirt and heavy and foreign particles.

2. Forms of Chlorine

a. The forms of chlorine that may be used, subject to the approval of the Engineer, are:

- 1) Sodium Hypochlorite in liquid form in glass, rubber-lined, or plastic containers containing 5% to 15% available chlorine. Meet AWWA B300 requirements.
- 2) Calcium Hypochlorite. Calcium hypochlorite in granular form and contains 65% available chlorine by weight. Calcium hypochlorite tablets are not allowed to be used. Meet AWWA B300 requirements.

3. Methods of Chlorination

a. Granules Method

- 1) The granules method gives an average 24-hour chlorine dose of not less than 25 mg/L.
- 2) The granules used must be approved for potable water use.
- 3) This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
- 4) During construction, 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.
- 5) The quantity of granules shall be as shown in Table 2 shall be placed at the beginning of the main and at each 500-foot interval.

Table 2- Quantity of Calcium Hypochlorite Required for Disinfection

Pipe Diameter (inches)	Calcium Hypochlorite Granules (ounces)
4	0.5
6	1.0

8	2.0
12	4.0
16 and larger	8.0

- 6) When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps.
- 7) Precautions shall be taken to ensure that air pockets are eliminated.
- 8) This water shall remain in the pipe for at least 24 hours.
- 9) If the water temperature is less than 5°C (41°F) the water shall remain in the pipe for at least 48 hours.
- 10) Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

b. Continuous Feed Method

- 1) The continuous feed method gives a 24-hour chlorine residual of not less than 10 mg/L.
- 2) At the option of the Engineer, calcium hypochlorite granules shall be placed in pipe sections. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. This procedure is recommended particularly where the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.
- 3) Prior to being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates as specified below.
- 4) Water from the existing distribution system shall be made to flow at a constant measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by methods such as placing a pitot gauge in the discharge, measuring the time to fill a container of known volume or measure the trajectory of the discharge and using the formula shown in Figure 1.

- 5) At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L chlorine concentration. To ensure that this concentration is provided, the chlorine concentration should be measured at regular intervals in accordance with the procedures described in the current edition of Standard Methods of AWWA M12-Simplified Procedures for Water Examination or using appropriate test kits.
- 6) Table 3 gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of 1% chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires 1 pound of calcium hypochlorite in 8 gallons of water.

Table 3 - Chlorine at 1% Concentration Required to Produce 25 mg/L Concentration

Pipe Diameter (in)	1% Chlorine Solution (gal)
4	0.16
6	0.36
8	0.65
10	1.02
12	1.44
16	2.60
20	3.57

- 7) During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 25 mg/L free chlorine.

c. Slug Method

- 1) Placing of calcium hypochlorite granules, preliminary flushing, and chlorinating the main shall be done in accordance with the procedures outlined in the Continuous Feed Method.
- 2) At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To ensure that this concentration is provided, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or “slug” of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hours.
- 3) The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.
- 4) As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

C. Final Flushing

1. After the required retention period, flush the chlorinated water from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than the system. All chlorinated water being discharged to surface waters or active irrigation ditches shall be dechlorinated in accordance with this Section.

- a. The flushing velocity in the main shall be not less than 2.5 feet per second (fps) unless City Utility Engineer or inspector determines that conditions do not permit the required flow to be discharged to waste. Table 4 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes. It is understood that such flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying.
 - b. In mains of 24 inches or larger diameter, an acceptable alternative to flushing is to broom sweep the main, carefully removing all sweepings prior to chlorinating the main.
2. The distance between blow offs and sampling taps shall be no further than 960 feet unless otherwise approved by the City Utility Engineer. The Contractor shall supply written flushing and sampling plan indicating where blow-offs and sampling taps will be located, where the flushed water will be discharged to, and all other applicable information needed for Missoula Water to assist in flushing and sampling activities.

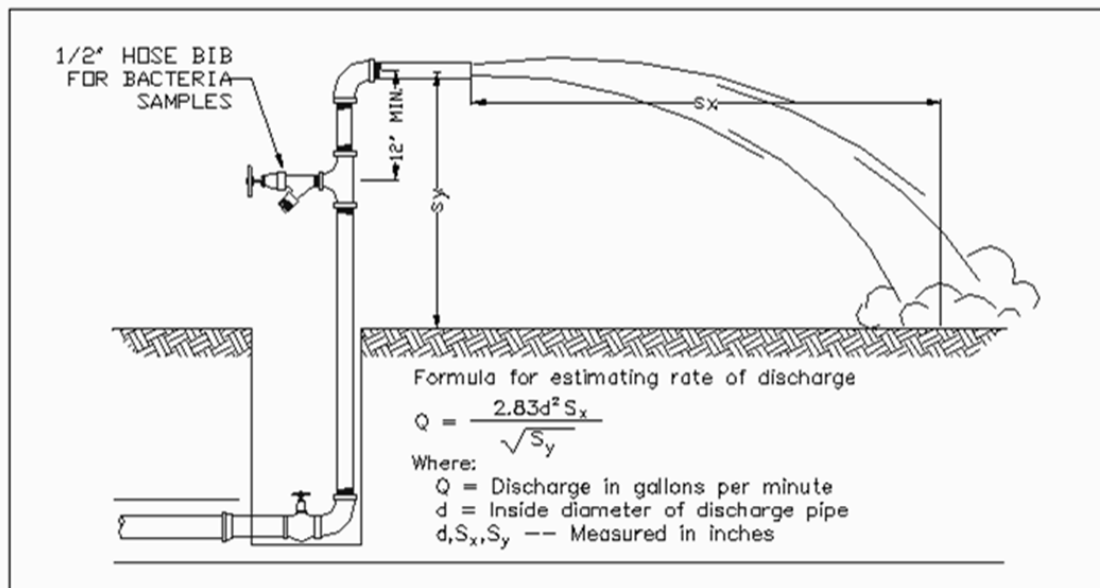


Figure 1 – Suggested Combination Blow-off and Sampling Tap

Table 4 – Required Flow and Openings to Flush Pipelines with 40 PSI Residual in Main^(a)

Pipe Diameter (inches)	Flow required to produce 2.5 fps velocity (gpm)	Size of tap on main ^(b) (inches)	Hydrant Outlets	
			Number	Size (inches)
4	100	15/16	1	2 ½
6	220	1 3/8	1	2 ½
8	390	1 7/8	1	2 ½
10	610	2 5/16	1	2 ½
12	880	2 13/16	1	2 ½
16	1565	3 5/8	2	2 ½
20	2450	-	-	-
<p>(a) With 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1000 gpm and a 4½-inch hydrant nozzle will discharge approximately 2500 gpm.</p> <p>(b) Size of tap on main with no significant length of discharge piping</p>				

2. De-chlorination

- a. Discharge of chlorinated water shall be performed in accordance with the Missoula Valley Water Quality District’s Policy Statement on “Allowable non-stormwater discharges.”
- b. Any chlorinated water discharged to dry wells does not require de-chlorination.
- c. Planned discharges to conveyances connected to surface waters shall be dechlorinated to below 0.01 ppm.
- d. Analytical results showing concentrations less than or equal to 0.1 ppm total residual chlorine (TRC) are considered to be in compliance.
- e. Missoula Water staff shall assist with de-chlorination where required.
- f. Discharges to surface water (including irrigation ditches) must be coordinated with the irrigation ditch owner and the MDEQ.

Discharge to surface water may not exceed surface water standards established in Circular DEQ-7 and may require a permit.

D. Bacteriological Tests

1. Standard Conditions

- a. After final flushing and confirmation that the chlorine residual is no higher than the system and before the water main is placed in service, bacteriological tests shall be performed to certify the water sampled from the main to be free of coliform bacteria contamination.
- b. Two consecutive samples collected at least 24 hours apart shall be required from the new main and each branch thereof. In the case of extremely long mains, it is desirable that samples be collected along the length of the line as well as at its end.
- c. Each sample shall be collected by both the Engineer for processing at a certified lab and by Missoula Water personnel for processing at the Missoula Water lab.
- d. Prior to proceeding with a pressure test, it must be determined that all samples are free of bacterial contamination. Samples processed by a certified lab must be free of bacterial contamination in accordance with the requirements of the specific tests performed. For tests performed in the Missoula Water lab, the first sample must be free of bacterial contamination for a period of 48 hours and the second sample must be free of bacterial contamination for a period of 24 hours. A standard plate count may be required at the option of the Engineer.

2. Special Conditions

- a. If, during construction, trench water has entered the main, or if in the opinion of Missoula Water or Engineer, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of no less than 200 feet and shall be identified as to location.
- b. Samples shall be taken of water that has stood in the main for at least 16 hours after flushing has been completed.

3. Sampling Procedures

- a. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate.
- b. No hose or fire hydrant shall be used in collection of samples unless specifically approved. A suggested combination blow-off and sampling tap useful for main up to and including 8-inch diameter is shown in Figure 1. A corporation cock may be installed in the main for sampling use.

4. Re-disinfection

- a. If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be re-flushed and shall be resampled. If check samples show the presence of bacterial contamination, then the main shall be re-chlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.
- b. High velocities in the existing system, resulting from flushing the new main may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is recommended to sample water entering the new main.

5. Disinfection Procedures When Cutting into or Repairing Existing Mains

- a. The following procedures apply primarily when mains are wholly or partially dewatered.
- b. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing to minimize the time customers are out of water.
- c. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.
- d. Swabbing with Hypochlorite Solution.
 - 1) The interior of all pipe and fittings used in making the repair (particularly couplings and sleeves) shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed.
- e. Flushing
 - 1) Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant location permit, flushing toward the work location from both directions is recommended.
 - 2) Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.
- f. Slug Chlorination
 - 1) Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated, except that the dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 minutes.

- 2) After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

g. Sampling

- 1) Bacteriological samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined.
- 2) If the direction of flow is unknown, samples shall be taken each side of the main break.
- 3) If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded.
- 4) Positive samples shall be evaluated by the Engineer for corrective action.

6. Retesting Fee

1. Missoula Water will charge an hourly fee based on the current "Staff Assistance Fee" shown in the City's Utility Rate Schedule for all work required for retesting. Missoula Water personnel will track the time required for retesting, and the fee will be charged based on this tracking.

E. Hydrostatic and Leakage Testing

1. No hydrostatic pressure test will be made against any portion of the system until satisfactory bacteriological sample reports are received. All bacteriological test results for the section of line to be statically tested must be in possession of the Engineer prior to beginning the test.
2. Hydrostatic pressure tests must be observed, recorded, and certified by either the Engineer or a representative of Missoula Water.

3. The Contractor shall provide the pressure test apparatus. The pressure test apparatus must be inspected by the Engineer or a representative of Missoula Water prior to the start of the test.
4. All pressure testing shall be in accordance with AWWA C600.
5. After the pipe has been laid and bacteria testing successfully completed, all newly laid pipe or any valved section of pipe shall be subjected to a hydrostatic pressure of not less than 1.5 times the stated working pressure at the lowest elevation of the test section. The pressure test shall be at least 2 hours in duration.
6. Pressure testing of all newly laid pipe shall include service lines up to the curb box. The contractor may choose to pressure test the main line prior to connecting the service lines. In this case, a subsequent pressure test will be required to include the service lines up to the curb box.
7. All equipment used in pressure testing shall be intended for use in potable water systems and should only be used for pressure testing potable water systems. All equipment shall be disinfected prior to conducting pressure tests.
8. Test pressures shall not:
 - a. Exceed the thrust restraint design pressures or 1.5 times the pressure rating of the pipe or joint, whichever is less,
 - b. Vary by more than +/- 5 psi,
 - c. Exceed the rated working pressure of the valves or hydrants when the pressure boundary of the test section includes closed, resilient-seated gate valves, butterfly valves, or hydrants, and
 - d. Be less than 1.5 times the stated working pressure at any time during the test. If the test pressure drops below 1.5 times the stated working pressure, the test shall be terminated and re-started at a higher pressure.

9. Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to Missoula Water personnel.
10. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place at the discretion of Missoula Water personnel.
11. Exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to Missoula Water personnel.
12. Determination of acceptable leakage rate shall be performed as follows:
 - a. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
 - b. The pipe installation will be rejected if the leakage exceeds that determined by the following formula:

$$L = \frac{S \times D \times \sqrt{P}}{148,000}$$

in which L is the allowable leakage, in gallons per hour; S is the length of the pipeline tested, in feet; D is the nominal diameter of

the pipe, in inches; and P is the average test pressure during the leakage test in pounds per square inch.

13. When testing against closed metal seated valves, an additional leakage per closed valve of 0.0078 gallon/hour/inch of nominal valve size shall be allowed.
14. When hydrants are in the test section, the test shall be made against the closed hydrant.
15. All visible leaks must be repaired regardless of the amount of leakage.”

3.5 WATER AND SEWER MAIN SEPARATION

Delete Paragraph A and replace with the following:

- “A. Maintain horizontal and vertical separation between water mains and sewer mains and water mains and stormwater mains in accordance with City of Missoula Standard Drawing 402.”

3.6 VALVES

Add the following sections:

- “D. All valves 4 inches and greater shall be tied down in accordance with City of Missoula Standard Drawing 406 unless they are flanged to a tee or cross connected to a branch piping in at least two directions. Each piping branch must be at least 18 feet from the tee or cross to the first unrestrained joint.
- E. All valves shall be installed in accordance with the manufacturer's recommendations and as shown in the City of Missoula Standard Drawing 405 and 406.
- F. All bolts shall be torqued according to the manufacturer’s specifications.”

3.7 FIRE HYDRANTS

Add the following sentences the end of Paragraph A:

“The hydrant shall have a minimum bury depth of 6 feet. The Contractor shall be responsible for providing a hydrant of appropriate barrel length. Hydrant extensions are to be avoided and will only be allowed with written permission of Missoula Water in the event the hydrant is installed below finished grade and shall be installed at the Contractor’s expense.”

Delete Paragraph B and replace with the following:

“B. Install hydrants meeting City of Missoula Standard Drawing 408 and in accordance with manufacturer’s recommendations, current regulations of the City, County, or other Fire Department having jurisdiction. The gate valve shall be a minimum of 3 feet from the hydrant.”

C. Fire Hydrant Lead Pipe

1. Lead pipe shall be Class 350 Ductile Iron Pipe meeting all specifications of water mains.
2. Electrical continuity shall be maintained from the water main to the hydrant with tracer wire in accordance with Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES.
3. Tracer wire shall be brought to the surface of the hydrant.
4. No unrestrained joints shall be allowed on a hydrant lead pipe.”

3.8 SERVICE LINE INSTALLATION

Delete the last sentence in Paragraph A and replace with the following:

“Ensure all services have a minimum 6.0 feet of cover.”

Delete Paragraph B and replace with the following:

“B. Where water services are stubbed out, mark the end of the service line using a wood marker and steel post as specified in City of Missoula Standard Drawing 404B.”

Add the following Paragraphs:

SECTION 02660 WATER DISTRIBUTION

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- "D. Tracer wire as defined in Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES shall be installed with all service lines. Tracer wire must maintain continuity from main to inside of building. Leave 10 feet minimum of wire in building for connection to plumbing. Where new water service line transitions to existing galvanized service line, the new tracer wire should be attached to the galvanized pipe using a Christy's or approved equal UL approved bronze grounding clamp suitable for direct burial.
- E. Buried water line warning tape as defined in Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES shall be installed with all service lines.
- F. When indoor plumbing is plastic, tracer wire shall be connected directly to metal pipe leading to an outside hose bib to facilitate service line location from outside the building.
- G. Water service lines should be pressure tested to the curb box concurrently with the water main.
- H. Service lines encountered during construction activities shall be repaired as quickly as possible.

Delete Section 3.9 TAPPING and replace with the following:

"3.9 TAPPING

- A. New Mains
 - 1. Contractor shall tap newly installed water mains unless specified otherwise. Provide all necessary products, parts, and appurtenances.
- B. Existing Mains
 - 1. Missoula Water personnel shall make all taps on existing water mains. The following requirements must be met before Missoula Water personnel will perform the tap:
 - a. Traffic control must meet statutory requirements and have been approved by City Engineering.

- b. Appropriate trench protective system (trench box, shielding, or sloping) that is adequate for the job, with a minimum width of 4 feet.
 - c. Trench box must have approved end panels.
 - d. Trench box must have an engineering document that the trench box has been certified.
 - e. Trench must have an approved ladder that extends 3 feet above the trench box and ditch bank and meets OSHA requirements.
 - f. Trench box cannot be placed on the water main or other utility pipes.
 - g. A ramp must be provided if there will be more than 12 inches between the trench box and ditch bank.
 - h. There shall be no equipment running adjacent to an open trench on job site while the tap is being done.
 - i. All materials must be at the job site, including pipe bedding for the Missoula Water pipe.
- 2. Contractor shall provide the corporation stop and saddle for service taps 2 inches and smaller. Missoula Water personnel shall perform the tap.
 - 3. The Contractor shall provide the sleeve and valve for service taps larger than 2 inches. Missoula Water personnel shall perform the tap.
 - 4. The Contractor shall apply for and schedule 1-inch taps a minimum of 72 hours in advance. One-inch taps on steel and AC mains shall require a minimum one-week notice in order to schedule an asbestos abatement contractor.
 - 5. The Contractor shall apply for and schedule taps 2 inches and larger a minimum of two weeks in advance.
 - 6. Installation
 - a. Before a tapping sleeve or saddle is installed, the exterior of the main to be tapped shall be thoroughly cleaned and the interior

surface of the sleeve shall be sprayed with sodium hypochlorite solution.

- b. Contractor shall use 0.05 ounces of sodium hypochlorite solution per square foot to disinfect.
- 6. The Contractor shall connect the service line to the corporation stop as required; install the service line, curb valve and box, and meter pit; and turn on corporation.
- 7. Curb box, stop, and service line to main must be in place and exposed prior to Missoula Water installing the tap.
- 8. Trace wire as defined in Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES shall be attached to the corporation stop or to a stripped portion of the tracer wire on the main.
- 9. Contractor shall thoroughly flush service lines and take all other necessary precautions to eliminate all filings and other debris resulting from the tapping procedure.
- C. Where multiple taps are to be installed, the minimum distance required between taps is 12 inches on ductile iron mains, 18 inches on steel, and 36 inches on PVC mains. The spacing on PVC mains may be reduced to 18 inches if the taps are radially offset and have been approved by City Engineering."

Delete Section 3.10 WATER MAIN INSULATION and replace with the following:

"3.10 WATER MAIN INSULATION

- A. Install insulation meeting the requirements in Section 02724 INSULATION."

Delete Sections 2.14 FLUSHING HYDRANTS, 2.15 YARD HYDRANTS, and 2.16 BLOWOFF HDYRANTS in their entirety.

Add the following Sections:

"3.11 CURB STOPS

- A. Curb stops and boxes shall be located 2 feet outside the property line, as shown on the project plans.

- B. The box shall be final set so that the top of the box is at finished ground elevation.
- C. In areas of new construction, each box shall be marked with a blue painted 2-inch × 4-inch board feet long set vertically in the ground to extend 2 feet above the ground or with a blue painted metal fence post.
- D. Trace wire as defined in Section 02221 TRENCH EXCAVATION & BACKFILL FOR PIPELINES & APPURTENANT STRUCTURES shall be looped loosely over the curb box.
- E. Curb stops must be operable. Contractor is responsible for all costs, including damages due to improperly installed curb boxes.

3.12 METER PITS

- A. Meter pits shall be installed within 2 to 5 feet of the right-of-way line, as shown in City of Missoula Standard Drawing 404B.
- B. Plastic meter pits shall not be installed in areas with vehicle traffic nor in permanent walkways, such as sidewalks.
- C. For irrigation meters installed in concrete pits, a ½-inch conduit must be run from the meter to the outside of an exterior wall for installation of a remote transmitter.

3.13 MANUAL AIR-RELIEF VALVES

- A. Manual air-relief valves shall be installed at all apparent high points along a newly installed water main and in any location during repairs or other activities where an apparent high point has been created.
- B. Tap shall be made directly on top of the pipe for maximum air release.

3.14 BLOW-OFFS

- A. Blow-offs shall be installed flush with finished grade in accessible locations that provide adequate drainage for flushing.
- B. A minimum of 5 feet shall be maintained between the blow-off and other system appurtenances including, but not limited to, tees, valves, and service taps.

- C. A minimum of 5 feet shall also be maintained between blow-offs and any concrete curbs and sidewalks.

3.15 CONSTRUCTION PHOTOS

- A. Construction photos shall be taken and provided as specified in Section 01600 WEEKLY CONSTRUCTION PHOTO DOCUMENTATION.”

END OF SECTION

SECTION 02720 STORM DRAIN SYSTEMS (MPWSS, as amended)

PART 1: GENERAL

1.3 REFERENCES

Add the following:

"AASHTO M330 ASTM D3212	Polypropylene Pipe, 12 to 60 in Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F2306	12 to 60 in Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications
ASTM F2736	6 to 30 in Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2881	12 to 60 in Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Pipe"

1.4 STANDARD DRAWINGS

Delete paragraph A and replace with the following:

"A. Refer to the City of Missoula Standard Drawings."

PART 2: PRODUCTS

2.1 GENERAL

- A. Add the following: "All public stormwater pipes 30 inches or less in diameter shall be constructed of PVC, polypropylene, or reinforced concrete pipe. All public stormwater pipes greater than 30 inches in diameter shall be constructed of reinforced concrete pipe."

2.2 PIPE MATERIALS

Add the following sections:

"E. Polypropylene Pipe (PP)

1. Furnish polypropylene pipe 12 inches to 30 inches having a smooth interior and annular exterior corrugations meeting ASTM F2881 or

AASHTO M330. The polypropylene pipe shall be watertight according to the requirements of ASTM D3212. The normal laying length is a maximum of 20 feet, except shorter runs are permitted adjacent to manholes, catch basins, or other appurtenances. Ensure each pipe length is marked with the size and code number. Spigot shall have two gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gaskets are free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

2. Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Fitting joints shall meet the watertight joint performance requirements of ASTM D3212.

2.3 MANHOLES

A. General

Delete Paragraph 1. in its entirety and replace with the following:

- “1. Furnish manholes constructed of precast concrete sections with frames, covers, and steps meeting details on the plans.”

D. FRAMES AND COVERS

Delete Paragraph 1. in its entirety and replace with the following:

- “1. Furnish frames and covers meeting City of Missoula standards.
2. Composite tapered grade rings shall meet the requirements in Specification Section 02370.”

2.3 INLETS AND CATCH BASINS

Delete Paragraph A in its entirety and replace with the following:

- “A. Furnish frames and covers meeting City of Missoula Standards.”

PART 3: EXECUTION

3.2 MANHOLES

- A. Construction
Replace “one inch per foot (8 cm per meter)” with “1/2-inch per foot”.

Add the following to the end of Section 3:

“The following applies to all structures with grade rings. No grade ring shall be offset more than 2 inches and the total offset shall not exceed the wall thickness of the structure. No wedges are allowed between grade rings, and the frame must be set flush with the top-grade ring.”

Add the following section:

- “B. Photos
1. Photographs of all underground connections to new and existing manholes are required by the City of Missoula as specified in Specification Section 02221.”

3.4 STORM DRAIN SERVICE LINES

Add the following section:

- “C. Storm drain service lines shall not be installed without prior approval of City Engineering.”

3.5 TESTS

Add the following section:

- “D. T.V. Inspection
1. T.V. inspection (TVI) will be required for new or repaired stormwater mains prior to final acceptance. Laterals shorter than 25 feet do not require a TVI. All television inspection shall be coordinated with the Engineer, and the means and methods shall be accepted by the Engineer prior to starting the inspection. A representative for the engineer of record must be present during the TVI. A stormwater line is deficient and unacceptable if:
 - a) The alignment is outside the specified limits,
 - b) Gravel, sediment, or other construction debris is visible in the pipe, or

- c) The pipe has visible defects such as open joints, pinched gaskets, cracked barrels, or bell, or similar defects.

2. Television inspection shall comply with the following:

- a) All TVI shall start in the center of the upstream manhole and shall start recording from this point to the center of the downstream manhole. One section of pipe only shall be displayed in each electronic file.
- b) The video shall display both the starting and next downstream manhole numbers as shown on the construction drawings, date, accurate footage, and contractor's name continually in either of the upper quadrants during video playback.
- c) The display screen shall show the entire pipe diameter and the measuring device in focus during playback.
- d) The screen contrast shall be adequate to clearly show all requirements and defects of the pipe.
- e) Only standard electronic video format shall be acceptable to the City of Missoula. This shall be .mp4, .mov., or .wmv formats only. All TVI information shall be transmitted electronically, and the file name shall include the project name and the section of pipe that has been videoed.
- f) During mainline TVI, the camera shall view and record the stormwater service lateral(s) at the connection to the main, if applicable.
- g) If deficiencies are shown on the video, the deficiencies shall be repaired, and the entire length of pipe from center of manhole to center of manhole shall be re-televised in accordance with this specification.
- h) The City of Missoula shall approve all devices used to measure residual water in the mainline.
- i) Any TVI retest of storm mains must conform to all the above standards.

3. All costs incurred for the TVI performed shall be the Contractor's responsibility. Pull the camera through the storm main at 30 feet per minute (9 meters per minute) maximum. If the camera is pulled by attaching to the hose of a hydraulic sewer cleaner, ensure the hose is not active during the pulling process.
4. Any remediation measures required to correct defect in the piping shall be per the direction of the Engineer, at the Contractor's expense. Any repairs to the main shall require additional T.V. inspection.
5. The City of Missoula reserves the right to perform such tests and inspections, in conformance with the testing requirements contained herein, including T.V. testing, prior to the end of the warranty period, and any non-conforming work discovered from such testing procedures shall be repaired by Contractor at Contractor's expense."

Add the following section:

"E. Survey Pipe Slope

1. Before final acceptance, Owner will require the elevation of all stormwater main inverts and culvert inverts be measured and incorporated into final record drawings. At a minimum, survey shall include the distance between manholes and invert or crown elevations of all pipes entering or exiting newly installed or modified manholes, and, length and invert or crown elevations of all culverts or other buried stormwater conveyance conduit. Elevation measurements may be collected using differential level loops or another method capable of producing 0.03-feet relative accuracy between manholes and 0.10-feet relative accuracy over a mile."

END OF SECTION

SECTION 02724 INSULATION (*added section*)

PART 1: GENERAL

1.1 SUMMARY

- A. This section covers the furnishing and installation of insulation as shown on the drawings and as specified.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Material shall be as specified herein.
- B. Insulation material shall be extruded polystyrene insulation board, in conformance with AASHTO Designation M230-70. Insulation material shall be designed specifically for in-ground installation.
- C. Insulation material shall be square edge and shall have the following properties:
 - 1. Compressive Strength: 35 psi minimum at 5% deformation or yield, as determined by ASTM D1621. Higher compressive strength insulation shall be designed by Engineer when traffic loading requires.
 - 2. Water Absorption (Percent by Volume): 0.25% maximum as determined by ASTM C 272.
 - 3. Thermal Resistance (R) Value: 5.0 SQ FT HR F/BTU at 75 Deg F, mean temperature in a 1-inch thickness as determined by ASTM C 518.
- D. Sealant and Mastic: Manufacturer's recommended standard.

PART 3: EXECUTION

3.1 INSTALLATION

- A. Thickness and overall dimensions of insulation material shall be as shown on the drawings as stated below.
 - 1. Sewer

- a. A minimum of 2-inch thickness insulation shall be provided per foot of missing cover or vertical void space less than 5 feet for sewer mains and pressure sewer services and 4 feet for gravity sewer services.
- b. A minimum of 2-inch-thick insulation shall be provided per foot of horizontal distance of less than 5 feet for sewer mains and 4 feet for sewer services from any buried, unheated structure, such as stormwater manholes, dry wells, telecommunication vaults, tunnels, and irrigation culverts.

2. Water

- a. A minimum of 2-inch-thick insulation shall be provided per foot of missing cover or vertical void space less than 6 feet for water mains and services. Bury depth shall be no less than 4 feet.
 - b. A minimum of 2-inch-thick insulation shall be provided per foot of horizontal distance of less than 6 feet for water mains and services from any buried, unheated structure, such as sewer and stormwater manholes, dry wells, telecommunication vaults, tunnels, and irrigation culverts.
- B. Minimum length of insulation material boards shall be 8 feet, and minimum width shall be 4 feet.
 - C. Insulation material boards must have staggered joints to prevent loss of heat. All joints shall be tightly butted. If 2-inch-thick installation material is used, the insulation boards must be overlapped a minimum distance of 6 inches or a 1-foot-long piece of insulation board must be put over each joint, completely covering the joint from edge to edge.
 - D. All field cutting of insulation material board shall be done with a straight edge to a neat line.
 - E. Polystyrene insulation must be protected against exposure to sunlight. Any unwrapped insulation to be stored on the job site for long periods of time shall be covered with a light-colored tarpaulin. The Contractor shall follow the manufacturer's recommendations to protect the insulation against combustion.
 - F. Three inches of bedding material is required between the top of the pipe being insulated and the insulation board, and two inches of pipe bedding is required above the insulation.

END OF SECTION

SECTION 02725 DRAINAGE CULVERTS (*MPWSS, as amended*)

PART 2 – PRODUCTS

2.1 GENERAL

Delete paragraph E. and replace with the following:

- “E. Culverts shall require flared end sections. Flared end sections can be replaced with headwalls where indicated in the project drawings.”

END OF SECTION

SECTION 02730 SANITARY SEWER COLLECTION SYSTEMS (*MPWSS, as amended*)

PART 1: GENERAL

1.4 STANDARD DRAWINGS

Delete paragraph A. and add the following:

“A. Refer to the most recent versions of City of Missoula Standard Drawings.”

PART 2: PRODUCTS

2.2 PIPE MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

2. Gravity Sewer Pipe

Delete paragraph a.3) in its entirety.

5. Delete Paragraph a. in its entirety and replace with the following

“a. Sewer service connections shall be made by installing standard “tee” fittings or tapping saddles. Wye fittings are not allowed. The use of tapping saddles on new main installation shall be approved by the City. Tapping saddles shall be Predco Fast-Fit sewer saddle with epoxy kit and tapping donut, or approved equal.”

6. Gravity Sewer Service Lines

Add the following paragraph:

a. Gravity sewer service pipe and fittings shall be ASTM D 1785 (PVC) Schedule 40. Pipe shall conform to ASTM D2665-82 and D3311-71 standards in accordance with UPC. Fittings shall conform to ASTM D2665-78 and D3311-79a and shall be glue fitting only. Solvent cement and primer shall conform to ASTM D2564-86.”

D. Ductile Iron Pipe (DIP)

1. General

Add the following section:

- “e. When installed inside a lift station, exposed ductile iron pipe and fittings shall be manufactured and delivered with no asphaltic coating. Exposed pipe, valves, fittings, and appurtenances shall be coated outside with a factory-applied, high-solids epoxy primer with all exposed pipes, valves, and fittings field coated after assembly with a polyamide epoxy coating of 10 mils minimum thickness. Coating shall be Sherwin-Williams Macropoxy 646 or approved equal.”

2.3 MANHOLES

A. General

Delete section 1. in its entirety and replace with the following:

- “1. Construction manholes from precast concrete sections having frames, covers, and steps meeting City of Missoula Standard Drawings. Manholes shall have eccentric cones only unless otherwise noted on the plans.”

C. Steps

Add the following sentences to the end of paragraph 1.

“Manhole steps shall be located at an angle of 90° from the line of the sewer pipe when possible. Steps shall be installed at maximum 16-inch centers.”

Delete paragraph D. in its entirety and replace with the following:

“D. Frames and Covers

- 1. All manhole frames and covers must be made of gray iron, meeting the requirements of AASHTO M 306, and complying with the City of Missoula Standards and Standard Drawings. All covers shall be bolt down and watertight.
- 2. Composite tapered grade rings shall be East Jordan Ironworks IR-C or approved equal.”

Add the following section:

“2.5 Lift Stations

A. Wet Well

1. Wet well sections shall be pre-cast concrete meeting ASTM C478 unless otherwise indicate on construction drawings.
2. Joints shall have pre-formed flexible O-ring gasket joints meeting ASTM C443 sealant joints.
3. Wet well inlets shall include a compression-type flexible connection. Cast into the wet well wall, providing 10 degrees deflection as manufactured by A-Lok Products or approved equal.
4. Apply waterproof coating tot exterior of wet well. Coating shall not be less than 80% solids.
5. The entire interior of the wet well shall be coated with an elastomer coating per the requirements of Specification Section 09950.

B. Lid

1. Wet well lid shall be pre-cast concrete meeting ASTM C478 unless otherwise indicated on construction drawings. Lid shall be a minimum 6-inch thickness.
2. Minimum HS20 load rating.
3. Double access door shall have a 4-feet by 5-feet minimum opening size, be watertight, and shall be HS20 rated. Haliday 5’-0” x 4’-0” Hatch or approved equal.”

PART 3: EXECUTION

3.1 PIPE AND SERVICE LINE INSTALLATION:

Add the following Paragraph:

“G. Detectable Warning Tape

1. Install detectable buried warning tape centered over all sanitary sewer mains and service lines in accordance with Specification Section 02221."

Delete Section 3.2 MANHOLES in its entirety and replace with the following:

"3.2 MANHOLES

A. Construction

1. Construct manholes to the specified dimensions. Make invert channels smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Make changes in flow direction with a smooth curve of as large a radius as the manhole size will permit. Make changes in channel grade and size gradually and evenly. The invert channels may be formed directly in the manhole base concrete or by laying half-pipe in the concrete. Make the floor of the manhole outside the channel smooth and slope toward the channel at one inch per foot.
2. All manhole joints shall have O-ring gasket joints meeting ASTM C923 (Resilient connectors between reinforced concrete manhole structures). The use of RAM-NEK jointing compound may be substituted on the manholes.
3. Manhole precast barrels, lids, and base sections shall meet ASTM C478, and the rejection criteria therein stated. Base sections shall be monolithically poured with the manhole walls or constructed with integral water stop gasket at the construction joint between the base and wall. Manhole inverts may be either pre-cast with the base or field poured.
4. Manholes shall include an O-ring water stop ring at pipeline penetrations or be cast with an A-Lok gasket or approved equivalent. If a flexible joint, other than the O-ring water stop ring are proposed, the Contractor shall present to the Engineer the proposed method of joining the pipes at the flexible joint immediately outside the manhole to insure the complete insertion of the pipe into the bell and adherence to the specified pipe alignment tolerances.
5. Install adjusting rings on each manhole to bring the manhole top elevation to match the existing or specified ground elevations. A minimum of 2-inch composite tapered adjustment rings and 2-inch concrete adjustment rings to achieve final grade. Total adjustment rings shall not exceed 12 inches. Use tapered adjustment to match the slope of

street, sidewalk, or related surfacing. Install Ram-Nek or approved equal joint sealant compound between the top of the manhole and all concrete adjustment rings. Adjustment rings that are offset to set final grade shall have any voids grouted to prevent penetration of water. The following applies to all structures with grade rings. No adjustment ring shall be offset more than 2 inches and the total offset shall not exceed the wall thickness of the structure. No wedges are allowed between adjustment rings and the frame must be set flush with the top-grade ring.”

Add the following sections:

“B. Connections to Existing Manholes

1. Connections to existing manholes will be core drilled unless otherwise approved by the Engineer. When connecting to existing manholes, line and grade must be verified by the Engineer so that grade and alignment can be adjusted if necessary. Contractor shall be responsible for performing all modifications to existing manholes per the plans and details. These modifications shall include pouring or rechanneling of the manhole floor, including sealing all penetrations, installing water stop rings, and applying any manhole coatings required.

C. Photos

1. Photographs of all underground connections to new and existing manholes are required by the City of Missoula as specified in Specification Section 02221.

D. Sanitary Sewer Connection Report

1. An accurate record of the location of all sanitary sewer service laterals as installed and the length of all service lines installed must be provided to the Engineer. Depth at the end of dry service line stub-ins is required. Sanitary service laterals shall be tied to manholes for gravity sewers and valves for STEP sewers.

3.3 SANITARY SEWER SERVICE LINES

- A. Change “Standard Drawing 02730-2” to “City of Missoula Standard Drawings or the Details on the Plans”

3.4 TESTS

- E. Air Test (Alternative)

Delete Paragraph 1. in its entirety and replace with the following:

- “1. The Contractor shall utilize low pressure air to test all gravity sewer mains. Use the test procedure described in the paragraphs below.”

Delete paragraph G. “T.V. Inspection” in its entirety and replace with the following

“G. T.V. Inspection

1. T.V. inspection (TVI) will be required for new or repaired sanitary sewer mains installed with the project prior to final acceptance. All television inspection shall be coordinated with the Engineer, and the means and methods shall be accepted by the Engineer prior to starting the inspection. All lines inspected shall be jetted with a commercial hydraulic sewer cleaner and televised within one hour of jetting/flushing. A representative for the engineer of record must be present during performance of jetting, flushing, and TVI. An approved measuring device shall also be attached to the camera for verification of ponding. A sewer line is deficient and unacceptable if:
 - a) The alignment is outside the specified limits,
 - b) Water ponds in any section equal to or greater than 1/2 inch unless otherwise approved by the City of Missoula, or
 - c) The pipe has visible defects such as open joints, pinched gaskets, cracked barrels or bell, or similar defects.
2. Television inspection shall comply with the following:
 - a) All TVI shall start in the center of the upstream manhole and shall start recording from this point to the center of the downstream manhole. One section of pipe only shall be displayed in each electronic file.
 - b) The video shall display both the starting and next downstream manhole numbers as shown on the construction drawings, date, accurate footage, and contractor's name continually in either of the upper quadrants during video playback.
 - c) The display screen shall show the entire pipe diameter and the measuring device in focus during playback.

- d) The screen contrast shall be adequate to clearly show all requirements and defects of the pipe.
 - e) Only standard electronic video format shall be acceptable to the City of Missoula. This shall be .mp4, .mpg, .mpeg, .mov., or .wmv formats only. All TVI Information shall be transmitted electronically, and the file name shall include the project name and the section of pipe that has been videoed.
 - f) During mainline TVI, the camera shall view and record the sewer service lateral(s) at the connection to the main, if applicable.
 - g) If deficiencies are shown on the video, the deficiencies shall be repaired, and the entire length of pipe from center of manhole to center of manhole shall be re-televised in accordance with this specification.
 - h) The City of Missoula shall approve all devices used to measure residual water in the mainline.
 - i) Any TVI retest of sewer mains must conform to all the above standards.
3. All costs incurred for the television inspection performed shall be the Contractor's responsibility. Pull the camera through the sewer at 30 feet per minute (9 meters per minute) maximum. If the camera is pulled by attaching to the hose of a hydraulic sewer cleaner, ensure the hose is not active during the pulling process.
 4. Any remediation measures required to correct defect in the piping shall be per the direction of the Engineer at the Contractor's expense. Any repairs to the main shall require additional T.V. inspection.
 5. The City of Missoula reserves the right to perform such tests and inspections, in conformance with the testing requirements contained herein, including T.V. testing, prior to the end of the warranty period, and any non-conforming work discovered from such testing procedures shall be repaired by Contractor at Contractor's expense."

H. Deflection Testing

Delete Paragraph 1 and replace with the following:

- "1. All sewer mains shall be tested for deflection to ensure the construction quality."

Add the following paragraph:

- "4. The 7-day deflection test is required on all sanitary sewer mains, minimum mandrel diameter shall be determined as 95% of inside pipe diameter, including manufacturer fabrication tolerances as an additive allowable deflection."

I. Material and Equipment for Testing

Delete Paragraph 1 in its entirety and replace with the following:

- "1. Before final acceptance, Owner will require all sewers to be inspected using a television camera after leakage tests. Dewatering equipment must be shut down a minimum of 24 hours prior to the television inspection to allow groundwater to return to typical levels. Adequately flush the sewer lines prior to each television inspection. Television inspection of dry sewer lines is not acceptable. Correct any deficiencies and re-inspect using a television camera. Sanitary sewer service lines may be subject to the same television inspection requirements as sanitary sewer mains at the discretion of the Engineer and Owner."

Add the following section:

"K. Manhole Leakage Test

1. Vacuum Test

- a. All manholes shall be tested in accordance with ASTM C1244 test method for concrete sewer manholes by the negative air pressure (vacuum) test. The vacuum test shall be conducted prior to manhole backfilling and witnessed by the Engineer. No backfilling of the manhole shall commence until authorized by the engineer. The vacuum test may be performed prior to the placement of adjustment rings and cast-iron ring.

2. Water Test

- a. Water testing will only be allowed where groundwater is below the bottom of the manhole during testing. Hydrostatic testing shall be constructed by sealing all pipe penetrations to the

manhole and filling the manhole to the top of the manhole cone with water. Water may be added over a 24-hour period to compensate for losses due to evaporation and absorption. Following the 24-hour saturation period. Any loss of water within a 30-minute period shall be a failed test and the manhole must be rejected."

Add the following section:

"L. Survey Pipe Slope

1. Before final acceptance, Owner will require the elevation of all gravity sewers inverts be measured and incorporated into final record drawings. At a minimum, survey shall include the distance between manholes and invert or crown elevations of all pipes entering or exiting newly installed or modified manholes. Elevation measurements may be collected using differential level loops or another method capable of producing 0.03-feet relative accuracy between manholes and 0.10-feet relative accuracy over a mile."

Add the following section:

"M. Wet Well Leakage Test

1. Fill the structure with water to the maximum height prior to leak testing and maintain level for 48 hours for moisture absorption by concrete. Close all valves or gates to the structure and measure the change in water surface for a 24-hour period. The allowable leakage rate for well structures must not exceed 0.1 percent of the water volume in a 24-hour period and must not show any visible leakage or dampness on the exterior walls. If drop in water surface exceeds the allowable leakage or visible leakage/dampness is observed on the exterior walls, repair the structure in accordance with the specifications and retest until a passing test is obtained. Cost of all leakage tests, repairs, and retests shall be borne by the Contractor at no extra cost to the Owner.

3.5 WATER AND SEWER MAIN SEPARATION

Delete Paragraph A. in its entirety and replace with:

- "A. Maintain horizontal and vertical separation between water mains and sewer mains as dictated by Montana Department of Environmental Quality."

END OF SECTION

SECTION 02740 PIPE CASINGS AND APPURTENANCES (*added section*)

PART 1: GENERAL

1.1 SUMMARY

- A. This section covers the furnishing and installation of steel pipe used for casing of sewer or water main pipe in locations where jurisdictional authority or City Engineer requires.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Steel Casing Pipes
 - 1. Steel casing shall be new, smooth wall, welded steel pipe fabricated from ASTM A36 plate or ASTM A570 and ASTM A139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi.
 - 2. External loading shall be AASHTO H20 highway or railroad loading plus jacking load, or E80 railroad loading when required. Casing pipes shall have the minimum nominal diameter and wall thickness as shown in table below. Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than $\frac{3}{4}$ inch.
 - 3. Minimum casing inside diameter shall exceed outside diameter of carrier pipe joints or couplings by an amount appropriate to allow the installation of the casing spacer to be used. Casing size stated above is a minimum but shall generally be as shown in the Table below.

Casing Pipe Minimal Nominal Diameter and Wall Thickness			
Carrier Pipe Nominal Dia. (in)	Casing Nominal Diameter (in)	Min. Thickness for Coated Pipe (in)	Min. Thickness for Non-Coated Pipe (in)
8	18	0.250	0.312
10	20	0.281	0.344
12	24	0.312	0.375
16	30	0.406	0.469
18	30	0.406	0.469
20	36	0.469	0.531
24	42	0.500	0.563
30	48	0.563	0.625

B. CASING SPACERS

- Casing spacers shall be 12-inch-wide stainless steel, bolt on style type with a shell made of at least two halves. The bands shall be 14-gauge T304 stainless steel at a minimum, the risers shall be 10-gauge T304 stainless steel at a minimum, and the coating shall be fusion bonded epoxy or heat fused PVC. Each spacer shall have a minimum of four runner supports manufactured of an ultra-high molecular with polyethylene or glass reinforced polymer. Bolts shall be T304 stainless steel with lock nuts. The runner supports shall be of adequate height to position the carrier pipe in the center of casing with a maximum clearance of 1 inch from the upper runner to the inside of the steel casing. Spacers shall be installed on the carrier pipe per the manufacturer's recommendations. Spacing of the casing spacers shall be per manufacturers recommendation for carrier pipe type and application. Modifications to the casing spacers may be allowed on a case-by-case basis to maintain the correct grade of the carrier pipe. Acceptable manufacturers are as follows:
 - Power Seal – Model 4810
 - Cascade Waterworks – Model CCS
 - Advance Products & Systems - Model SS1
 - City Approved Equal

C. END SEALS

- Casing end seals shall be used to completely close both openings on either side of the casing to make it watertight. These ends seals shall be pull-on (seamless) or wrap-around with stainless steel straps for securing to the carrier pipe and the casing. End seals shall be constructed of specifically compounded synthetic rubber a minimum thickness of 1/8

inch. Acceptable manufacturers are as follows:

- Advance Products & Systems – Model AW
- PSI – Model C
- Power Seal
- City Approved Equal

D. CATHODIC PROTECTION

1. Where soil conditions warrant, Engineer shall design cathodic protection to prevent corrosion with the use of magnesium anodes.

PART 3: EXECUTION

3.1 INSTALLATION

- A. Steel casing shall be installed with the same tolerance specifications as required for Sanitary Sewer. See MPWSS Section 02730, Paragraph E.
- B. Minimum distance between the end of the steel casing and manholes, valves, or other structures shall be 5 feet unless otherwise approved by the City Engineer.
- C. Carrier pipes shall be fusion-welded HDPE, when approved, or have restrained joints.
- D. Do not use petroleum products for lubricant. Contractor shall take care during installation of carrier pipe to not damage pipe. All carrier piping shall be pressure tested as required in the Specifications.

END OF SECTION

SECTION 02900 BOULEVARD LANDSCAPING (*added section*)

PART 1: GENERAL

1.1 DESCRIPTION

- A. This work includes all labor, equipment, and materials for boulevard landscaping within the public right-of-way to include ground surface preparation, furnishing and installing landscape material, and irrigation systems in locations and areas shown on the plans.
- B. Hydraulic seeding is not included in this section and is covered in SECTION 02920 HYDRAULIC SEEDING.
- C. Plantings and landscaping within center medians, roundabouts, and traffic circles are not included in this section and are covered in the current edition of the *Missoula Parks and Recreation Design Manual*.

1.2 SUBMITTALS

- A. Submit to the Engineer applicable topsoil sources, seed mixture certifications, fertilizer descriptions, pre-emergent herbicides, and mulch certifications including a vendor's statement certifying that each seed lot has been tested by a recognized seed testing laboratory within 6 months of date of delivery. Ensure the statement includes: Name and address of laboratory, date of test, lot number for each seed species, and the test results including name, percentages of purity and of germination, percentage of weed content for each kind of seed furnished, and for seed mixes, the proportions of each kind of seed.

PART 2: PRODUCTS

2.1 TOPSOIL

- A. Use on-site or imported topsoil that is loose, friable, loamy soil, free of excess acid and alkali. Ensure topsoil does not contain construction debris, sod, rocks over 1-inch in size, sub-soil, or other undesirable material that would form a poor seedbed. Before stripping and stockpiling topsoil, ensure it has supported the growth of healthy crops, grass, or other vegetable growth. Use imported topsoil from the below listed approved sources or which meet the acceptable soil parameters in Section B. Obtain approval of topsoil source and test results from Engineer prior to use of on-site sources or delivery of off-site sources.

B. The following requirements apply to topsoil:

1. Soil sample testing is required for all topsoil used on projects covered under this manual.
 - a. Take samples from 6 inches below grade at representative locations across the source site and submit as a composite sample.
 - b. Acceptable soil parameter levels per ASTM D5268-19 Standard Specification for Topsoil Used for Landscaping and Construction Purposes:

Soil Parameter	Acceptable Ranges
Phosphorus (Bray P1 test) *	20-100 ppm
Phosphorus (Olsen P test) *	12-50 ppm
Potassium (K ₂ O)	150-800 ppm
CEC	5-35 meq/100g
pH Value	6.0-8.0
Organic Matter Content	5-15%

* Only one of the two phosphorus tests needs to be met. Typically, labs will run one or the other based on the pH of the sample.

- c. Acceptable textures per ASTM D7928 Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis:

Soil Type	Particle Size (mm)	Acceptable Range
Sand	0.075-4.75	20-70%
Silt	0.002-0.075	10-60%
Clay	<0.002	5-30%

- i. Total particles passing the #4 sieve shall comprise 90% of the total sample by weight.
 - ii. Maximum particle size shall be 1 inch.

C. Approved Material Sources:

1. Garden City Compost “Enriched Topsoil” is an approved topsoil source that meets the requirements of this section and therefore does not require submittal of test results.

2.2 PRE-EMERGENT & HERBICIDE

- A. Where required in landscaping areas, pre-emergent weed control shall be an application of Surflan, or approved oryzalin equal, applied at manufacturer's recommended rate and application method.
- B. Where required in landscaping areas, pre-emergent herbicide shall be an application of glyphosate applied at manufacturer's recommended rate and application method.

2.3 SEEDING

- A. Furnish seed and seed mixture, free of all prohibited noxious weed seed or any other weed seed prohibited by state or local ordinance. The maximum weed seed percentage allowed is 1.0% by weight.
- B. Seal and label all seed containers to comply with Montana Seed Law and Regulations or to meet U.S. Department of Agriculture regulations under the Federal Seed Act, if shipped in interstate commerce.
- C. Do not use wet, moldy, or otherwise damaged seed in the work.
- D. Seed Selection: Identify the proposed seed mixture, including the botanical and common name and percentage by weight of each species and variety, percentage of purity, expected percentage of germination, and maximum allowable percentage of weed seed. Include the year of production and date of packaging.
- E. Furnish seed mixture of the species described in the contract documents. Furnish seed in standard containers labeled with the seed name, lot number, net weight, percentages of purity, germination, hard seed, and percentage of maximum weed seed content for each seed species.
- F. Approved seed mixes for boulevards:
 - 1. Boulevard Turf /Kentucky Bluegrass Blend (application rate per supplier)
 - 60% Fescue
 - 40% Bluegrass
 - 2. Bioswale / Drought Tolerant, Low Stature Dry-Land Grass/Forb Blend (application rate 35lbs/ac)
 - 60% Idaho Fescue (*Festuca idahoensis*)
 - 25% Sheep Fescue (*Festuca ovina*)
 - 10% Sandberg's Bluegrass (*Poa secunda*)

5% Dry-Land Wildflowers to include at least 3 of the following species:

Blanket Flower (*Gaillardia aristata*)
White Yarrow (*Achillea millefolium*)
Fringed Sage (*Artemesia frigida*)
Short Penstemon (*Penstemon procerus*)
Hairy Golden Aster (*Heterotheca villosa*)

2.4 FERTILIZER

- A. Where required, furnish standard commercial fertilizers supplied separately or in mixtures containing the specified percentages of total nitrogen, available phosphoric acid, and water-soluble potash. Apply fertilizer at the specified rate and depth meeting the applicable state and federal laws. Furnish fertilizer in standard containers clearly labeled with name, weight, and guaranteed analysis of contents. No cyanamide compounds of hydrated lime are permitted in mixed fertilizers.
- B. Fertilizers may be supplied in one of the following forms:
 - 1. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
 - 2. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
 - 3. A granular or pellet form suitable for application by blower equipment.

2.5 BOULEVARD REPAIRS

- A. Use topsoil for repair areas of equal or better quality to the existing topsoil in the repair area. Ensure the soil is free of large stones, roots, stumps, construction debris or other materials that interfere with sowing, and establishing turf. Obtain approval from the Engineer before placing topsoil.

2.6 OTHER LANDSCAPING MATERIALS

- A. Other landscaping materials allowed in locations per City of Missoula ordinance must be submitted to the Engineer for approval if not listed below.
- B. ROCK MULCH
 - 1. Provide clean, 3-inch depth of 1-inch – 3-inch river rock mulch or equivalent sized gravel or crushed rock. Apply pre-emergent oryzalin weed control prior to placing weed barrier fabric. Provide and install non-

woven, Class A type fabric equal to DMS-6200, Type 1, 4 oz. or 6 oz. per square yard weed barrier filter fabric underlayment as a weed protection barrier. Install weed barrier fabric before placing rock mulch, with a minimum overlap of 6 inches.

C. BARK MULCH

1. Provide clean, dry mulch materials for the entire planting area, consisting of $\frac{3}{4}$ -inch to 1 $\frac{1}{4}$ -inch fir bark or approved equal that is free from foreign and harmful materials. Submit mulch sample to the Engineer prior to delivery to the site. Apply pre-emergent oryzalin weed control prior to placing weed barrier fabric. Provide and install non-woven, Class A type fabric equal to DMS-6200, Type 1, 4 oz. or 6 oz. per square yard weed barrier filter fabric underlayment as a weed protection barrier. Install weed barrier fabric before placing bark mulch, with a minimum overlap of 6 inches.

2.7 IRRIGATION SLEEVES

- A. When specified on the plans, irrigation sleeves shall be 4-inch diameter, Class 315 PVC and placed under all paved areas where irrigation lines will be routed to a depth of 4 inches below finished subgrade.
- B. When specified on the plans, irrigation sleeves 6 inches and larger shall be Schedule 40, or heavier, PVC pipe.
- C. All sleeve locations shall be stamped in any adjacent concrete surface with an "S" to provide exact location.

2.8 REPAIR OF EXISTING IRRIGATION SYSTEMS

- A. Coordinate all work with the owner of any existing irrigation systems. Contact the owner before work is started in the area of existing systems to coordinate shut off of the water supply and maintenance of existing landscaping.
- B. Locate, mark, excavate, cap, remove, and/or relocate existing sprinkler system components that may be encountered during project construction. Search for and become aware of any sprinkler systems located within the construction limits.
- C. Use care to avoid damage to the existing sprinkler system. Repair, replace, or reroute any part of an underground sprinkler system that conflicts with the proposed work. Coordinate with landowner for any sprinkler relocations and

extensions. Extend sprinkler systems where shown on the plans or directed by Engineer to ensure adequate irrigation coverage. Do not damage sprinkler heads or supply lines. Replace damaged sprinkler heads and supply lines with identical materials at no cost to the property owner or the Owner.

PART 3: EXECUTION

3.1 PREPARATION

- A. The soil layer between the topsoil down to a minimum depth of 18" from top of curb or top of sidewalk must consist of native soils removed of asphalt debris, concrete debris and washout, trash, imported aggregate and cobble, demolition and construction debris, woody debris, brick, pavers or other masonry materials, and other material determined by the Engineer to be detrimental to the preparation of topsoil placement and vegetative growth. Backfill material shall be non-compacted (approximately 75-80% proctor) in areas where seeding and planting will occur. Relieve over-compaction in areas compacted due to construction activity in the landscape areas. Scarification/Excavation shall be considered incidental to the work for which it is associated.

3.2 TOPSOIL PREPARATION AND INSTALLATION

- A. Place at least 6 inches of topsoil in all areas to be vegetated as shown on the plans.
- B. Place topsoil and harrow, rake, or work the area by other suitable methods into a smooth, even surface. Ensure the prepared topsoil surface is firm enough to prevent settlement once installed.
- C. After installation of topsoil and soil has been compacted, loosen soil to complete an adequate bed for seed or sod installation. An ideal bed is when topsoil is lightly compacted until an average person leaves a footprint ¼ to ½ inches deep in the soil.

3.3 SEEDBED PREPARATION AND SOWING

- A. Clear the areas to be seeded of all debris, vegetation, and other material determined by the Engineer to be detrimental to the preparation of a seedbed. Once the area is cleared, disc, harrow, rake, or work the area by other suitable methods into a smooth, even seedbed. Ensure the prepared seedbed surface is firm enough to prevent seed loss from high winds or normal rainfall. If rolling is required, perform rolling before seeding using a suitable roller of a weight appropriate to the soil conditions.

3.4 SEED APPLICATION

- A. Do not sow seed in winds that prevent proper embedment into the surface.
- B. Perform seeding when the temperature and moisture are favorable to germination and plant growth. Seed preferably before June 1st and after October 1st of each year. Seeding dates must be approved by the Engineer.
- C. APPLICATION METHODS. There are three acceptable application methods for seeding including broadcast seeding, drill seeding, and hydroseeding. Sow seed using a force feed drill having a grass seed attachment, except of slopes steeper than 3:1 or on areas too small to be seeded with a force feed drill. In these areas, seed may be sown by broadcast spreader, power sprayers, blowers, or other effective methods. Use equipment in good working order. Select the appropriate application method for the specific area on the site.
 - 1. BROADCAST SEEDING.
Suitable for small areas. Seed must be applied at the specified rate and lightly scarified into the soil.
 - 2. DRILL SEEDING.
Suitable for most areas. Follow the seed supplier's directions for application.
 - 3. HYDRAULIC SEEDING/HYDRO-MULCH.
Suitable for most areas and recommended for bioswales and slopes greater than 3:1. Refer to MPWSS 02920.

3.5 FERTILIZER

- A. Where applicable, spread and work fertilizer into the soil during the final seedbed preparation at manufacturer's recommended rate and application method.

3.6 CARE OF SEEDED AREAS

- A. Keep the seeded area moist until it has germinated and its continued growth is ensured. Prevent erosion during watering. Water is considered incidental to the work.
- B. Protect all seeded areas from traffic or pedestrian use with warning barricades or other Engineer-approved methods.

- C. Maintain the seeded area, performing any required watering and mowing until the seed is firmly established. Prevent weeds and other undesirable vegetation from establishing in the seeded area. Mow weeds and rake and remove the clippings from the areas.
- D. Replace any seeded areas failing to germinate that have died or been damaged by construction activities. Replace such areas to meet the contract requirements. The contract warranty period applies to this item.

3.7 LANDSCAPE RESTORATION

- A. Immediately following completion of work, restore all existing landscaped areas to their original or better condition. This includes, but is not limited to, all labor, equipment, and materials necessary to replace topsoil, fine grade, seed, mulch, modify and repair sprinkler systems, repair landscape beds, and other improvements that were disturbed by the work. Contractor shall review the property prior to bidding the work and include all restoration items within their bid.
- B. Re-use existing materials when in good condition. If items such as sprinkler systems, mulch areas, landscape walls, etc., are damaged during removal, replace with new materials acceptable to the landowner. Provide compatible sprinkler system materials of equal or better quality. Remove and salvage reusable components to landowner.
- C. Notify each property owner at least one week prior to beginning any work that affects their property. Review each property with the property owner to determine appropriate modifications and any special considerations, such as sprinkler system repair, and work out details and scheduling for such repairs.

PART 4: MEASUREMENT AND PAYMENT

4.1 GENERAL

- A. Landscaping items are measured and paid for at the unit bid price for the completed and accepted quantities under the following:

<u>Pay Item</u>	<u>Pay Unit</u>
Boulevard Landscaping	SF

- B. Payment Includes all labor, tools, equipment, materials, and incidentals necessary to complete the work in full compliance with the plans and specifications.
- C. Contractor shall take measures to control the disturbed vegetation outside the limits of the improvements shown on the typical sections and shall be required to install topsoil and seed in all other damaged areas at contractor's expense.

END OF SECTION

SECTION 03210 REINFORCING STEEL (*MPWSS, as amended*)

PART 2 - PRODUCT

2.1 Furnish all new material meeting the following requirements.

A. Bar Reinforcement

Add the following paragraph:

- “2. Use of fiberglass rebar is allowed with approval of the Engineer. Furnish fiberglass rebar of the specified dimensions per the Contract Documents with tensile strength equal to or exceeding the Grade 60 steel equivalent.”

END OF SECTION

SECTION 03310 STRUCTURAL CONCRETE (MPWSS, as amended)

PART 2: PRODUCTS

2.1 CLASSIFICATION

- A. Replace the last sentence in paragraph 1 with the following: “All class M concrete supplied on the project shall have a minimum cement content of 564 lb/yd³ unless a design deviation is granted by the City Engineer, and maximum H₂O/cement ratio of 0.45 as the concrete will be exposed to freezing and thawing and possibly the presence of deicing chemicals.”

2.2 COMPOSITION OF CONCRETE

Add the following sentence to the end of paragraph A.1.a.:

“The use of mineral admixtures, including fly ash, pozzolan, or ground granulated blast furnace slag, is not allowed unless specifically authorized by the Engineer.”

PART 3: EXECUTION

3.5 CURING CONCRETE

Add the following paragraph to F.2. Impervious Membrane Curing

- “e. All concrete shall be cured in conformance with the latest City of Missoula standards. Reference specification sections 02528 and 02529 for current standards and allowable curing products and applications.”

3.6 WEATHER AND NIGHT LIMITATIONS

A. GENERAL

Replace paragraphs 2 through 6 with the following sections:

- “2. Cold-Weather Placement: Comply with ACI 306.1 and as follows:
 - a. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

- b. When forecasted low temperature is expected to fall below 40°F (4.4°C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M), which could vary depending on the mix design constituents.
 - c. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen base, subbase, or subgrade materials, or on base, subbase, or subgrade containing frozen materials.
 - d. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - e. A cold weather placement and curing plan in accordance with ACI 306R-16 should be developed and submitted for approval by the Engineer of Record if cold weather conditions as discussed in ACI 306R-16 are expected. This approved plan should be sent to the City prior to placement of concrete.
 - f. If placement occurs during cold weather conditions, both laboratory and field specimens should be fabricated by an independent testing agency and allowed to cure in accordance with ASTM C31. Design compressive strength verification (lab cured specimens) should be evaluated as well as the effectiveness of cold weather placement and protection methods (field-cured specimens) used in relation to compressive strength.
3. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
- a. Maintain concrete temperature below 90°F (32°C) at time of placement. Chilled mixing water 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.
 - b. Fog-spray all forms, steel reinforcement, and base, subbase, or subgrade just before placing concrete. Keep base, subbase, or subgrade uniformly moist without standing water, soft spots, or dry areas.
 - c. If placement occurs during hot weather conditions, discussed in ACI 305R-10, both laboratory and field specimens should be

fabricated and allowed to cure in accordance with ASTM C31. Design compressive strength verification of lab-cured specimens should be evaluated as well as the effectiveness of hot weather placement and protection methods for field-cured specimens used in relation to compressive strength.

- d. When hot weather concreting is anticipated, submit a hot weather concreting plan for review and approval. Include detailed procedures, including production, placement, finishing, curing, and protection of concrete during hot weather concreting.
- e. Hot weather can create problems in delivery, mixing, placing, and curing hydraulic-cement concrete that can adversely affect the properties and serviceability of the concrete.
- f. Hot weather—one or a combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise causing detrimental results: high ambient temperature, high concrete temperature, low relative humidity, and high wind speed.
- g. Potential problems in hot weather for concrete in the freshly mixed state include:
 - a) Increased water demand
 - b) Increased rate of slump loss and corresponding tendency to add water at the job site
 - c) Increased rate of setting, resulting in greater difficulty with handling, compacting, and finishing and a greater risk of cold joints
 - d) Increased tendency for plastic shrinkage and thermal cracking
 - e) Increased difficulty in controlling entrained air content
- h. Damage to concrete caused by hot weather can never be fully alleviated. Potential deficiencies to concrete in the hardened state can include:
 - a) Decreased strengths resulting from adding water to satisfy the higher water demand
 - b) Increased tendency for drying shrinkage if additional water was added to the concrete

- c) Thermal cracking from either cooling of the overall structure or from temperature differentials within the cross section of the member
 - d) Decreased durability resulting from cracking
 - e) Greater variability of surface appearance, such as cold joints or color differences, due to different rates of hydration or different water-cementitious materials ratios (w/cm)
-
- i. Concrete mixed, placed, and cured at elevated temperatures normally develops higher early strengths than concrete produced and cured at lower temperatures, but strengths are generally lower at 28 days and later ages.
 - j. Effect of surface drying—Plastic shrinkage cracking is frequently associated with hot weather concreting in arid climates.”

3.7 TESTING

- A. Add the following sentence:

“The frequency of testing specified in this section may be reduced or increased at the sole discretion of the Engineer.”

END OF SECTION

SECTION 09950 FLEXIBLE COATING AND LINING SYSTEM (*added section*)

PART 1: GENERAL

1.1 DESCRIPTION

- A. This work includes all labor, equipment, and materials to furnish and install concrete lining system in manholes as shown on drawings. The work in this section includes, but is not limited to, surface preparation, installation of flexible coating and lining system, protection of surfaces not to be treated, touch-up, and clean-up.

PART 2: PRODUCTS

2.1 PRODUCTS

- A. Primer:
 - 1. Specialty Products Elasta-flex Primer
 - 2. Perma-Tech; PR-704P Urethane Primer
 - 3. Or approved equal
- B. Elastomer Coating:
 - 1. Sherman Williams Dura-Plate 6000
 - 2. Or approved equal

PART 3: EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the job site in manufacturer's original, unopened containers bearing manufacturer's name and label and the following information:
 - 1. Product name
 - 2. Product description (generic product classification)
 - 3. Manufacturer's lot number
 - 4. Color
- B. Store materials in sealed original manufacturer's containers in a protected area out of direct sunlight. Keep containers clean and undamaged. Adhere to manufacturer's published storage temperature and shelf-life recommendations. Protect all materials from freezing.

3.2 INSPECTION

- A. Examine surfaces to receive elastomer coating to ensure conditions are satisfactory for application of materials.

3.3 PROTECTION OF ITEMS NOT TO BE PAINTED

- A. Unless otherwise stated or shown, protect the areas or items that will not require coating in the following manner:
 - 1. Mask surfaces are not intended to be coated.
 - 2. Cap or seal all open piping prior to beginning any surface preparation or coating work.
 - 3. Protect nearby structures, equipment, vehicles, buildings, etc., from surface preparation and coating operations.

3.4 SURFACE PREPARATION

- A. Clean surfaces to remove dust, dirt, oil, grease, efflorescence, and other foreign materials in accordance with waterproofing manufacturer's instructions.
- B. Remove oil, grease, and efflorescence by scrubbing surface with detergents or solvents and thoroughly rinsing with water.
- C. Sandblast or mechanically abrade concrete walls to create a minimum surface profile for the system in accordance with SSPC-SP13/NACE 6.
- D. Fill all cracks, voids, and bugholes with manufacturer-approved product.
- E. Prior to the application of the elastomer coating system, all surfaces shall be at a minimum saturated surface dry (SSD).

3.5 APPLICATION

- A. Apply epoxy coating system in accordance with the manufacturer's installation procedures.
- B. Roll or spray epoxy primer on all surfaces at rate and as recommended by the manufacturer. Minimum dry film thickness shall be 6 mils.

- C. Spray elastomer lining material at rate and as recommended by the manufacturer in two coats. Minimum dry film thickness shall be 125 mils.
- D. If thickness requirements are not obtained, additional coats shall be applied to meet the minimum thickness requirements stated above at Contractor's own expense.
- E. Contractor shall follow manufacturer's recommendations for minimum cure times.
- F. Contractor shall apply primer and lining material to manhole castings and underside of lid in addition to the manhole walls.

3.6 CLEANUP

- A. Clean spillage and overspray from adjacent surfaces as recommended by manufacturer.

3.7 FIELD QUALITY CONTROL

- A. All surface preparation work and individual coats are subject to inspection by Engineer, Owner, and coating manufacturer's representative.

END OF SECTION