City of Fond du Lac

Standard Specifications for Public Works Construction

2025 Edition

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City of Fond du Lac 2025 Standard Specifications Summary of Revisions

The following notable changes have been made to the City of Fond du Lac Standard Specifications for Public Works Construction.

Part 100: General Requirements and Covenants

- 101.3 Add inadvertent release to definitions.
- 101.3 Revise definitions for engineer and unacceptable work.
- 102.9 Add information on tax exemptions.
- 104.3 and 104.3.2.3 Revise to clarify that revisions to contract may not exceed 115% of the prices bid.
- 107.22 Add requirements for drone coverage.
- 107.23 Revise to indicate to comply with federal and state law.
- 109.4.4 Revise material cost markups for extra work.
- 109.6.2 Add payment timeline.

Part 200: Sewer Construction

- Remove the following sections: erosion control, rock excavation, and crack and damage survey.
- Add numbers to the parts, sections, and subsections of the specifications and referenced sections or subsections by number where applicable.
- Add table number to tables.
- Change wording style of specifications to write in form of direct commands to the contractor.
- Revise the basis of payment for most sections.
- Update the manufacturer and product name for various materials.
- Remove definitions and acronyms that are listed in general requirements and covenants.
- Add definition for cover material in definitions and acronyms section.
- Remove the submittal; and substitution of materials subsections in the general requirements for sewer construction section.
- Add erosion and sediment control; pipe and fitting markings; shipment and storage of pipe and fittings; connection to existing pipe; and crack and damage survey subsections in the general requirements for sewer construction section.
- Revise the tracer wire systems – tracer wire; tracer wire connectors; tracer wire access points; laying of pipe; and concrete classification subsections in the general requirements for sewer construction section.
- Revise the clearing and grubbing; and demolition and removal subsections in the site preparation section.
- Revise the aggregate slurry backfill; removal of obstructions; unstable foundations; bedding – constructing foundation subsections in the trenching section.
- Add rock excavation; and finish subsections in the trenching section.
- Revise the general requirements; materials – general; casing spacers; casing installation; tracer wire; casing pipe installation; steel casing pipe joints; and testing subsections in the boring and jacking section.
- Add materials - corrosion protection; casing end seals; construction - corrosion protection; boring without casing pipe; and settlement monitoring at railroad tracks subsections in the boring and jacking section.
- Remove lumber subsection in the boring and jacking section.

- Revise the general requirements; drilling plan; and pilot hole subsections in the directional drilling section.
- Add drilling fluid subsection in the directional drilling section.
- Revise the materials – general; joints; reinforced concrete pipes (round and horizontal elliptical); sanitary sewer pipe materials, storm sewer pipe materials; polyvinyl chloride pipe joints subsections in the pipes section.
- Revise the pipes; joints; and fittings subsections in the force main section.
- Revise liquid bonding admixture subsection in the catch basins, manholes, and inlet section.
- Revise materials – general; joints; and laying lateral pipes subsections in the laterals section.
- Revise the general subsection in the sewer connections section.
- Rename testing section to testing and cleaning.
- Revise the scope; low pressure air test; water infiltration test; water exfiltration test; deflection test; and hydrostatic test subsections in the testing and cleaning section.
- Add responsibility for performing testing; deflection testing; sewer cleaning and televising; force main testing; and sewer cleaning subsections in the testing and cleaning section.
- Revise the general requirements subsection in the abandonments section.

Part 300: Erosion and Sediment Control

- 303.4.15 Revise to add temporary flow restriction plates to item 3.
- 303.5.14 Revise to add temporary flow restriction plates to item 2.

Part 400: Water Main Construction

- 402.2.3 Revise notification requirements for water shutoffs.
- 402.3.9.2 Revise to add tracer wire connectors at intersections.
- 402.4.2 Revise to require encasement of certain connections to existing water mains.
- 402.4.14 Revise to reference subsection covering air tests.
- 402.4.18 Revise to clarify tracer wire installation at service boxes.
- 402.4.21 Add requirements for replacement of damaged water services.
- 402.5 Revise to add removal of existing fittings in payment for connect to existing water main. Add items covering adjustment of elevations and aggregate slurry backfill.
- 404.3.1 Revise to eliminate acceptance of pea gravel for bedding and cover materials.
- 404.4.1.6 Revise to require trench dams for water services.
- 404.4.1.10 Revise to clarify requirements for over excavation in wet trenches.
- 404.4.2.7 Revise pipe sizes allowed to use ⅜-inch crushed stone chips.
- 404.5 Revise to clarify how removal of contaminated soils will be paid and to add pay item for aggregate slurry backfill.
- 405.2 Revise to add requirements for jacking plans.
- 405.3.1 Revise to clarify casing pipe requirements and add requirements for interlocking joint casing pipe.
- 405.3.4 Remove lumber subsection.
- 405.3.4 Add corrosion protection requirements.
- 405.3.5 Renumber sand slurry subsection to 405.3.7.
- 405.3.5 Revise casing spacer liner materials, revise list of approved casing spacers, and renumber.
- 405.3.6 Add casing end seal requirements.
- 405.4.2 Add item 7 to clarify bore head location relative to casing.

- 405.4.3 Revise item to clarify requirements for welded and interlocking joints.
- 405.4.4 Add corrosion protection requirements.
- 405.4.5 Add requirements for boring without casing pipes.
- 405.4.10 Revise requirements for sealing ends of casing pipes, for filling between casing and carrier pipes, and renumber.
- 405.4.13 Add requirements for settlement monitoring at railroad tracks.
- 405.6 Revise payment for casing pipes.
- 406.2 Add requirement to follow WDNR Conservation Practice Standard.
- 406.3 Add subsection on drilling fluids.
- 406.4.1 Revise to add requirements for drilling plans and renumber.
- 406.4.4.1 Revise to add requirements for drilling fluids and renumber.
- 406.4.6.2 Revise sand for grout requirements and renumber.
- 406.5 Change drilling fluid leak to inadvertent return.
- 407.3.1 Revise to clarify pipe sizes.
- 408.3.1 Revise to clarify pipe sizes.
- 408.3.4.3 Revise restrained joint gasket requirements.
- 409.3.1 Revise to clarify pipe sizes.
- 413.3.5 Revise item 3 to list correct material and renumber.
- 413.4.9 and 413.5 Revise to specify work to adjust water valve manholes and add bid item.
- 415.3.5, 415.4.6, 416.3.5, 416.4.6, 417.3.6, and 417.4.5 Revise curb box parts.
- 415.3.6.1 Revise requirements on when a service saddle is required.
- 415.4.9, 416.4.9, and 417.4.7 Revise to add reference to 404.4.1.6.
- 417.3.5.1 Revise requirements on when a service saddle is required.
- 418.3 Revise to clarify allowed disinfection products.
- 418.4.1.1, 418.4.1.2, and 418.4.3 Revise chlorination time for cold temperatures.
- 418.4.3 Revise chlorinated water discharge requirements.
- 418.4.5 Revise bacteriological testing requirements.
- 419.3.1 Revise pressure test requirements.
- 419.3.2 Revise leakage test requirements for testing against valves.
- 420.3.1 Add item on removing abandoned water mains, hydrant leads, and service piping.
- 420.3.6 Revise to clarify backfill requirements.
- 420.3.7 Add requirement to remove leaded joint fittings.
- 420.3.8 Add requirement to allow owner to salvage materials.
- 420.4 Add pay item for removal of water mains, hydrant leads, and service piping.
- 421 Add section on temporary water supply systems.
- 405.4.6, 406.4.5, and 417.4.1 Revise to add reference to tracer wire requirements in 402.4.18.

Part 500: Electrical Construction

- 501.1 Add acronym for CCT.
- 502.2.3 Revise required record drawing information for conduit and wire/cable.
- 502.4.2 Revise sign clearance requirements.
- 503.3.2 and 503.3.3 Revise access box product lists.
- 503.3.4 Remove steel pull boxes subsection and renumber.
- 503.3.7 Add subsection on fiber optic flush-mounted locating boxes.
- 503.4.3, 503.4.4, 503.4.5, and 503.5 Revise or add requirements for fiber optic marker posts and flush-mounted locating boxes. Revise basis of payment.

- 503.4.6 and 503.5 Add subsection on adjusting pull boxes and access boxes and define payment.
- 504.4.1 Revise and add directional drilling requirements.
- 504.4.1 Revise tracer wire requirements.
- 504.4.3 Revise conduit depth requirements for driveways and parking lots.
- 504.4.8 Revise loop detector lead-in conduit and conduit base course requirements.
- 504.5 Revise to clarify contractor is responsible for costs from inadvertent returns.
- 505.3.6 Revise type UF cable requirements.
- 505.3.11 Revise wording.
- 505.3.12 Remove communication cable subsection and renumber.
- 505.4.2 Revise tracer wire requirements.
- 505.4.5 Revise traffic signal cable size.
- 506.3.1 Revise meter pedestal product list.
- 506.4 Revise wire size in item 4.
- 508.3.1 Revise luminaire product list.
- 508.3.1, 508.3.4, 509.3.1, and 509.3.2 Change anodizing to powder-coating for transformer bases and pedestal bases.
- 508.3.5 Revised finish requirements.
- 509.3.3 and 509.3.5 Add items for steel poles and monotube poles and arms.
- 509.3.6 Add requirement for retroreflective backplates and revise band finish requirements.

Part 600: Paving and Miscellaneous Construction

- Revise several subsections to reference specific subsections in parts 200 and 400.
- 604.4.1 Revise wording.
- 608.3.1.1 Revise to include stone piles and stone fences and marsh in common excavation.
- 609.2.2 Revise requirements on when blasting is allowed.
- 610.2.4 Revise to add driveways to removal list.
- 610.2.6 Revise wording and add asphaltic curb to materials included under asphalt pavement removal.
- 610.2.10 Revise to obtain approval from Post Office when removing mailboxes.
- 610.2.12 Add subsection on adjusting pull boxes and access boxes.
- 610.2.13 Revise to separate adjustment of city-owned and private utility structures.
- 610.3 Revise to clarify payment for removing or adjusting private utility facilities.
- 611.2.2 Revised to add pulverizing.
- 615.4.4 Revised to remove proof roll requirements and renumber.
- 617.2.3 Revised title.
- 617.5 Revised to eliminate thickness plates from item 3.
- 618.4.1 Revised to add curb type for hammerhead turnarounds.
- 618.4.3 Revised base course limits for integral concrete pavement.
- 618.4.5 Revised to add curing requirements for backside of curb and gutter.
- 619.5 Revise basis of payment for base course for sidewalk and carriage walk.
- 619.5 Revise item covering damaged or improperly installed utility boxes.
- 621.3.1 Revise to remove color concrete color comparison to existing crosswalks.
- 621.4.2 Revise to indicate picture framing comparison location more clearly.
- 622.3.3, 622.4.7, and 622.5 Revise to add requirements for manhole adjusting rings and define payment.
- 625.2.2 Revise to clarify disposal requirements.
- 628.3 Add sign mounting and clearance requirements.
- 633 Add section on landscaping and restoration on private property.

100 General Requirements and Covenants

101 Definitions and Acronyms

101.1 General

1. The owner defines the contractor and owner responsibilities within the contract documents in one of the following ways:
   A. Taken in context, the contract language makes the responsible party clear.
   B. Direct commands written to the contractor.
   C. Using "shall" to indicate contractor responsibility and "will" to indicate owner responsibility.
2. If the contractor thinks the responsibility for an action under the contract is unclear or given to the wrong party, the contractor needs to seek clarification from the owner.

101.2 Acronyms

1. The owner identifies acronyms used throughout the contract here in 101.2. The owner may also identify acronyms within individual parts of the contract. Interpret acronyms used throughout the contract as follows:

AASHTO	The American Association of State Highway and Transportation Officials
ADA	The Americans with Disabilities Act
AISI	The American Iron and Steel Institute
ANSI	The American National Standards Institute
APL	WisDOT approved products list
ASTM	The American Society of Testing and Materials
AWG	American wire gauge
AWWA	The American Water Works Association
CMM	WisDOT Construction and Materials Manual
DR	Dimension ratio
HDPE	High-density polyethylene
OSHA	Federal Occupational Safety and Health Administration
PVC	Polyvinyl chloride
SDR	Standard dimension ratio
SPS	Wisconsin Department of Safety and Professional Services Administrative Code
WDNR	Wisconsin Department of Natural Resources
WisDOT	Wisconsin Department of Transportation

101.3 Definitions

1. The owner defines terms used throughout the contract here in 101.3. The owner may define, or redefine, terms within individual parts of the contract. Interpret these terms, used throughout the contract, as follows:

   Addenda. Revisions to the contract documents developed before opening of proposals.

   Adverse Weather Days. A day the contractor is scheduled to work when weather, or job conditions caused by recent weather, cause the contractor to lose 4 or more hours of work on the controlling item.

   Advertisement for Bids, Advertisement, Notice to Contractors. The advertisement for proposals for work or materials on which bids are required. The advertisement will contain a description of the proposed work and the time and place of submitting and opening proposals.

   Award. The owner’s acceptance of a bid.

Bidder. An individual, partnership, joint venture, corporation, limited liability company, limited liability partnership, or a combination of any or all jointly, submitting a proposal (bid) for the work advertised in the invitation for bids, acting directly or through a duly authorized representative.

Business Days. Every day the calendar shows, except Saturdays, Sundays, and holidays.

Calendar Days. Every day the calendar shows, including Saturdays, Sundays, and holidays.

Certificate of Compliance. A document, provided by a manufacturer, producer, or supplier of a product, stating that the product as furnished to the contractor complies with the pertinent specifications and contract requirements.

Certified Report of Test or Analysis. A certified test report, provided by a manufacturer, producer, or supplier of a product, indicating that actual results of tests or analyses comply with the elements of the specification requirements.

Change Order. A written order to the contractor detailing changes to the specified work quantities or modifications within the scope of the original contract.

City, Municipality, Owner. The City of Fond du Lac, Wisconsin.

City Manager. The City Manager of the City of Fond du Lac, Wisconsin. The City Manager and the Director of Administration are the only individuals that may bind the City of Fond du Lac or authorize in writing any contract, change order, or extra work.

Completion Date. The calendar date shown in the proposal on or before which the work contemplated under the contract must be completed.

Contract. The written agreement between the owner and the contractor setting forth the obligations of the parties to the contract, including, but not limited to, performance of the work, furnishing of labor and materials, and basis of payment. The contract includes the advertisement for bids, proposal, contract form, performance bond, detailed specifications, special provisions, addenda, general plans, detailed plans, notice to proceed, and contract change orders and agreements required to complete the construction of the work in an acceptable manner, including authorized extensions, all of which constitute one instrument.

Contractor. The individual, partnership, joint venture, corporation, limited liability company, limited liability partnership, or agency undertaking the performance of the work under the terms of the contract and acting directly or through a duly authorized representative.

Detailed Specifications, Standard Specifications. Written directions and requirements approved for general application and repetitive use as contained herein for street and utility construction and for administration of the contract.

Deputy Procurement Officer. The Deputy Procurement Officer of the City of Fond du Lac, Wisconsin.

Director of Administration. The Director of Administration of the City of Fond du Lac, Wisconsin. The City Manager and the Director of Administration are the only individuals that may bind the City of Fond du Lac or authorize in writing any contract, change order, or extra work.

Director of Public Works. The Director of Public Works of the City of Fond du Lac, Wisconsin or any person designated by the Director of Public Works to perform a particular task.

Engineer. The City Engineer of the City of Fond du Lac, Wisconsin or any person designated by the City Engineer to perform a particular task. The engineer has decision-making authority on behalf of the city with respect to construction items as specified in 105.1.

Equipment. Machinery and articles necessary for the proper construction and acceptable completion of the work. This includes the supplies, tools, and apparatus for upkeep and maintenance of the equipment.

Extra Work. All work performed by the contractor, with written approval of the owner, that does not appear in the proposal or contract as a specific bid item accompanied by a unit price, and that is not included under the price bid for other bid items in the contract. Extra work may also consist of additions to, or changes in, design of contract bid items or portions of contract bid items, if additions are wholly disassociated from or outside the scope of work in the contract, and if the work caused by these additions or changes must be performed under conditions or in a manner materially different from the conditions and manner existent for contract bid items under the original scope of work.

Inadvertent Release. An unintended return or release of drilling fluid during horizontal directional drilling. Also known as a frac-out or inadvertent return.

Materials. Substances specified for use in the construction of the work.

Notice to Proceed. A written notice from the owner to the contractor of the time period within which the prosecution of the work must begin.

Performance Bond. The owner-approved form of security, executed by the contractor and the contractor's surety or sureties, guaranteeing the performance of the contract work, completion of the contract requirements, and the payment of claims as provided in 779.14 of the Wisconsin statutes.

Plans. The owner-approved plans, profiles, typical cross-sections, working drawings, and supplemental drawings that show the location, character, dimensions, and details of the work to be done.

Project. The designated physical area together with improvements to be constructed under the contract.

Proposal, Bid. The written offer of the bidder, submitted on the prescribed proposal form, to perform the work at the prices quoted by the bidder; commonly known as the "bid."

Proposal Form. The approved form on which the owner requires formal bids to be prepared and submitted for the work.

Proposal Guaranty. The security furnished with a bid to guarantee that the bidder will enter into the contract if the bid is accepted.

Schedule of Prices. The prepared schedule, included as part of the proposal form, containing the estimated quantities of the bid items for which unit bid prices are invited.

Special Provisions. Written directions and requirements applicable to a specific project and not otherwise prescribed in the standard specifications. The requirements of the special provisions govern the work and take precedence over the specifications or plans whenever they conflict.

Specifications. Written directions, provisions, and requirements contained in the detailed specifications or special provisions, together with written agreements and documents referenced in the contract, pertaining to the method or manner of performing the work, the quantities of work, and the quality of materials to be furnished under the contract; as made part of the contract and contained in or referenced in the proposal.

Standard Detail Drawings. The City of Fond du Lac Standard Detail Drawings or the WisDOT Standard Detail Drawings in effect at the time of bid opening.

Surety. The company executing a performance bond with the contractor.

Unacceptable Work. Work that does not substantially conform to the contract and results in a product that is insufficient to fulfill the needs of the project. The owner may insist upon repairs or replacement of nonconforming work.

Work. The furnishing of all labor, materials, equipment, and incidentals and the performing of all tasks needed to complete the project or a specific part of the project as specified in the contract, together with fulfillment of all associated obligations and duties required under the contract.

Work Day. Any day that a contractor can work on a project and which would or does necessitate an inspector on the project for any part of the day. If inclement weather curtails construction, the engineer shall decide what portion, if any part of a day, shall be called a "Work Day." Work days may be counted to the nearest one-half day. A record of work days shall be kept on the job by the inspector.

Working Day. A calendar day, except Saturdays, Sundays, holidays, and the period from November 16 to March 31, both dates inclusive, on which weather or other conditions not under the control of the contractor will allow construction operations to proceed for at least 8 hours of the day with the normal working force engaged in performing the controlling item of work which would be in progress at this time.

101.4 References

1. Unless specified by year or date, cited publications refer to the most recent issue, including interim publications, in effect on the bid closing date.

102 Bidding Requirements and Conditions

102.1 Bidder's Responsibility

1. The owner will let the work in conformance with, but not limited to, the following sections of the Wisconsin statutes.
   A. Section 62.15 regarding public works construction.
   B. Section 779.14 regarding liens on contractors.
   C. Section 66.0901(2) regarding proof of responsibility.

102.2 Prequalifying Bidders

1. All bidders shall file with the Director of Public Works, during regular working hours, not less than 5 days prior to the day set for opening bids, proof of responsibility on forms furnished by the owner.
2. The Director of Public Works shall, determine if the bidder is qualified for the type of work for which the bidder requests prequalification. The decision of the Director of Public Works shall be final and conclusive and may cause the rejecting or disregarding of said bid.
3. The Director of Public Works may require a special prequalification for particular projects and/or may require additional information regarding a prequalified bidder's prequalifications to do certain aspects of the work.
4. The proof of responsibility shall be on file for the current year of the opening of bid date.

102.3 Bidding Proposal Content

1. The proposal form is the owner-required form the prospective bidder must use to prepare and submit bids for the work. The owner will provide the proposal from that includes:
   A. Location and description of the project.
   B. Estimate of quantities and type of work to be performed or materials to be furnished.
   C. Time to complete the work.
   D. Amount of the proposal guaranty.
   E. Schedule of prices.
   F. Contract requirements not contained in the detailed specifications.
   G. Special provisions

2. Documents bound with or attached to the bidding proposal are a part of the proposal. Do not detach or alter bound documents when submitting the proposal. The plans, detailed specifications, and other documents designated in the bidding proposal are a part of the proposal, whether attached or not, and need not be returned when the proposal is submitted.

102.4 Interpreting Bid Proposal Quantities

1. Submit unit bid prices for the estimated quantities as given in the schedule of prices. These quantities are approximate and the owner only uses them for the comparison of bids. Do not plead misunderstanding or deception because of these quantities as to the character, location, or other conditions pertaining to the work.
2. The owner will only pay the contractor for the actual quantities of the work performed or materials furnished under the contract. The owner may increase or decrease the contractor's scheduled quantities of work as provided in 109.3 without invalidating the bid prices.

102.5 Examining Contract Documents and Work Site

1. The bidder shall not take advantage of an error or omission in the contract. Carefully examine the contract documents and notify the owner immediately upon discovering errors or omissions. Also perform a reasonable site investigation before submitting a proposal. Submitting a proposal is an affirmative statement that the bidder has examined the contract documents, investigated the site, and is satisfied as to the character, quality, quantities, and the conditions the bidder will encounter in performing the work that the bidder could determine by walking the project site. A reasonable site investigation also includes investigating borrow sites, hauling routes, and all other locations related to the performance of the work.
2. The owner has endeavored to determine the location of existing utilities in the area of the work and so indicate on the appropriate drawings. The owner makes no warranty as to the accuracy or completeness of such representations. It is understood and agreed that the cost of performing work in the vicinity of existing utilities indicated or reasonably inferable is included in the bid price.
3. No employee, agent or consultant of the owner is authorized to make any representations as to the materials or workmanship involved, or the conditions to be encountered, and the contractor agrees that no such statement or the evidence of any document or plan, not a part of this contract, shall constitute any grounds for claim as to conditions encountered. No verbal agreement or conversation with any employee, agent or consultant of the owner, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.
4. The owner may include in the contract documents, or make available for the bidder's review one or more of the following:
   A. As-built drawings.
   B. Available information relative to subsurface exploration, borings, soundings, water levels, elevations, or profiles.
   C. The results of other preliminary investigations.

   If the contractor wishes to supplement their site inspection with owner documents, they should request those documents from the owner.
5. A reasonable site investigation also includes review of documents the owner makes available under 102.5 item 4. This information is for the bidder's general knowledge only and is not a substitute for the bidder's own investigation, interpretation, or judgment. The information provided applies only to the locations and at the times indicated.
6. Submit inquiries regarding the bid by email to the City of Fond du Lac Deputy Procurement Officer.

102.6 Preparing the Proposal

1. Submit completed proposals on the owner's proposal form described in 102.3. Submit proposal on standard 8.5 x 11-inch paper. Submit legible information only. Write everything in ink, by typewriter, or by computer-controlled printer. Provide all dollar amounts in dollars and cents, in numerals. Attach all addenda to the submitted proposal.
2. Properly execute the proposal. Place the required signatures, in ink, in the space provided on the bidding proposal as indicated below:
   A. A proposal submitted by an individual shall be signed by the bidder or by a duly authorized agent.
   B. A proposal submitted by a partnership shall be signed by a partner or by a duly authorized agent thereof.
   C. A proposal submitted by a joint venture shall be signed by a member or a duly authorized agent of at least one of the joint venture firms.
   D. A proposal submitted by a corporation shall be signed by an authorized officer or duly authorized agent of such corporation. Also show the name of the state chartering that corporation and affix the corporate seal.
   E. A proposal submitted by a limited liability company shall be signed by a manager, a member, or a duly authorized agent.
3. Provide a unit price for each bid item listed in the schedule of prices, including undistributed quantities. Calculate and show, in the bid amount column, the products of the respective unit prices and quantities. For a lump sum bid item, show the same price in the unit price column and in the bid amount column pertaining to that bid item. Show the total bid obtained by adding the values entered in the bid amount column for the listed bid items.
4. If alternates or credits are present on the schedule of prices, include a separate unit price for each alternate or credit. The price for the alternates and credits will be the amount added to or deleted from the base bid if the owner selects the alternate or credit. In the evaluation of bids, owner may select any combination of alternates and credit or owner may choose not to accept any alternate bids or credits.
5. If a unit price or lump sum bid already entered in the proposal needs to be altered, cross out the entered unit price or lump sum bid with ink or typewriter and enter the new price above or below and initial it in ink.
6. A change that the bidder makes in the proposal is not an alteration if the bidder makes that change as directed in a specific instruction contained in an addendum.
7. Except for virtual bidding, a Microsoft Excel spreadsheet of the schedule of prices is available on the City of Fond du Lac website. The bidder may submit the proposal on a printout of said spreadsheet as long as it is attached to these specifications.

102.7 Virtual Bidding

1. Submit electronic proposal when required in the advertisement for bids. A summary of the items and units is included in the documents for reference. The official contract documents will only be available on the virtual bidding website. The proposal shall contain an acknowledgement of receipt of all addenda, number and dates, which shall be filled in on the proposal form. Print all names below the signatures.

102.8 Irregular Proposals

102.8.1 Schedule of Prices

1. The owner will correct arithmetic errors or omissions found in the completed schedule of prices as follows:

A. Discrepancy between a unit price and the corresponding bid amount, or in the absence of a bid amount: the owner will use the unit price to determine the correct bid amount.
B. Bidder leaves the unit price column or the bid amount column blank for a lump sum bid item: the owner will use the single value shown to obtain the correct unit price and the correct bid amount for that bid item.
C. Discrepancy between the total bid and the sum of the correct bid amounts, or in the absence of a total bid: the owner will use the correct bid amounts to determine the correct total bid.

102.8.2 Rejection of Proposals

1. Proposals containing any omission, alterations of form, additions or conditions not called for, conditional or alternate bids unless called for, incomplete bids, or proposals otherwise regular which are not accompanied by a proposal guaranty will be considered irregular and may be rejected. The owner reserves the right to waive technicalities as to changes, alterations, or reservations, and make the award to the best interest of the owner. The owner, in its own interest, may re-advertise for bids or proceed with the work in another manner.

102.9 Taxes

1. Effective with all contracts executed after January 1, 2016, the sales price from the sale, storage, use or other consumption of tangible personal property that is used in conjunction with a public works improvement for a tax exempt entity (including the City of Fond du Lac), is exempt from State of Wisconsin sales tax. Said property must become a component of the project owned by the tax exempt entity and includes: any building; shelter; parking lot; parking garage; athletic field; athletic park; storm sewer; water supply system; or sewerage and waste water treatment facility, but does not include a highway, street or road.
2. The contractor shall ensure that the exemption for sales and use tax available under Wisconsin statutes 77.54(9m) applies where available. The contractor shall provide all necessary documentation as required by the State of Wisconsin and the City of Fond du Lac to comply with this exemption.
3. Follow the State of Wisconsin Department of Revenue instructions included in Publication 207 to claim tax exemptions. The owner will not provide their tax-exempt certificate to the contractor in order for the contractor to purchase goods or materials for the contract.
4. Each bid shall include all applicable taxes in effect at the time the bid is submitted. Bidders who are uncertain as to what items are subject to tax, or who require further explanation or clarification are requested to contact the State of Wisconsin Department of Revenue, Madison, Wisconsin.

102.10 Proposal Guaranty

1. A proposal must be accompanied by a proposal guaranty made payable to owner in an amount of 5% of bidder's maximum bid price (determined by adding the base bid and all alternates) and in the form of a properly executed bid bond or certified check drawn from the account of the bidder.

102.11 Proposal Delivery

1. Submit bids by hand or by mail or via the internet using virtual bidding as required in the advertisement for bids.
2. If submitting a bid on paper, place each proposal, together with the proposal guaranty, in a sealed envelope. On the outside of each envelope, plainly indicate the project name and the name and address of the bidder. For mailed submittals, mark the sealed proposal as indicated above and enclose in an additional envelope. Preferably, use registered mail. The owner will accept proposals

at the place, until the hour, on the date designated in the advertisement for bids. The owner will return proposals received after the designated time to the bidder unopened.

3. Controlled access screening is mandatory for all bidders seeking access to the Fond du Lac City County Government Center, 160 South Macy Street. Anyone visiting the building is required to enter and exit the facilities through the main public entrance (north entrance). Screening will take place in the lobby of the building. Allow sufficient time to get through the screening process if bid will be submitted by hand.
4. If submitting a bid via the internet, use the virtual bidding website as prescribed in the advertisement to bids. The owner will accept proposals until the hour on the date designated in the advertisement for bids. Only bidders qualified according to the requirements for prequalification will be allowed to access the bid worksheet. If bidder is qualified and needs access to bid worksheet, bidder shall contact engineer. Submit the proposal guaranty and other contract documents using virtual bidding website. Bids submitted on paper or bids received after the date and time described for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the bidder unopened.

102.12 Modifying or Withdrawing Proposals

1. Virtual bids may be modified and revised until such time bids are opened as indicated in the advertisement for bids.
2. Provide a written request to withdraw a proposal already filed with the owner. Submit the withdrawal request before the deadline set for receiving proposals. The bidder named on a withdrawn proposal cannot subsequently bid on that contract unless the owner issues a new invitation for bids.
3. The owner may withdraw a bidding proposal already issued or return unopened a proposal already filed with the owner if, after issuing the bidding proposal, the bidder is found to be ineligible to bid on that contract.
4. If within 24 hours after bids are opened any bidder files a duly signed written notice with owner and promptly thereafter demonstrates to the reasonable satisfaction of owner that there was a material and substantial mistake in the preparation of its bid, that bidder may withdraw its bid, and the proposal guaranty will be returned. Thereafter, if the work is re-bid, that bidder will be disqualified from further bidding on the work.

102.13 Public Opening of Proposals

1. Proposals will be opened on the date and at the hour and place set in the advertisement for bids and unless non-responsive, read aloud publically except as specified in 102.8.2 and 102.14. If a proposal has no total bid shown, the owner will not read the bid.
2. Bidders or their authorized agent and other interested persons are invited to be present.
3. After verification for accuracy under 103.1, an abstract of the amounts of the base bids and major alternates, if any, will be made available to the bidders after the bids have been reviewed.
4. The owner may postpone the receipt of bids time or the opening of bids time due to emergencies or unforeseen conditions. If the owner changes the hour or the date of the receipt of bids time or the opening of bids time, the owner will issue an addendum to notify prospective bidders.

102.14 Disqualification of Bidders

1. Any one or more of the following causes may be considered as sufficient for rejection of the bid or bids and disqualification of the bidder from further bidding for such periods of time as shall be determined by the owner.

A. Developments subsequent to the establishment of bidder's competence and qualifications which, in the opinion of the owner would reasonably by construed as affecting the responsibility of bidder.
B. Conviction of a violation of a state or federal law or regulation, or rule or regulation of a federal department, board or commission, relating to or reflecting on the competency of the bidder for performing construction work.
C. More than one proposal for the same work from an individual, partnership, or corporation under the same or different names.
D. Evidence of collusion among bidders.
E. Lack of responsibility as shown by the quality or timeliness of past work for the owner.
F. Non-compliance with the terms of previous or existing contracts.
G. Uncompleted work which, in the judgment of the owner, might in any way hinder or prevent the prompt completion of additional work if awarded.
H. Uncompleted work on which the actual time used has exceeded the contract time set therefore, or on which work performance or progress is not satisfactory in the judgment of the owner.

103 Contract Award and Execution

103.1 Consideration of Proposals

1. Following the public opening of the proposals received, the owner will compare them based on the summation of the products of the quantities of work listed and the contract unit prices offered. In case of discrepancies, errors, or omissions, the owner will make corrections as specified in 102.8.1. In awarding contracts, the owner, in addition to considering the amounts stated in the proposals, may consider one or more of the following:
   A. The responsibility of the various bidders as determined from a study of the data required under 102.2.
   B. The responsiveness of the bid as determined under 102.6.
   C. Information from other investigations that the owner may make.
2. The owner will also review the proposals for the irregularities described in 102.8 and review the eligibility of the bidder as specified in 102.14. The owner will determine whether irregularities are matters of form rather than substance and can be waived without prejudice to other bidders or the public interest.
3. Until the final award of the contract, the owner may reject any or all proposals, or waive technicalities. The owner, in its own interest, may re-advertise for bids or proceed with the work in another manner.

103.2 Awarding the Contract

1. Unless rejecting all proposals, the owner will award the contract to the lowest responsible bidder whose proposal complies with 103.1. If two or more responsible bidders submit identical low bids, the owner will determine the successful bidder by flipping a coin.
2. The owner will award the contract within 30 days after the opening of the proposals. If the owner does not make an award within 30 calendar days after opening the proposals, the lowest responsible bidder, after those 30 days, may request, in writing, that the owner make the award. The work outlined in the proposal may be awarded as a whole or in part or parts, according to the best interests of the owner.

103.3 Canceling the Award

1. The owner may cancel a contract award before execution without liability.

103.4 Returning Proposal Guaranty

1. The owner may, at its discretion, return the proposal guaranties of all except the lowest responsible bidder after determining the lowest qualified bidder. The owner will return the lowest responsible bidder's proposal guaranty as soon as the bidder executes and submits in the proper form the contract, performance bond, and other required documents. If the owner does not make the award within 30 days all bidders' proposal guaranties will be returned unless such delay is from causes beyond the control of the owner.

103.5 Performance Bond

1. At the time of submitting the contract for execution by the owner, the bidder shall deposit a valid performance bond with the owner in the amount at least equal to 100% of the contract price covering both faithful performance of this contract and payment of all persons performing labor and furnishing materials in connection with the contract.

103.6 Executing and Approving the Contract

1. The bidder to whom or to which the contract has been awarded, shall properly execute, on the forms provided, the contract and the performance bond, and shall within 10 days after the contract is mailed, return them to the office of the owner.
2. The contract is not binding on the owner until the final execution of the contract. The contract final execution date is the date the final signer signs the contract.

103.7 Failure to Execute Contract

1. The owner may cancel the award if, within 10 days after the date of notice of the award of the contract, the successful bidder does not do the following:
   A. Return required forms or supply other owner-requested information.
   B. Execute the contract and performance bond.
2. If the owner cancels the award, the owner may retain the proposal guaranty, not as a penalty, but in payment of liquidated damages the owner sustains due to the bidder's failure to execute. If the retained proposal guaranty is a bid bond, pay the owner the proposal guaranty amount within 10 days of demand.

104 Scope of Work

104.1 Intent of the Contract

1. The intent of the contract is to prescribe a complete work or improvement which the contractor undertakes to do in full compliance with the plans, the specifications, the special provisions, proposal, and contract. Perform all work including such additional, extra, and incidental work as may be considered necessary to complete the project in a satisfactory and acceptable manner, as provided in the plans, proposal, and contract. Furnish, unless otherwise provided in the specifications, special provision or contract, all materials, equipment, tools, labor, and incidentals necessary to complete the work.
2. If the contractor does not fully understand the plans and specifications or the intent concerning any part of the work, make the necessary inquiries of the engineer before bidding.

104.2 Accuracy of Plans

1. The plans for the project represent the best data available on all existing surface features and underground utilities. Preparation of the plans is based on actual field measurements whenever possible, such measurement pertaining both to alignment and to grade. Utility locations which could not be field-measured are plotted from the best map or plan sources available. Therefore, the

information shown on the plans represents to the best of the engineer's knowledge an accurate picture of the conditions to be encountered in prosecution of the work.

104.3 Revisions to the Contract

104.3.1 General

1. The owner reserves the right to revise the contract plans, character, or quantity of work, at any time. These revisions do not invalidate the contract or release the performance bond. The contractor agrees to complete the contract as revised. Do not proceed with revised work without the owner's prior written approval. Upon receiving written approval, proceed immediately with the revised work.
2. The contractor must notify the engineer if the contractor believes a revision to the contract is necessary. The owner will determine if a potential contract revision is necessary and will notify the contractor of its determination in writing. The contractor must proceed with the owner's direction.
3. If the alterations or changes in quantities do not significantly change the character of the work under the contract, the owner will pay for the altered work at the contract price.
4. If the owner determines a revision is necessary, the contractor is entitled to no reimbursement for loss of anticipated profit.
5. In case a satisfactory adjustment in price cannot be reached for any item requiring a change order, the owner reserves the right to terminate the contract as it applies to the items in question and make such arrangements as may be deemed necessary to complete the work.
6. The costs of revisions to the quantity of work and change orders combined may not exceed the total cost of the project, based on the original contract quantities and the unit prices bid, by more than 15%.

104.3.2 Issuing Change Orders

104.3.2.1 Change Orders for Extra Work

1. The owner will issue a change order to accomplish extra work as defined in 101.3.

104.3.2.2 Change Orders for Differing Site Conditions

1. During the progress of the work, if one or more of the following differing conditions are encountered at the site, the party discovering the condition must promptly notify the other party of the specific condition before further disturbing the site and before further performing the affected work.
    a. A subsurface or latent physical condition, differing materially from those indicated in the contract.
    b. An unknown physical condition of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work specified in the contract.
2. If the contractor discovers the differing condition, the contractor shall provide oral notification as specified in 104.4.1, of the specific differing condition before further disturbing the site and before further performing the affected work.
3. The project engineer will investigate the conditions. If the project engineer determines the conditions materially differ and cause an increase or decrease in the cost, time, or both, required to perform the work under the contract, the owner will adjust the contract price, time, or both, and modify the contract in writing accordingly. The project engineer will respond to the contractor as to whether or not an adjustment is warranted.

4. The owner will not allow a contract adjustment unless the contractor has provided the required notice as specified in 104.4.

104.3.2.3 Change Orders for Changed Quantities

1. The owner may make changes to the quantity of work that meet both of the following:
   a. Changes that, based on the original contract quantities and the unit prices bid, do not alter the total cost of the project by more 15%.
   b. Changes that, based on the original contract quantities, do not alter the quantity of a major bid by more than 25%. A major item shall be construed to be any item, the total cost of which is equal to or greater than 10% of the total contract price, computed on the basis of the proposal quantity and the contract unit price.
2. The owner will issue a change order to make changes that alter the quantity of a major bid item by more than 25%.

104.3.2.4 Change Orders for Eliminated Work

1. The owner has the right to partially eliminate or completely eliminate work, other than major items, that the engineer finds to be unnecessary for the project. Major items may be omitted by change orders.

104.4 Contractor Notification

1. Subsection 104.4 specifies the step-by-step communication process to be followed to expedite the resolution of potential contract revisions identified by the contractor.

104.4.1 Contractor Oral Notification

1. If the contractor believes that the owner’s action, the owner's lack of action, or some other situation results in or necessitates a contract revision, the contractor must promptly provide oral notification to the project engineer. Upon notification, the project engineer will attempt to resolve the identified issue.

104.4.2 Contractor Written Statement

1. If the project engineer has not responded or resolved the identified issue within 5 business days after receipt of initial notification, provide a contractor written statement to the project engineer.

104.5 Extra Work and Force Account Work

1. Perform extra work in conformance with the specifications in a proper workmanlike manner and as may be directed by the engineer.
2. Submit a change order itemizing and covering the prices for extra work as specified in 104.3. Do not start work until the owner approves the change order.
3. The engineer may direct the contractor to perform extra work under force account. Submit a written proposal for the work including the planned equipment, materials, labor, and work schedule.
4. Payment for extra work and force account work will be made as specified in 109.4.4.
5. Claims for extra work not authorized in writing by the owner prior to the work being done will be rejected.

104.6 Roadway Maintenance and Traffic Control

104.6.1 Access Requirements

1. Maintain a minimum of one lane of traffic through the project limits for residents, access to businesses, and emergency vehicles at all times. Where utility crossings or tie-in connections are required through an intersection or into a through street make provisions to maintain a minimum one lane of traffic at all times. Maintain access for all cul-de-sacs, alleys, or other locations where the only access point will be restricted by the project work operations.
2. Maintain a minimum 10-foot wide access at all times for emergency vehicles, unless approved otherwise by the engineer.
3. Provide reasonable access for any special needs person who lives on or adjacent to any of the streets scheduled for construction. Access shall be continuous. Coordinate with the special access needs residents and provide a plan for emergency vehicle access and routine property access to be approved by the engineer. In the event that an emergency vehicle cannot access these locations the contractor shall notify Fond du Lac County Dispatch at 920-906-5555.
4. Provide adequate access to all churches and schools, business and industrial establishments, and special events at all times necessary for them to maintain their operation.
5. Provide adequate access for residents who are moving and to building contractors.
6. Phase all work such that adequate parking exists within 1,000 feet of all residents and businesses on all streets.
7. Provide and maintain suitable pedestrian crossings at least 4 feet in width at all intersections, unless directed otherwise by the engineer.
8. Conduct the work in a manner to provide safe, reasonably-direct, all-weather, 24-hour access to properties via driveways at all times with the exception of concrete cure time. Make provision for gapping, partial pours, or alternate temporary access points to provide access at all times to businesses or special needs/handicap needs residents. Access provisions are subject to approval by the engineer.
9. Provide adequate, level pedestrian walkways to each affected property when driveway access is not able to be maintained.
10. Do not stop, load or store any equipment or materials in a location which will hinder, distract, or impede a safe and suitable traffic operation on lanes of the roadway required to be kept open to traffic unless otherwise approved by the engineer.
11. At all times, keep the roadbed, at the contractor's expense, in such condition that the public can travel in convenience and safety. Traffic service will be given precedence over other work, and the contractor's failure to comply with these requirements shall be cause for suspension of other operations until compliance has been secured.
12. Whenever opening the road or a portion of the road to traffic, conduct the remainder of the construction operations in a way that causes the least obstruction to traffic.

104.6.2 Barricades, Warning Signs, and Flagmen

1. Conform all traffic control signs, devices, and flagging operations to the WisDOT *Wisconsin Manual on Uniform Traffic Control Devices* and WisDOT *Wisconsin Work Zone Field Manual*.
2. Submit a traffic control plan to the engineer, for approval, prior to work being performed which would restrict the normal traffic patterns on and adjacent to the project limits. Provide a schedule indicating planned dates of lane or road closures on the plan.
3. Provide signs, in advance of decision points, identifying alternate accessible, continuous, and unobstructed paths of travel for use by pedestrians with disabilities. Provide proximity actuated audible signs or other non-visual means within the public right-of-way of conveying the information that identifies the alternate pedestrian access route.
4. Provide a local person responsible for providing and maintaining all traffic control devices on the project whenever the contractor shuts down his operations for a period of time, including nights and weekends. Provide the name, address, and telephone number of the responsible party to

both the engineer and the City of Fond du Police Department. The individual must be someone who can be called at all times, day or night, in case of an emergency and who will have the authority to perform or correct work immediately, if required.

5. Prior to the beginning of any construction, furnish all necessary barricades, detour signs, road closing signs, flares or flashers, fencing, flag persons, etc. to provide adequate traffic control and still maintain the accesses described in 104.6.
6. Mount temporary traffic control signs on wood, tubular steel, or u-channel sign posts when the signs are planned to be in place 14 continuous days and nights or greater. Signs that will be in place less than 14 continuous days and nights may be mounted on portable supports.
7. All project locations shall be closed to through traffic while remaining open to local traffic unless noted otherwise.
8. Where the street will remain open to local traffic, maintain temporary stop signs or provide and maintain other temporary traffic control signs and devices as required by the engineer. The owner will provide temporary stop signs to be used by the contractor.
9. The contractor is responsible for all damages to the work due to failure of barricades, signs, lights, flagmen and watchmen to protect it. The engineer may order the damaged portions immediately removed and replaced by the contractor without cost to the owner, if, in his opinion such action is justified. The contractor's responsibility for the maintenance of barricades, signs, and lights does not cease until all contract work is complete.

104.6.3 Temporary Hazards

1. Use drums, cones, flaggers, or temporary fencing, in addition to the traffic control for the motorists, to delineate and protect the public from temporary hazards, equipment operations, vertical drop-offs greater than 2 inches, and any other hazardous conditions that are a result of the construction activity. All costs associated with these devices or practices are incidental to the activities that may create a hazard.

104.6.4 No Parking Signs

1. Provide and install "No Parking Signs" in areas directed by the engineer where there is limited access to through traffic due to manholes and/or water valves sticking up above the road surface. The signs will prohibit parking on one side of the street where the opposite side of the street is blocked by the obstructions.
2. Provide and install "No Parking Signs" in advance of grading and paving operations, or as directed by the engineer, to assure vehicles will not be parked in the proposed work area the following work day.

104.6.5 Garbage and Recycling Collection

1. Coordinate with the owner for collection of garbage/recycling. The owner will collect areas under construction early in the day unless other mutually agreed upon arrangements are made. Provide adequate access for garbage and recycling collection.

104.6.6 Removal of Snow

1. The contractor is responsible for immediate snow removal or ice control operations to maintain traffic on sections of streets which they have obstructed and are open to traffic or closed to through traffic.

104.6.7 Traffic Control and Maintenance During Suspensions of the Work

1. The suspension of work as specified in 105.1, in no way relieves the contractor of the obligation of roadway maintenance and traffic control as specified in 104.6.

104.6.8 Opening of Section of Road to Traffic

1. Do not open the road to public traffic without the engineer's written direction or written authorization. The engineer may direct the contractor to open sections of the road for the convenience of the traveling public. The engineer may authorize the contractor to open sections of the road to public traffic due to the contractor's request. By opening sections to public traffic, the contractor is not relieved of performing the maintenance. However, the owner will assume all costs for repair and maintenance solely attributable to public traffic use, and beyond the control and without fault of the contractor. The engineer's direction or authorization to open sections of the road to public traffic does not constitute acceptance and waives no other contract provisions.
2. Furnish, erect, and maintain those traffic control devices as may be required for the safe accommodation of the traffic.
3. The contractor is not liable for injuries or damages sustained by a person using the opened road except for injuries or damages resulting from the contractor's own operations, negligence, or noncompliance with the requirements for traffic control under 104.6.
4. Whenever opening the road or a portion of the road to traffic, conduct the remainder of the construction operations in a way that causes the least obstruction to traffic.

104.6.9 Contractor Responsibilities

1. The provisions of 104.6 do not relieve the contractor of responsibility for injury or damage caused by the contractor's negligence in properly safeguarding public travel.

104.7 Removing Structures and Obstructions

1. Remove from within the construction limits all or parts of existing structures or obstructions designated for replacement or that interfere with new construction as directed the engineer. The owner will pay for the removal of existing structures or obstructions, not specified in the contract but subsequently required, as extra work.
2. Do not excavate or remove any material from within the right-of-way that is not within the vertical and horizontal excavation limits the plans show, without being authorized in writing by the engineer.
3. Take ownership of all materials required to be removed and not necessary for the work unless otherwise indicated.

104.8 Disposal Sites

1. The contractor is responsible for obtaining a suitable disposal site for all debris, or discarded materials, rubbish, and all materials not designated to be salvaged or retained on the site or by the landowner(s).
2. The cost of disposal is incidental to the contract except as specified in 612.4.
3. Provide the engineer with a list of all disposal sites.
4. Comply with applicable laws and regulations including, but not limited to, construction site erosion control, grading, wetland, contaminated site, and floodplain regulations for all land disturbance and fill activities.
5. Contact the City of Fond du Lac Community Development Department to determine whether proposed disposal sites and operations within the City of Fond du Lac municipal boundary comply with all land use and floodplain requirements and regulations and obtain permission to use the site.
6. The engineer shall approve all temporary and permanent disposal sites within the City of Fond du Lac municipal boundary prior to the disposal of any material. Provide documentation that the landowner has provided permission for any proposed activities, provide landowner contact

information, provide documentation that the site has been approved by the City of Fond du Lac Community Development Department, and provide documentation that all applicable permits have been obtained and that activities will comply with applicable regulations. Provide the engineer with a copy of approved permits on request for sites outside the City of Fond du Lac municipal boundary.

104.9 Final Cleanup

1. Upon completion of the work and before the owner accepts the work as specified in 105.9.1 and makes final payment as specified in 109.7, the contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. Cut all brush and wood within the limits indicated and leave the street in a neat and presentable condition. Do not deposit material removed from the project on adjacent properties unless so directed by the engineer. The contractor shall restore, at no cost to the owner and in general conformity with the contract for the bid item or bid items involved, all work completed under other previous contracts that the contractor has damaged.
2. The cost of final cleanup is incidental to the contract.
3. Work days may be charged against the contractor until all clean-up is completed to the satisfaction of the engineer.

105 Control of Work

105.1 Engineer's Authority

1. The engineer decides all questions regarding:
   A. Interpretation of the contract.
   B. The quantity, quality, and acceptability of materials furnished and work performed.
   C. Rate of progress of the work.
   D. Payment, contract administration, and the acceptable fulfillment of the contract.
   E. Disputes.
   F. Mutual rights under the contract.
2. The engineer may suspend the work in writing for any reason at any time during the contract. The owner will allow no additional payment or time extension due to a suspension of work.
3. The engineer will determine estimated quantities for progress payments as specified in 109.6.
4. All decisions of the engineer will, when so requested, be rendered in writing. Written decisions of the engineer are final and conclusive.

105.2 Conformity with the Contract

105.2.1 General

1. Perform all work the contract specifies. Produce quality work within limits of precision reasonably expected of good construction. Produce work conforming to the lines, grades, cross-sections, dimensions, and material requirements the contract specifies or the engineer establishes. Monitor construction operations to identify potential unacceptable work as defined in 101.3. Promptly remove and replace, or otherwise correct, unacceptable work at no expense to the owner.
2. The contract may specify specific values with allowable tolerances, ranges, minimums, or maximums. Control operations to produce work that falls within the specified tolerance or range, falls above a specified minimum, or falls below a specified maximum. If the contract does not specify a tolerance, range, minimum, or maximum value, control operations to produce work conforming to the contract within accepted manufacturing or construction industry standards.

3. The contract may specify standard manufactured items such as fences, wire, plates, rolled shapes, pipe conduit, etc. If these items are identified by gauge, unit weight, section, dimensions, etc., these identifications are nominal weights or dimensions.

105.2.2 Nonconforming Work

105.2.2.1 Engineer-Accepted Nonconforming Work

1. If the work does not conform to the contract, the engineer will determine the circumstances under which that nonconforming work may be accepted and allowed to remain in place. The engineer will document the basis of acceptance and may execute a change order to adjust the contract unit prices for the nonconforming work. If the contract does not specify a price adjustment, the engineer may adjust the price.

105.2.2.2 Unacceptable Work

1. The engineer will issue a written order to remove and replace or otherwise correct nonconforming work that the engineer deems unacceptable work, as defined in 101.3. If the contractor does not comply with the engineer's written order, the engineer may effect a remedy and deduct the cost from payments due the contractor.

105.2.2.3 Unauthorized Work

1. Unauthorized work is work performed as follows:
   a. Without the lines and grades being given.
   b. Beyond the lines and grades the contract shows or the engineer provides.
   c. Without the engineer's prior approval.
   d. Without the City Manager or Director of Administration’s prior written approval on change orders or extra work.
   e. Without proper inspections.
   f. After the engineer has temporarily suspended the work verbally or in writing as specified in 105.7.
   g. In violation of a written direction the engineer issues.
2. The owner may elect to not measure or pay for unauthorized work. The engineer may issue a written directive to remove unauthorized work at no expense to the owner. If the contractor does not comply with the engineer's written directive, the engineer may remove unauthorized work and deduct the cost from payments due the contractor or recover on the contractor’s performance bond.

105.3 Coordination of the Contract Documents

1. All documents included under the definition of contract in 101.3 are essential parts of the contract. A requirement occurring in one is binding as though occurring in all. These documents provide for and describe the complete contract.
2. During the progress of the work, the contractor may request that the engineer interpret or provide information relative to the contract.
3. If there is a discrepancy between documents, the governing order is as follows:
   A. Addenda.
   B. Special provisions.
   C. Plans.
   D. Detailed specifications.

4. If there is a discrepancy on a drawing, the drawing dimensions, unless obviously incorrect, govern over scaled dimensions. If there is a discrepancy in the plans, the typical sections or details govern over the standard detail drawings.
5. Neither the contractor nor the owner may take advantage of an error or omission in the contract. Notify the engineer immediately as specified in 104.4 upon discovering an error or omission. The engineer will offer an interpretation and make the necessary corrections.

105.4 Coordination with the Contractor

105.4.1 Contractor Obligations

1. Give the work the constant attention necessary to promote the progress of the work. Promptly supply the materials, tools, plant, equipment, labor, and incidental items required to perform the work.
2. Cooperate with the engineer and with third parties engaged upon or near the work. If the owner grants a third party a permit to do utility work, the engineer may issue a change order directing the contractor to make or repair required roadway openings. The owner will pay the contractor as specified in 104.3 as extra work.
3. Maintain one copy each of the plans, specifications, and special provisions at the site of work at all times. The engineer will supply the contractor with copies of the contract. If the owner has electronically computed estimated grading quantities, the owner will furnish that information to the contractor upon request.
4. Supervise and direct the work competently and efficiently. Devote the attention and apply the expertise necessary to perform the work as the contract specifies. Monitor the work in progress to ensure that the work conforms to the contract. The contractor is solely responsible for the means, methods, techniques, sequences, and procedures of construction. The contractor is not responsible for the negligence of others in the design or specification of specific means, methods, techniques, sequences, or procedures of construction described in and expressly required under the contract.
5. Employ a competent English-speaking superintendent or designate an English-speaking representative capable of reading and understanding the contract and experienced in the type of work being performed. The superintendent or designated representative is the authorized agent of the contractor and has full authority to execute the engineer's directions or instructions without delay. Ensure that the superintendent or designated representative is on the project or accessible to the engineer during all hours of each work day. Notify the engineer promptly when replacing the superintendent or designated representative.

105.4.2 Cooperation Between Contractors

1. The owner may, at any time, contract for or perform other work on or near the work covered under the contract. Cooperate with other contractors engaged upon or near the work.
2. The contractor shall, or the engineer may, direct the contractor to:
   A. Schedule and conduct the work to avoid interference with the operations of other contractors engaged upon or near the work.
   B. Perform the work in the proper sequence in relation to that of other work in the area.
   C. Join the work to that of others in a manner consistent with accepted manufacturing or construction industry practices.
   D. Conduct operations and maintain the work so that adequate drainage is provided at all times.
3. The contractor is responsible for damage done by the contractor or the contractor's agents to work performed by other contractors. The engineer will resolve disputes between 2 or more

contractors, engaged upon or near the work, regarding the rights of each under their respective contracts.

105.5 Construction Staking

1. The owner will furnish and set original horizontal and vertical control points. Prosecute the work using these points for field control. Provide adequate notification for the owner to set control points as required by the engineer. The engineer and contractor must agree on the meaning of all stakes, measurements, and marks before the contractor begins work. Verify the accuracy of all measurements before constructing any permanent structure. Do not take advantage of any errors in setting control points.
2. Carefully preserve all stakes and markings set by the owner for guidance of either the contractor or the owner. The contractor may be responsible for the cost of replacing any stake or marking removed or destroyed by the contractor, at the discretion of the engineer. The engineer may deduct the cost of replacing stakes and marking from payments due the contractor.

105.6 Authority and Duties of Project Engineer

1. As the engineer's direct representative, the project engineer has immediate charge of the engineering details of each construction project. The project engineer is responsible for field administration of the project. The engineer authorizes the project engineer to reject defective material and to suspend all work being improperly performed. The engineer may delegate additional authority, as granted under 105.1, to the project engineer.

105.7 Authority and Duties of Inspectors

1. As the engineer's authorized representatives, inspectors may inspect all work done and all materials furnished.
2. The owner authorizes inspectors to:
   A. Call the contractor's attention to work or materials that do not conform to the contract.
   B. Reject materials until the engineer is notified and decides all questions at issue.
   C. Temporarily suspend work, by verbal order, until the engineer is notified and decides all questions at issue. If the contractor refuses to suspend work on verbal order, the inspector will issue a written order and after delivering to superintendent or designated representative immediately leave the site. The owner will withhold payment and acceptance of all work done during the absence of the inspector.
3. The owner does not authorize inspectors to do the following unless the engineer specifically delegates:
   A. Revoke, alter, or waive any requirements of the contract.
   B. Approve or accept any portion of the completed project.
   C. Act as foreperson or perform other duties for the contractor.
4. The engineer may delegate additional authority to the inspector.

105.8 Inspecting Work

1. The engineer may inspect, at any time, all materials and all parts of the work. This inspection may include the preparation, fabrication, or manufacture of materials or components on or off the project site. Allow the engineer safe access to all parts of the work. Furnish the information and assistance needed to make a complete inspection.
2. If the engineer requests, uncover or remove portions of finished work for inspection. After inspection, restore that work to the contract requirements. If the owner finds the work acceptable, the owner will pay for uncovering, removing, and restoring that work as extra work. If the owner

finds the work unacceptable, the contractor shall pay for uncovering, removing, and restoring that work.

3. Failure to reject defective work or materials does not prevent the owner from rejecting defective work discovered later.

105.9 Inspection and Acceptance

105.9.1 Project Acceptance

105.9.1.1 General

1. Notify the engineer when the project is substantially complete as defined in 105.9.1.3. As soon as practicable, the engineer will inspect the work and categorize it as one of the following:
    a. Unacceptable or not complete.
    b. Substantially complete.
    c. Complete.

105.9.1.2 Unacceptable or Not Complete

1. The engineer will identify, in writing, work that is unacceptable or not complete. Immediately correct or complete that work. The engineer will assess contract time until the work is corrected or completed.
2. Proceed as specified in 105.9.1.1 until the engineer determines that the work is complete.

105.9.1.3 Substantially Complete

1. When the project is substantially complete the engineer will relieve the contractor of maintenance responsibility for the completed work and no longer assess contract time. The project is substantially complete if the contractor has completed all contract bid items and change order work, except for the punch list. As applicable, the following must have occurred:
    a. All lanes of traffic are open on a finished surface.
    b. All signage and traffic control devices are in place and operating.
    c. All drainage, erosion control, excavation, and embankments are completed.
    d. All safety appurtenances are completed.
2. The engineer will provide a written punch list enumerating work the contractor must perform and documents the contractor must submit before the engineer will categorize the work as complete.
    a. Punch list work includes uncompleted cleanup work required under 104.9 and minor corrective work. Immediately correct or complete the punch list work. The engineer may restart contract time if the contractor does not complete the punch list work within 5 business days after receiving the written punch list. The engineer and contractor may mutually agree to extend this 5-day requirement.
    b. Punch list documents include whatever contract required documentation is missing. The engineer may restart contract time if the contractor does not submit the punch list documents within 15 business days after receiving the written punch list. The engineer and contractor may mutually agree to extend this 15-day requirement.
3. Proceed as specified in 105.9.1.1 until the engineer determines that the work is complete.

105.9.1.4 Complete

1. When the engineer determines that the project is complete, the engineer will give the contractor written notice. The project is complete when the contractor has completed all contract bid items, change order work, and punch list work including the submission of all missing documentation.

105.9.1.5 Lien Waivers

1. Provide signed releases of liens and waivers of debts and claims for all labor performed, equipment rented, and materials furnished under the contract from the following:
   a. Contractor.
   b. Suppliers to contractor.
   c. All subcontractors.

105.9.1.6 Final Acceptance

1. The engineer will grant final acceptance of the project after determining that all contract work is complete; all contract, materials, and payroll records are reviewed and approved; and the semi-final estimate quantities are final under 109.7.
2. Failure to discover defective work or materials before final acceptance does not prevent the owner from rejecting that work or those materials later. The owner may revoke final acceptance if the owner discovers defective work or materials after it has accepted the work.

105.9.2 Guaranty

1. Guaranty the work performed under this contract against defects in workmanship and materials for a period of one year from the date of final acceptance by the owner.
2. Upon notification by the owner, make required replacements or acceptable repairs of the defective work meeting the contract specifications unless directed otherwise by the engineer. The required repairs or replacement includes total and complete restoration of any disturbed surface to original or better than original condition which existed before the repairs or replacement, regardless of improvements on lands where the repairs or replacement will be required.
3. The contractor is responsible for the costs of all repairs or replacements made by the contractor and any repairs or replacements made by the owner. Pay on demand the costs of repairs or replacements made by the owner.

105.10 Claims Process for Unresolved Changes

105.10.1 Notice of Claim

1. If the contractor has followed the procedures for revising the contract specified in 104.3 and provided the notification specified in 104.4, but still disagrees with the owner, the contractor may pursue the issue as a claim. File a notice of claim with the project engineer concerning the disagreement within 14 calendar days of receiving the engineer's decision.
2. The project engineer may deny the applicable portion of a claim if the contractor does not do the following:
   A. File the notice of claim within 14 calendar days as specified in 105.10.1 1.
   B. Give the project engineer sufficient access to keep a record of the actual labor, materials, and equipment used to perform the claimed work.
3. Upon filing the notice of claim, maintain records of labor, material, and equipment costs. Unless the project engineer issues a suspension, continue to perform the disputed work. The owner will continue to make progress payments to the contractor as specified in 109.6.

105.10.2 Submission of Claim

1. Submit the claim to the project engineer as promptly as possible following the submission of the notice of claim, but not later than the end of the time allowed under 109.7 for the contractor to respond in writing to the engineer-issued semi-final estimate. If the contractor does not submit the claim within that response time, the owner will deny the claim.
2. The owner will not accept the submission of a claim until the contractor makes no further requests to submit updated information that may affect the owner's final decision.

105.10.3 Content of Claim

1. Include a detailed, factual statement of the request for additional compensation and contract time. Include the date the issue was identified, the date initial notification was given to the project engineer, and the dates and specific locations of work involved.
2. Include references to relevant contract provisions and a narrative summarizing how the contract provisions support the request for a revision to the original contract.
3. When requesting additional compensation, include an itemized list of costs with a narrative supporting the requested amount and explaining how the costs are tied to the requested contract revision.
4. Include relevant supporting documentation.

105.10.4 Owner Final Decision

1. The owner will have up to 28 calendar days, from the contractor's submission of the claim, to perform a final review of the claim and conduct all meetings. The owner may request, in writing, that the contractor submit additional information related to the claim. Submit that additional information, or notify the owner in writing to base its decision on the information previously submitted. The owner will provide a written decision.

106 Control of Materials

106.1 General

1. Provide materials conforming to the contract. Use new products and materials for items permanently incorporated into the work unless the contract specifies or allows otherwise. Use materials the contract specifies unless the engineer authorizes substitutes under 108.11. Monitor construction operations to identify potential nonconforming materials and prevent their incorporation into the work.
2. All materials are subject to the engineer's approval before incorporation into the work. The engineer may inspect or test all materials at any time during their preparation, storage, and use. Notify the engineer of the proposed source of materials before delivering those materials to the project site. If the engineer requests, provide samples of material and access to facilities that the engineer needs to assess the acceptability of all materials. The owner will, on request, share with the contractor available information on a source or material.
3. For fabricated components, the materials and the fabricator are subject to the owner's approval before delivery of those components to the project site. The engineer may require the contractor to obtain components from another owner-approved source if the owner determines a fabricator's product does not conform to the contract.
4. Do not incorporate materials into the work until the engineer approves those materials. However, the contractor may request permission to incorporate materials not already approved. The engineer will grant this permission only if the contractor can provide convincing evidence that the engineer will subsequently find those materials conforming. Incorporation of materials before approval is at

the contractor's risk and permission to do so does not imply that the owner will subsequently approve those materials.

5. Except as required under the contract, ensure that products incorporated into the work, either temporarily or permanently, do not display advertising or messages not directly related to the manufacturer, properties, or function of those products; or advertising or messages in violation of state statutes.

106.2 Approval and Acceptance of Materials

106.2.1 General

1. The owner will approve materials or components demonstrated to conform to the contract. The owner will base its approval on conformance with the contract as close as practicable to the point of incorporation into the work. The owner approves materials based primarily on the engineer's tests, tests the contractor performs, or tests the manufacturer performs and certifies. For materials conditionally approved at the point of manufacture or source of supply, the engineer may:
   A. Retest or re-inspect materials after delivery to the project site.
   B. Reject material subsequently found to be non-complying.
2. The owner may augment test results with documented performance history or inspection of processing, storage, handling, and construction operations. If the contract requires or the engineer requests, provide written documentation of the origin, composition, or process of manufacture of a material.
3. Conform to manufacturer-recommended procedures for products incorporated into the work unless the contract specifies otherwise. Provide copies of those procedures if the engineer requests. The contractor may request that the owner approve alternate procedures.
4. The owner's approval of materials or components does not constitute acceptance of the work incorporating those materials or components.

106.2.2 Submittals

1. Submit to the engineer digital copies of current manufacturer’s specifications, mix designs, sieve and fracture analyses, construction details, and construction procedures for review prior to installation or fabrication. Provide the following information:
   A. The proposed material or structure.
   B. Compliance with specified standard(s).
   C. Supplier and manufacturer’s name, address, and phone number.
   D. Information requested by the engineer to suitability of material, component, or procedure.
2. Provide submittals a minimum of 2 weeks before a proposed material will be used or a structure will be constructed or installed.
3. The engineer will provide written approval of accepted materials. Resubmit for approval any submittal rejected by the engineer. Do not order materials subject to construction detail review prior to receipt of written approval of material.

106.2.3 Approved Products Lists

1. When specified furnish products from lists of approved products and approved manufacturers or suppliers developed and maintained by WisDOT. The owner may retest or re-inspect products after delivery to the project site to verify that they conform to the contract. A product is nonconforming if verification test results indicate the product does not meet the requirements for inclusion in the WisDOT APL.

106.2.4 Approval by Certification

106.2.4.1 General

1. For manufactured products or assemblies, the owner may base approval on a product certification or require both a product certification and production plant certification.

106.2.4.2 Product Certifications

1. For manufactured products or assemblies, the engineer may accept a certified report of test or analysis, or a certificate of compliance instead of performing tests on samples. If not designated in the contract for the specific material involved, the engineer will determine the form, content, and distribution of the required documents. Submit digital copies of each document that the engineer specifies.
2. For testing documented by certificate, all sampling and testing procedures and testing facilities are subject to the review and approval of the owner. The owner may sample and test products to verify the certified test results. Provide samples as the owner directs.
3. Products are nonconforming if one or more of the following apply:
    a. Certifications are not provided within the specified time or in the specified form.
    b. Certified properties do not conform to the contract.
    c. Verification test results indicate the products do not conform to the contract.

106.2.5 Approval By Sampling and Testing

106.2.5.1 General

1. Except as specifically provided in the contract, the engineer will determine sampling and testing frequencies and sample locations, both on and off the project site.
2. The owner will determine the sampling and testing methodology using the following order of precedence. The owner will:
    a. Use specific methods the contract references.
    b. Use WisDOT CMM specified methods if the contract does not reference specific methods.
    c. Use the AASHTO *Standard Specifications for Highway Materials and Methods of Sampling and Testing* or ASTM standards if the contract does not reference specific methods and the WisDOT CMM does not specify a method.
3. All laboratory facilities sampling and testing materials incorporated into the work must be qualified, for the specific tests they are performing, by WisDOT under its laboratory qualification program.

106.2.5.2 Owner Testing

1. Furnish without charge all samples that the engineer requires and provide the facilities and staff required for collecting and forwarding them to the owner. The owner will, on request, share with the contractor test results obtained on contractor-furnished samples of materials.

106.3 Storing and Handling Materials

1. Store and handle materials to preserve their quality and fitness for the work and in compliance with manufacturer's recommendations. Provide easy access for the owner to inspect and test stored materials. Even if approved before storage, the engineer may find materials nonconforming based on re-inspection before incorporation into the work.

2. Provide the engineer with the storage locations of materials intended for the work. If the engineer allows, the contractor may store materials on portions of the right-of-way not required for public travel. Provide additional off-site storage space at no additional expense to the owner. Off-site storage areas for approved or conditionally approved materials are subject to the owner's inspection and approval.
3. When considered necessary, place materials on wooden platforms or other hard, clean surfaces and not on the ground, and place under cover when directed.

106.4 Nonconforming Materials

1. For nonconforming materials identified before incorporation into the work, the engineer will do one of the following:
   A. Reject those materials. Unless the engineer allows otherwise, remove rejected materials from the project site at no cost to the owner. The engineer may allow the contractor to correct rejected materials. Obtain the engineer's approval for previously rejected, but subsequently corrected, materials before incorporating those materials into the work.
   B. Approve those materials subject to potential reduced payment. The engineer will determine the circumstances under which those nonconforming materials may be approved for incorporation into the work. The engineer will document the basis of approval and may execute a change order to adjust the contract unit prices for the nonconforming materials. If the contract does not specify a price adjustment, the engineer may adjust the price.
2. For materials incorporated in the work and later found to be nonconforming, the engineer will do one of the following:
   A. Reject those materials subject to the provisions of 105.2.2.2 for unacceptable work.
   B. Approve those materials and adjust the contract price as provided in 105.2.2.1 for engineer-accepted nonconforming work.

107 Legal Relations and Responsibility to the Public

107.1 Laws to Be Observed

1. At all times, observe and comply with all applicable federal and state laws and administrative rules, codes, local laws, ordinances, and regulations that affect the conduct of the work, and applicable orders or decrees of bodies or tribunals having jurisdiction or authority over the work. The owner will consider no plea of misunderstanding or ignorance thereof. The contractor shall indemnify and save harmless the owner and all of its officers, agents, and employees against any claim or liability arising from or based on the violation of any applicable law, ordinance, regulation, order, or decree, whether by the contractor or the contractor's employees, subcontractors, or agents.
2. Comply with all applicable federal, state, and local health official rules and regulations governing safety, health, and sanitation. Provide all necessary safeguards, safety devices, and protective equipment. Take all other actions reasonably necessary to protect the life and health of employees on the project and the safety of the public.

107.2 Haul Routes

1. During the construction of this contract, the contractor and all of his representatives will be restricted as to the streets which may be used for the transport of materials and equipment. The owner will require the contractor and subcontractors use main arterials and non-residential streets. Heavy traffic routes may be found at https://ecode360.com/15560916#15560916. Supply the proposed haul routes to the engineer prior to commencing hauling. The contractor and the engineer will mutually cooperate to establish haul routes that are satisfactory to both parties while protecting other streets from damage. Monitor and remove tracked soils from haul routes.

107.3 Permits and Licenses

1. Obtain all permits and licenses, pay all charges and fees, and give all notices necessary to perform the work except for permits obtained by the owner and indicated in the special provisions. The contractor shall comply with all permit requirements whether the permit is issued to the contractor, the owner, or the maintaining authority.

107.4 Patented Devices, Materials and Processes

1. Include in the bid prices royalties and costs arising from patents, trademarks, and copyrights. Before using a design, device, material, or process covered by letters, patents, or copyrights, provide for its use by suitable legal agreement with the patentee or owners. Provide proof of this agreement with the engineer if necessary. The contractor and the contractor's surety shall provide indemnification from all claims for infringement of patents, trademarks, or copyrights as specified in 107.8.

107.5 Public Convenience and Safety

1. Maintain the safety of the traveling public and control traffic as specified in 104.6.
2. If the contract provides that the road or portions of the road are closed to public traffic during construction, the engineer may direct or authorize the contractor to open sections of the road to public traffic before the work is completed.
3. When hauling materials on public roads or streets, equip vehicles subject to spillage with tailgates and adequate sideboards. Use covers and other protective devices necessary to prevent spillage. The contractor is responsible for removing spillage from the entire area within the right-of-way of the haul route. Immediately remove spillage that interferes with or creates a hazard for traffic.
4. Notify Fond du Lac County Dispatch at 920-906-5555 at least 24 hours before closing a road, street, or highway.
5. If excavating adjacent to a building or wall, give the property owner sufficient written notice of the impending excavation. The contractor and the contractor's surety shall hold the owner harmless from damage to the building or wall.
6. Limit the hours of operation of construction equipment to 7:00 a.m. to 7:00 p.m. Monday through Friday unless the engineer approves extended hours of operation.

107.6 Use of Explosives

1. Observe the utmost care when using explosives so as not to endanger life and property. Use, store, and handle explosives and highly inflammable materials conforming to applicable federal, state, and local laws and regulations including the rules of the State of Wisconsin Department of Commerce.

107.7 Protecting and Restoring of Property and Property Marks

107.7.1 General

1. Notify, in writing, all public and private property owners whose property interferes with the work. Advise them of the nature of the interference, and arrange with them for the disposition of the property. Upon request, furnish the engineer with copies of all notifications and final agreements.
2. Use every reasonable precaution to prevent damage to all property including poles, trees, shrubbery, crops, and fences adjacent to or interfering with the work; all overhead structures including wires, cables, etc.; and all underground structures including water or gas shut-off boxes, water meters, pipes, conduits, etc.; within or outside the right-of-way.
3. Assume liability for all damage to public or private property resulting from contractor operations, defective work or materials, or non-execution of the contract. Restore property, to a

condition similar or equal to that existing before causing the damage, as the engineer directs or in a manner acceptable to the property owner. If the contractor fails to restore property within a reasonable time, the owner may, upon 48 hours written notice, restore that property as the engineer deems necessary. The owner will deduct restoration costs from payments due the contractor under the contract.

107.7.2 Property Marks

1. Locate, protect and carefully preserve all known property and survey marks and land monuments. Do not disturb or destroy markers until the engineer has arranged for their referencing, perpetuation, or replacement. Upon completion of the project, the owner will examine the project in the field to verify that all known markers remain in place. If it is found that the markers have been lost through construction, final payment will be withheld until the contractor has replaced the markers. A land surveyor having a current State of Wisconsin registration in land surveying shall perform replacement of markers. No additional compensation will be provided for this work.

107.7.3 Burning

1. Do not start fires without first securing the necessary permits and the approval of the City of Fond du Lac Fire Chief. Comply with applicable requirements of the WDNR's air pollution control rules, including the limitations on open burning. When burning brush, stumps, or rubbish, take care not to damage standing trees, shrubs, or other property. Assume liability for all damage caused by fires.

107.8 Responsibility for Damage and Tort Claims

1. The contractor and their insurer shall defend, indemnify, and save harmless governmental entities involved in the project, or in which all or part of the project site is located, including officers, agents except for consulting firms, and employees of any of the foregoing from suits, actions, or claims brought because of injuries or damages sustained by any person or property arising from one or more of the following:
   A. Contractor operations.
   B. Contractor neglect in safeguarding the work.
   C. Contractor use of unacceptable materials in constructing the work.
   D. Acts or omissions, neglect, or misconduct of the contractor.
   E. Claims or amounts recovered for an infringement by the contractor of patent, trademark, or copyright.
   F. Claims or amounts arising or recovered under the workers compensation act, relating to the contractor's employees.
   G. The contractor’s noncompliance with a law, ordinance, order, or decree relating to the contract.
2. The owner may retain payments due the contractor in amounts the owner deems sufficient to cover the cost of suits, actions, or claims caused by the reasons specified in 107.8 item 1. The owner will not release this retainage until the contractor furnishes satisfactory evidence of one of the following:
   A. The contractor is adequately protected from the suits, actions, or claims with the insurance coverages specified in 107.22 or other insurance.
   B. The parties have settled the suits, actions, or claims.
3. The owner is not liable to the contractor for damages or delays resulting from third-party work, except for excusable delays specified in 108.13.2 and 108.13.3. The owner also is exempt from liability to the contractor for damages or delays resulting from injunctions or other restraining orders obtained by third parties.

107.9 Third-party Beneficiary

1. This contract does not create anyone as a third-party beneficiary. This contract does not authorize non-parties to the contract to maintain actions for damages under the contract.

107.10 Contractor's Responsibility for Work

1. Within 107.10, the term “work” is redefined to mean “the work product that is completed in its final position and is incorporated in the project.”
2. Maintain charge and care of the work until the engineer accepts the work under 105.9. Protect the work against injury or damage caused by public traffic, the action of the elements, or from other causes, whether arising from the execution or non-execution of the work. Rebuild, repair, restore, and make good injuries or damages to work caused by the above at no additional cost to the owner.
3. The contractor shall not bear the expense for damage to the work caused by abnormal and unforeseeable occurrences beyond the control of, and without the fault or negligence of, the contractor. These abnormal and unforeseeable occurrences include but are not limited to the following:
   A. Cataclysmic phenomena of nature.
   B. Acts of the public enemy.
   C. Acts of government authorities.
4. Before suspending the work, take the necessary precautions to prevent damage to the project, prevent traffic accidents, and provide for normal drainage. Erect necessary temporary facilities at no expense to the owner as specified in 104.6.
5. The contractor is responsible for all damages to equipment and supplies regardless of the circumstances.

107.11 Personal Liability of Public Officials and Employees

1. In carrying out contract provisions, or in exercising power or authority granted to them by or within the scope of the contract, the owner, the engineer, or their authorized representatives have no liability, either personally or as officials of the city. In all of these matters, they act solely as agents and representatives of the city. The contractor waives all rights of action against the owner, its agents, or employees.

107.12 Statutory Limitation of Liability

1. The City of Fond du Lac is a governmental entity entitled to governmental immunity under law, including Wisconsin statutes 893.80. Nothing contained herein shall waive the rights and immunities to which each party may be entitled under law, including all of the immunities, limitations, and defenses under Wisconsin statutes 893.80, or any subsequent amendments thereof, any federal law, common law, or other applicable laws.

107.13 No Waiver of Legal Rights

1. The owner may correct a measure, estimate, or certificate at any time before or after final acceptance. The owner may recover from the contractor, surety, or both, overpayments upheld for a breach (failure to fulfill contract obligations). A waiver on the part of the owner of a breach of a part of the contract is not a waiver of another or subsequent breach.
2. The following owner actions do not waive the owner's rights or power under the contract:
   A. Payment for or acceptance of all or portions of the work.
   B. Extension of contract time.
   C. Possession of the work.

3. Assume liability for latent defects, fraud, gross mistakes as may amount to fraud, or as regards to the owner's rights under a warranty or guaranty without prejudice to the terms of the contract.

107.14 Railroad Coordination

107.14.1 General

1. Coordinate with the railroad for all work performed on or near the railroad right-of-way.
2. The railroad's chief engineering officer may inspect the work and contractor operations on grade separations and their approaches, grade crossings, or on railroad right-of-way. Perform the work in a manner satisfactory to the railroad's chief engineering officer.
3. Perform all work within the railroad's right-of-way in a way that does not interfere with the safe and uninterrupted operation of railroad traffic. Maintain clearances during construction as follows:
   A. Do not operate equipment closer than 25 feet horizontally from a track centerline or 22 feet vertically above the top of a rail, except under the protection of railroad flaggers.
   B. Do not store materials or equipment closer than 25 feet horizontally from a track centerline.
   C. Provide an obstruction-free work zone adjacent to a track extending 12 feet or more horizontally on both sides of the track centerline. Keep this work zone free of construction debris.
   D. Unless the railroad's chief engineering officer approves otherwise in writing, maintain minimum clearances from falsework, forms, shoring, and other temporary fixed objects as follows:
      a. Provide 12 feet, plus 1.5 inches per degree of track curvature, measured horizontally from the track centerline.
      b. Provide 21 feet, plus compensation for super-elevated track, measured vertically above the top of the highest rail.
4. Comply with the railroad's rules and regulations regarding operations on or near the railroad right-of-way as follows:
   A. When working on the railroad right-of-way.
   B. When working within 25 feet of the track centerline or adjacent facilities, including equipment or extensions of equipment that can fall within 25 feet of the track centerline or adjacent facilities.

   If the railroad's chief engineering officer requires, arrange with the railroad to obtain the services of qualified railroad employees to protect railroad traffic through the work area. Bear the cost of these services and pay the railroad directly. Notify the railroad's representative, specified in the project special provisions, in writing at least 10 business days before starting work near a track. Provide the specific time planned to start the operations.
5. Develop shop drawings, with detailed plans and computations, for shoring, if the contract requires shoring of an excavation near a track.
6. Make all necessary arrangements for crossing a railroad's track at a location other than an existing public crossing. Bear all costs incident to that crossing, including flagging costs.

107.14.2 Work by Railroad

1. The railroad company may perform work or operations incident to the project that are the subject of an agreement between the owner and the railroad company. Do not alter this work without the consent of the railroad company. If the railroad company makes contractor-requested alterations with railroad company forces, pay the railroad company for those alterations.

2. Bear the cost of the movement or adjustment of telegraph, telephone, or signal facilities owned, operated, or maintained by the railroad company and not otherwise provided for in the contract or in agreements between the owner and the railroad company.

107.14.3 Railroad Insurance Requirements

1. Provide railroad protective liability insurance, in addition to the other types and limits of insurance required in 107.22, for any work over, under, or near railroad tracks. Keep railroad protective liability insurance coverage in force until completing all work, under or incidental to the contract, on the railroad right-of-way or premises of the railroad and until the engineer determines that the work is complete as specified in 105.9.1.4.
2. Provide a separate policy for each railroad owning tracks on the project. Ensure that the railroad protective liability insurance policies provide the following minimum limits of coverage:
   A. Coverage A, bodily injury liability and property damage liability; $5 million per occurrence.
   B. Coverage B, physical damage to property liability; $5 million per occurrence.
   C. An annual aggregate amount of $10 million that applies separately to each policy renewal or extension.
3. Obtain coverage from insurance companies licensed to do business in Wisconsin that have a Best's Insurance Reports rating of A- or better. The cost of the required insurance coverage and limits is incidental to the contract.
4. Submit the following to the owner as evidence of the required coverage:
   A. A certificate of insurance for the required railroad protective liability coverages.
   B. Notification from the railroad company that the contractor has provided sufficient insurance information to begin work.
5. Do not begin work on the right-of-way or premises of the railroad company until the owner receives the submittals specified in 107.14.3 4.
6. Notify the railroad and the owner immediately upon cancellation or initiating cancellation, whichever is earlier, or any material change in coverage. Cease operations within 50 feet of the railroad right-of-way immediately if insurance is cancelled or reduced. Do not resume operations until the required coverage is in force.

107.15 Environmental Protection

1. Comply with all applicable federal, state, and local laws and regulations that control the prevention of pollution of the environment including those related to the introduction or spread of invasive species or pathogens in waterways.
2. Comply with laws relating to solid waste disposition and air pollution. Control and minimize the dispersion of dust and particulate matter and other pollutants into the atmosphere.
3. Take all necessary precautions to prevent pollution of streams, lakes, wetlands, and reservoirs with fuels, oils, bitumens, calcium chloride, magnesium chloride, paint, or other harmful materials. Conduct and schedule work operations to avoid or minimize siltation of streams, lakes, and reservoirs. Protect drainage ways, culverts, and drainage structures from debris caused by a contractor operation.
4. Do not ford live streams unless a plan for the fording operation meets the engineer's approval and results in minimum siltation to the streams. Do not operate machinery on the bed of live streams.
5. If work areas or pits are located in or adjacent to live streams, lakes, or wetlands, separate the work areas or pits from the stream, lake, or wetland by a dike, silt fence, or other barrier to keep sediment from entering these locations. Take care during the construction and removal of these barriers to minimize the siltation or filling of the stream, lake, or wetland.

6. Treat water from aggregate washing or other sediment producing operations by filtration, a settling basin, or other means sufficient to reduce the sediment content to not more than that of the stream or lake into which the water is discharged.

107.16 Construction Over or Adjacent to Navigable Waters

1. Within107.16, the term "governmental authority" means the U.S. Army Corps of Engineers, the U.S. Coast Guard, the WDNR, or other agency having jurisdiction over the navigable waters within the project limits and empowered to take the actions specified in 107.16.
2. Conduct all work over, on, or adjacent to navigable waters so that free navigation of the waterways is not impeded and existing navigable depths are not impaired except as allowed by permit issued by the governmental authority. Obtain all permits required by 107.3 before beginning construction.
3. Ascertain from the governmental authority the minimum horizontal and vertical clearance requirements for navigation during construction, and maintain those clearances during the period of construction.
4. If the governmental authority during progress of the work issues directions or orders affecting the contractor's operations or order of procedure, the contractor shall promptly file with the engineer a written copy of the directions or orders.
5. Should the contractor during the progress of the work lose, dump, throw overboard, sink, or misplace material or equipment, which in the opinion of the governmental authority may interfere with or obstruct navigation, the contractor shall promptly recover or remove the same. Give immediate notice with descriptions and locations of possible obstructions to the governmental authority. If the governmental authority requires, mark or buoy the obstructions until their removal. Should the contractor refuse, neglect, or delay compliance with the above requirements, the governmental authority may remove the obstructions. The owner may deduct the cost of this removal from payments due to the contractor, or may recover the cost under the bond deposited by the contractor.
6. During construction, provide temporary lights, waterway markers, other devices, or combination thereof as the governmental authority specifies and requires.
7. All expenses the contractor incurs to maintain navigation are incidental to the contract cost.

107.17 Erosion Control

1. The engineer has full authority to suspend or limit grading and other operations pending adequate performance of permanent erosion control measures, such as finish grading, topsoiling, mulching, matting, and seeding, and all temporary erosion control measures that the engineer orders.

107.18 Use of City Water

1. If the contractor desires to use City of Fond du Lac water for any part of the project, the contractor shall obtain permission and obtain water as follows:
   A. Apply for a hydrant meter rental permit from the Fond du Lac Water Utility and comply with all terms and conditions and pay all fees.
   B. The contractor may obtain water from the non-potable effluent water hydrant located at the Fond du Lac Regional Wastewater Treatment & Resource Recovery Facility at 700 Doty Street. Access is available Monday through Friday from 6:00 a.m. to 3:00 p.m. Gain access during these times.
2. The contractor shall not make connections to city facilities without permission from the Fond du Lac Water Utility.
3. Ensure that fire hydrants are accessible at all times to the City of Fond du Lac Fire Department. Do not place material or other obstructions closer to a fire hydrant than allowed by ordinances, rules,

or regulations, or within 5 feet of a fire hydrant in the absence of specific ordinances, rules, or regulations.

107.19 Contractor's Responsibility for Utility Facilities, Property, and Services

1. The owner expressly reserves the right to construct utility services in the highway or street, or to grant permits for the same, at any time. Coordinate and cooperate with utilities in the removal and rearrangement of existing facilities to minimize their service interruption and duplication of work by the utilities. At least 3 business days before breaking ground, the contractor shall notify the proper utility authorities that the contractor's operations may affect their facilities including: streets, gas and water pipes, electric and other conduits, railroads, poles, manholes, catch basins, sewers, and other property. Never hinder or interfere with utility representatives in the protection or operation of their facilities. Obtain all necessary information regarding existing facilities. Protect existing facilities from damage and unnecessary exposure.
2. Obtain all necessary information regarding the planned installation of new facilities identified in the contract. Make proper provision and give proper notification so the utilities can install new facilities at the proper time without delay or unnecessary inconvenience. Do not pave over the location of a new underground facility, planned for installation concurrently with this contract, before installing the facility.
3. If the contractor damages or interrupts service, the contractor shall notify the utility promptly. Coordinate and cooperate with the utility in the repair of the facility. Determine who is responsible for repair costs according to Wisconsin statutes 66.0831 and 182.0175(2).
4. If the contractor finds facilities in conflict with the line and/or grade of proposed construction, the engineer will arrange with the utility or the contractor to adjust or relocate the facility. The owner will have up to 4 working days to complete alterations. The owner may adjust or relocate the proposed construction to avoid conflict with facility. If deemed necessary, the owner will revise the contract as specified in 104.3. The contractor may dig test holes at no expense to the owner to try to avoid possible conflicts.
5. If the contractor finds facilities not identified in the contract, the engineer will determine whether adjustment or relocation of the facility is necessary to accommodate contract work. The engineer will arrange with the utility or the contractor to adjust or relocate the facility. If deemed necessary, the owner will revise the contract as specified in 104.3.
6. If existing duct packages will be left in place, provide extra care when performing adjacent work. Coordinate with the utility owner as needed to complete work items. Where access is not available for vibratory compaction of sewer backfill materials or crushed aggregate base course under future pavement, use aggregate slurry backfill in conformance with the requirements of 204.3.5.

107.20 Hazardous Substances

1. Whenever the construction operations encounter or expose an abnormal condition that may indicate the presence of a hazardous substance, immediately discontinue construction operations near the abnormal condition and notify the engineer. Treat all abnormal conditions with extreme caution. Abnormal conditions include, but are not limited to, the following:
   A. The presence of a tank or barrel.
   B. An obnoxious odor.
   C. Excessively hot earth.
   D. Smoke.
   E. Visible fumes.
   F. Discolored earth or sheen on groundwater.
2. Do not resume construction operations in this area until the engineer so directs. The contractor may continue work in other areas of the project unless the engineer otherwise directs.

3. Take actions to prevent the hazardous substance from spreading into an uncontaminated area.
4. Dispose of hazardous substances conforming to the requirements and regulations of the responsible state or federal agencies. If the engineer requires the contractor to dispose of the hazardous substance and the contract does not provide for this work, the work is extra work. If the responsible state or federal agency requires special procedures for the disposal, the owner will arrange with qualified persons to dispose of the substance.

107.21 Archaeological and Historical Findings

1. For construction operations on the project, if encountering human remains or if encountering artifacts of potential archaeological or historical significance, immediately stop operations at the encounter site and notify the engineer. Cooperate, as necessary, by moving construction operations from the encounter site and complying with the engineer's directions. The contractor may continue work elsewhere on the project unless the engineer directs otherwise. Do not resume operations at the encounter site without the engineer's permission.
2. For operations on private property, if encountering human remains or if encountering artifacts of potential archaeological or historical significance, immediately stop operations at the encounter site and notify the engineer and the responsible state agencies. Cooperate, as necessary, by moving construction operations from the encounter site and complying with the responsible state agencies' directions. Do not resume operations at the encounter site without the responsible state agencies' permission.

107.22 Insurance Requirements

107.22.1 Insurance Requirements for General Contractors

1. For contractors, maintain the following types and limits of commercial insurance in force until the engineer determines that the work is complete:
    A. Commercial general liability insurance coverage together with excess or umbrella liability policies including coverage for products liability, completed operations, contractual liability and XCU coverage with the following minimum limits:
        a. $6,000,000 each occurrence limit.
        b. $6,000,000 general aggregate per project (other than products-completed operations).
        c. $6,000,000 products-completed operations aggregate limit.
        d. $6,000,000 personal and advertising injury.
    B. Cover any use of drones by the contractor under the general liability insurance coverage or via special endorsement.
    C. Workers’ compensation as required by the State of Wisconsin and employers’ liability insurance with sufficient limits to meet the underlying excess or umbrella liability insurance requirements.
    D. Automobile liability insurance coverage together with excess or umbrella liability policies with minimum limits of $6,000,000 combined single limit per accident for bodily injury and property damage, provided on a Symbol 1-Any Auto basis.
    E. Property coverage meeting the following requirements:
        a. Contractor shall determine amount of coverage perils and policy form necessary to complete project should a loss of any type occur and to meet requirements of the contractor’s surety.
        b. Covered property will include property in transit, property stored on the project work site, and property stored off the project work sites.
        c. The City of Fond du Lac, architect, engineer and subcontractors must be added as loss payees to the policy.

F. The contractor may satisfy these requirements with primary insurance coverage or with excess/umbrella policies.
G. The City of Fond du Lac, its elected or appointed officials, agents, and employees must be named as an additional insured under the general liability and umbrella liability policies, including any special endorsements.

2. For a joint venture, limited liability company, or partnership; ensure that the bidding entity is the named insured and that coverages apply jointly and severally to its member entities.
3. Obtain coverage from insurance companies licensed to do business in the State of Wisconsin that have a Best's Insurance Reports rating of A or better and a Financial Size Category of no less than Class VI. The cost of providing the required insurance coverage and limits is incidental to the contract.
4. Notify the owner immediately upon cancellation or initiating cancellation, whichever is earlier, or any material change in coverage. Cease operations immediately if any insurance is cancelled or reduced. Do not resume operations until the required coverage is in force.

107.22.2 Insurance Requirements for Subcontractors

1. For subcontractors, at a minimum maintain commercial general liability insurance, workers' compensation, employers' liability insurance, and automotive liability insurance coverage meeting the requirements and limits required for contractors in 107.22.1.

107.22.3 Certificates of Insurance

1. Submit certificates of insurance and additional insured policy endorsements on all policies specified with the City of Fond du Lac Department of Administration. Do not commence work until insurance has been obtained and insurance coverage submitted to the owner. Do not allow subcontractors to commence work until insurance has been obtained. Submit certificates of insurance to the owner upon request.

107.22.4 Indemnification of the City of Fond du Lac and Its Officials

1. Indemnify and hold harmless the City of Fond du Lac, its elected or appointed officials, agents, and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage loss or expense meets both of the following:
   A. Is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom.
   B. Is caused in whole or in part by any negligent act or omission of the contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.
2. In any and all claims against the City of Fond du Lac, its elected or appointed officials, agents, and employees by any employees of the contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under 107.22.4 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the contractor or any subcontractor under Workmen's Compensation Act, disability benefit acts or other employee benefit acts.

107.23 Equal Opportunity

1. In connection with the performance of work under this contract, the contractor agrees to follow relevant federal and state law and not to discriminate against any employee or applicant for

employment because of age, race, religion, color, handicap, sex, physical condition, developmental disabilities as defined in Wisconsin statutes 51.01(5), sexual orientation or national origin. This provision includes, but is not limited to, the following:

A. Employment.
B. Upgrading, demotion or transfer.
C. Recruitment or recruitment advertising.
D. Layoff or termination.
E. Rates of pay or other forms of compensation.
F. Selection for training, including apprenticeship.

2. The contractor agrees to post in conspicuous places available for employees and applicant's employment notices to be provided by the contracting officer setting forth the provision of the non-discrimination clause.

108 Prosecution and Progress

108.1 Subletting the Contract

1. Do not sublet, sell, transfer, assign, or otherwise dispose of the contract, a portion of the contract, or a right, title, or interest in the contract without the owner's written consent. If the owner consents to the contractor subletting a portion of the contract, the contractor is relieved of no responsibility for the fulfillment of the contract or of no liability under the contract and bond. Do not allow a subcontractor to proceed with work without the owner's written consent.
2. Request permission in writing to sublet a portion of the contract. If the engineer requires, submit evidence that the proposed subcontractor is experienced and equipped for the work. The engineer may also require submission of a copy of the proposed subcontract. Submit all subsequent changes in the terms of a subcontract for the owner's consent.
3. If proposing to have a party other than a subcontractor perform work, notify the engineer and submit details of this arrangement in writing. The engineer will determine if that arrangement constitutes subcontracting. The engineer may also require the contractor to file, with the engineer, copies of all other agreements between any parties regarding the performance of work under the contract.

108.2 Preconstruction Meeting

1. After the awarding the contract, attend a preconstruction meeting scheduled by the owner with the contractor, subcontractors, representatives of any utility having facilities within the limits of the project, and the owner's representatives. The construction schedule and coordination of work procedures necessary to attain a reasonably smooth operation with a minimum amount of conflict and loss of construction progress will be discussed.

108.3 Notice to Proceed

1. Commence work within 10 days after issuance of the written notice to proceed and diligently prosecute the work to final completion, ready for use, without delays and as expeditiously as possible.

108.4 Start of the Work

1. For the purpose of determining contract time, the contract starting date is defined as follows: The contract starting date will be the date construction operations are started or the tenth calendar day following the date of written notification from the owner, whichever is earlier.

108.5 Prosecution of the Work

1. The owner will issue a written notification to begin or resume work for all completion date contracts. Do not begin or resume work before receiving the owner's written notification. Notify the engineer at least 3 business days before starting or resuming work. Notify the engineer at least one business day before changing the schedule of work, such as working on Saturdays, Sundays, and owner-specified holidays.
2. Give the work the constant attention necessary to promote the progress of the work. Promptly supply the materials, tools, equipment, and incidental items required to perform the work. Employ an ample force of workers and provide a construction plant properly adapted to the work and of sufficient capacity and efficiency to accomplish the work in a safe and skillful manner as provided in the contractor's progress schedule. Maintain all plants in good working order and make provisions for immediate emergency repairs.
3. Do not allow work, with the exception of concrete cure time or prior approval from the project engineer, to remain idle or without significant work progress for more than 7 consecutive calendar days.
4. Take precautions necessary to protect the work as specified in 107.10. Include in the contract price the cost for taking precautions and protecting the work. The cost of taking precautions and protecting the work is incidental to the work as specified in 109.2 and 109.6.1.

108.6 Progress Schedules

1. Submit a bar chart progress schedule at least 7 calendar days before the preconstruction meeting.
2. Plan and execute the work to meet the contract-required interim completion dates and the specified contract time or completion date. The engineer will use the schedule to monitor the progress of the work. The schedule is not part of the contract.

108.7 Progress Meetings

1. Unless the engineer directs otherwise, the contractor and the engineer will meet every 2 weeks at the site of construction at a time to be approved by the engineer.
2. Meetings will include the following:
   A. An assessment of progress.
   B. An updated schedule provided by contractor covering the subsequent 2 weeks.
   C. Traffic control.
   D. Property access.
   E. Changes to the work.
   F. Other agenda items required by the engineer.
3. The contractor's project manager and representatives of any subcontractors performing pertinent work must attend the meeting.

108.8 Limiting Operations

1. Limit operations to prevent undue inconvenience to the traveling public. If the engineer concludes that the extent of the contractor's work zone unnecessarily inconveniences the public, the engineer will require the contractor to finish sections in progress before allowing the contractor to start work on additional sections.

108.9 Character of Workers

1. Provide personnel necessary to supervise and complete all contract work as specified. Ensure workers have the experience and skills necessary to perform assigned work.
2. Remove from the project all personnel performing in an unskilled manner or who are intemperate or disorderly. If the engineer concludes that personnel are performing in an unskilled manner or are intemperate or disorderly, the engineer may direct the contractor, in writing, to remove them from

the project. Do not allow removed personnel to return to the project without the engineer's written consent.

3. The engineer may suspend the work in writing, withhold progress payments due the contractor, or both for the following reasons:
   A. The contractor does not furnish suitable and sufficient personnel to perform the work.
   B. The contractor does not remove personnel from the project as specified in 108.9 2.

108.10 Methods and Equipment

108.10.1 General

1. Use equipment of the capacity and mechanical condition necessary to perform work conforming to the contract. Ensure that the equipment does not harm the roadway, pavement, structures, adjacent property, other highways, workers, or the public. Use equipment conforming to the specific contract requirements for individual bid items or classes of work.
2. If the contractor does not provide adequate equipment, properly maintained, the engineer may:
   A. Order the contractor to remove the equipment.
   B. Suspend specific operations until the contractor provides adequate equipment.
   C. Determine that the contractor is in default of the contract.
3. Equip each unit of motorized construction equipment with a muffler constructed to the equipment manufacturer’s specifications. The contractor may substitute other mufflers producing equivalent results. Maintain mufflers and exhaust systems in good operating condition, free from leaks and holes.

108.10.2 Moving Heavy Loads

1. For all vehicles operated on completed subgrade, base, or pavement that will remain a permanent part of the project, do not exceed the legal loading defined in Wisconsin statutes for Class A highways without the engineer's written permission. For structures, do not exceed that legal loading without written permission whether or not the structure will remain a permanent part of the project. Adhering to these requirements, or allowed variations, does not relieve the contractor of liability for damage caused by those operations.

108.11 Substituting Equipment, Methods, and Materials

1. Use the equipment, methods, or materials specified in the contract unless the engineer authorizes substitutes. If the contract does not specify equipment, methods, or materials, the contractor may use those the contractor demonstrates, to the engineer's satisfaction, to produce conforming work.
2. Obtain the engineer's authorization before substituting for equipment, methods, or materials specified in the contract. Submit a written request to the engineer describing the equipment, methods, or materials proposed and the reasons for the change. Provide plans, manufacturer's data, shop drawings, specifications, test results, certified report of test or analysis, certificate of compliance, or other pertinent data. The engineer's authorization of a substitution does not relieve the contractor of the obligation to produce work conforming to the contract as specified in 105.2.1.
3. Whenever the contract specifies a proprietary product or uses the name of a manufacturer or vendor, the term “or equal” is implied. Understand the specific article, material, or equipment mentioned as indicating the type, function, and minimum standard of design, efficiency, and quality desired. Do not construe the exclusion of products of comparable quality, design, and efficiency.
4. If after use of substituted equipment, methods, or materials, the engineer finds the work nonconforming, the contractor shall complete the remaining work with the specified equipment, methods, or materials. The nonconforming work is subject to 105.2.2.

5. As a condition of approving a substitute, the owner may require a price adjustment in an amount not to exceed the cost savings resulting from the use of a proposed substitute. If no price adjustment is made, the owner will pay for a substitute made under 108.11 at the contract price for the original work. The owner will not extend contract time for a substitute.

108.12 Contract Time for Completion Date Contracts

1. Complete all or any portion of the project called for in the contract within the time or times for completion of the contract. All time limits in the contract are crucial elements of the contract.
2. The proposal will specify the time for completion as a given completion date.
3. For completion date contracts, contract time begins with the start of work as specified in 108.4 and concludes on the specified completion date. Complete the contract on or before that date.

108.13 Determining Contract Time Extensions and Payment for Excusable Delays

108.13.1 General

1. The owner may extend contract time by change order. The owner will only extend contract time if an excusable delay affects the controlling item of work. Excusable delays are unforeseen and unanticipated delays not resulting from the contractor's fault or negligence. Provide documentation and schedule updates to support requested time extensions.
2. The owner may choose not to consider time extensions for delays unless the contractor notifies the engineer as specified in 104.4 and updates the schedule. The engineer will evaluate the facts, pay adjustment, and time extension for the delay. The engineer's findings are final and conclusive.

108.13.2 Excusable, Non-Compensable Delays

108.13.2.1 General

1. Non-compensable delays are excusable delays not the contractor's or the owner's fault. The owner will not pay for the delay costs listed in 109.4.6 for non-compensable delays.
2. For non-compensable delays under completion date contracts, the owner will extend contract time if the conditions specified in 108.13.1 are met. The owner will relieve the contractor from associated liquidated damages, as specified in 108.14, if the owner extends time under 108.13.1.
3. The following are non-compensable delays:
    a. Delays due to earthquakes, other cataclysmic phenomena of nature the contractor cannot foresee and avoid, severe weather or job conditions caused by recent weather as specified in 108.13.2.2.
    b. Extraordinary delays in material deliveries the contractor or their suppliers cannot foresee and forestall resulting from strikes, lockouts, freight embargoes, industry-wide shortages, governmental acts, or sudden disasters.
    c. Delays due to acts of the government, a political subdivision other than the City of Fond du Lac, or the public enemy.
    d. Delays from fires or epidemics.
    e. Delays from strikes beyond the contractor's power to settle not caused by improper acts or omissions of the contractor, their subcontractors, or their suppliers.
    f. Delays caused by non-completion of work by utilities or other third parties, if the contract does not specify a number of days or a completion date for that utility or third-party work.

g. Delays caused by conflicts with existing utility facilities and structures as specified in 107.19 item 4.
h. Altered quantities as specified in 109.3.

108.13.2.2 Extension of Contract Time for Severe Weather

1. The engineer will award a time extension for severe weather on completion date contracts. Submit a request for severe weather days if the number of adverse weather days, as defined in 101.3, exceeds the anticipated number of adverse weather days listed below.
   a. January: 31; February: 28; March: 31; April: 5; May: 4; June: 4, July: 3; August: 3; September: 4; October: 5; November 1 thru 15: 2; November 16 thru 30: 15; December 31
   b. The total includes an anticipated winter suspension from November 16 through March 31.
2. Submit the request to the engineer at the end of the month. Indicate the number of adverse weather days that occurred during that month. Provide progress schedule documentation to show that the controlling item of work was delayed. Show that the delay was beyond the control of the contractor. The engineer will assess the contractor's submittal and indicate how many adverse weather days are confirmed.
3. For each calendar month, the engineer will grant a severe weather day for each confirmed adverse weather day that exceeds the number of anticipated adverse weather days 108.13.2.2 item 1 shows. When the contractor requests severe weather days, the engineer will give the contractor a monthly written statement showing the number of days credited for severe weather. At the end of the project, the owner will extend time on completion date contracts for the cumulative number of severe weather days credited each month.

108.13.3 Excusable Compensable Delays

1. Compensable delays are excusable delays due to the owner’s actions or lack of actions, or determined by judicial proceeding to be the owner’s sole responsibility. The engineer will grant a time extension for a compensable delay if the conditions specified in 108.13.1 are met.
2. The following are compensable delays:
   A. A contract change for revised work as specified for extra work under 104.3.2.1, for a differing site condition under 104.3.2.2, or for significant changes to the quantities under 104.3.2.3.
   B. A contract change for an engineer-ordered suspension.
   C. The unexpected discovery of human remains, an archaeological find, or historical find consistent with 107.21.
   D. The unexpected discovery of a hazardous substance consistent with 107.20.
   E. The non-completion of work that utilities or other third parties perform, if the contract specifies a number of days or a completion date for that utility or third-party work.
3. For a compensable delay or a time extension, the owner will relieve the contractor from associated liquidated damages under 108.14, and will pay the contractor for delay costs determined as follows:
   A. Adjust the contract price as specified in 109.4.2 through 109.4.4 for delays under item A of 108.13.3 item 2.
   B. Adjust the contract price as specified in 109.4.6 for delays under items B through E of 108.13.3 item 2.

108.14 Liquidated Damages

1. If the contractor does not complete the work within the contract time or within the extra time allowed under engineer-granted time extensions, the owner will assess liquidated damages. The owner will deduct a specified sum from payments due the contractor for every calendar day on completion date contracts that the work remains uncompleted.
2. This deducted sum is not a penalty but is a fixed, agreed, liquidated damage due the owner from the contractor for the added cost of engineering and supervision resulting from the contractor's failure to complete the work within the contract time.
3. Unless enhanced in the special provisions, the owner will assess the daily liquidated damages shown in ***Table 108-1***:

Table 108-1
Liquidated Damages

Original Contract Amount		Daily Charge	
From More Than	To and Including	Calendar Day	Working Day
$0	$250,000	$945	$1,890
$250,000	$500,000	$835	$1,670
$500,000	$1,000,000	$1,045	$2,090
$1,000,000	$2,000,000	$1,570	$3,140
$2,000,000	-	$2,185	$4,370

4. If the engineer allows the contractor to continue and finish the work or any part of it after the contract time expires, the owner waives no rights under the contract.

108.15 Terminating the Contract for Default

1. The owner, after giving written notice to the contractor and the contractor's surety, may take the prosecution of the work out of the hands of the contractor or the contractor's surety, or both, for one or more breach of the contract the contractor commits, as follows:
   A. Failing to begin the work under the contract within the time specified.
   B. Failing to perform the work with sufficient workers, equipment, or materials to complete the work within the specified time.
   C. Failing to complete the contract within the contract time specified, as extended by the engineer.
   D. Performing the work unsuitably, or not obeying an engineer directive to remove and replace or otherwise correct unacceptable work.
   E. Discontinuing the prosecution of the work before completion without the engineer's permission.
   F. Failing to resume work that the engineer discontinued within a reasonable time after notice to do so.
   G. Insolvency or bankruptcy, or committing an act of bankruptcy or insolvency.
   H. Allowing a final judgment against the contractor to stand unsatisfied for a period of 48 hours.
   I. Making an assignment for the benefit of creditors.
   J. Failing to comply with the provisions of the contract relative to hours of labor, wages, equal opportunity, character and classification of workers employed.
   K. Failing to acquire or maintain the required insurance.
   L. Failing to carry on the work in an acceptable manner.
2. The owner will give the contractor and the contractor's surety written notice specifying the delay, neglect, or default and the action required. If the contractor or the contractor's surety, within a period of 10 calendar days after that notice, fails to proceed satisfactorily in compliance therewith, the owner then has full power and authority to take the work out of the hands of the contractor or

the contractor's surety, or both; to use all suitable materials and equipment on the project; or to enter into contract, or use other methods that the owner requires to complete the work.

3. If the owner takes over the incomplete work under 108.15, the owner will deduct all additional costs and damages and the costs and charges of completing the work under contract from payments due the contractor. If the total of those damages, costs, and charges is less than the sum that would have been payable under the contract if the contractor had completed the work, then the contractor is entitled to receive the difference subject to all claims for liens thereon that may be filed with the owner. If that total exceeds the sum that would have been payable under the contract, the owner will consider the contractor and the contractor's surety liable, and the contractor and the contractor's surety shall pay to the owner the amount of that excess.
4. The owner will not relieve the contractor and the contractor's surety of the liability for the assessment of liquidated damages under 108.14 because of the contractor's default.
5. The rights and remedies of the owner are in addition to all other rights and remedies provided by law or under the contract and the bonds.
6. If, after the owner gives notice of default as specified in 108.15 item 1., it is determined that the contractor was not in default, the rights and obligations of the parties are the same as if the notice of termination had been issued as specified in 108.16.
7. If a court finds the owner's default of the contractor under 108.15 to be legally improper, the owner will treat the contract as if the owner had terminated the contractor for convenience as specified in 108.16. The owner will pay the contractor as specified in 108.16.

108.16 Terminating the Contract for Convenience of the Owner

1. The owner may terminate the contract or any part of the contract for reasons beyond the control of the owner or contractor after determining that termination is in the owner's or the public interest. Reasons for termination include, but are not limited to, one or more of the following:
   A. A national emergency that creates a shortage of materials, labor, or equipment by: reason of war conditions involving the United States; reason of orders of the federal government or its duly authorized agencies; or executive orders with respect to prosecution of war or national defense.
   B. Orders from duly constituted authorities relating to energy conservation.
2. The owner will deliver to the contractor a termination notice specifying the extent of termination and the effective date.
3. Upon receipt of a termination notice, do not proceed with the affected bid items unless directed to do so in that notice. Complete all bid items specified in the termination notice. That work includes punch list items and all work necessary to ensure the safety of the public, to properly secure work already constructed or partially constructed, and to secure the project site. Perform this work, which may include bid items not in the original contract, the contract specifies. The contract is sufficiently complete upon completion and acceptance of all bid items specified in the termination notice, except punch list items. After completion of the punch list items and all contract-required documents, the owner will terminate the contract by issuing a final certificate and payment. The owner reserves the right to declare in default a contractor who does not carry out the conditions of a termination for convenience.
4. If the owner orders termination of the contract for convenience, the owner will pay for all completed work as of that date at the contract price. The owner will pay for partially completed work at agreed prices or by force account methods specified in 109.4.4 provided, however, that payment does not exceed the contract price for the bid item under which the work was performed. The owner will pay for work eliminated by the termination only to the extent provided under 109.5. The owner will pay for new work, if any, at agreed prices or paid for by force account methods specified in 109.4.4.

5. The owner may allow the contractor to purchase materials that the owner obtained for the work but that have not been incorporated into the work at actual cost delivered to a designated location or otherwise disposed of as mutually agreed.
6. The owner may, at the owner's option, purchase unused materials that the contractor has obtained and that the owner has inspected, tested, and accepted, at the points of delivery as the owner designates and at a cost shown by receipted bills or other proper evidence.
7. If the engineer directs, promptly remove equipment and supplies from the project site or other owner property. If the contractor does not remove the equipment and supplies as directed, the owner may do so at the contractor's expense.
8. Within 60 calendar days of the effective termination date, submit claims for additional costs actually incurred. Do not include claims for loss of anticipated profits on work not performed. The contractor may claim one or more of the following:
   A. Costs for reasonable idle equipment time or mobilization efforts.
   B. Bidding and project investigative costs.
   C. Overhead expenses attributable to the terminated project.
   D. Subcontractor costs not otherwise paid for.
   E. Actual idle labor cost if work is stopped before the termination date.
   F. Guaranteed payments for private land usage as part of the original contract.
9. Make cost records available to the owner to the extent necessary to determine the validity and amount of each item claimed.
10. The owner will not relieve the contractor of contractual responsibilities for the work completed. The owner does not relieve the contractor's surety of its obligations.

108.17 Terminating the Contractor's Responsibility

1. The contractor's responsibilities are terminated, except as set forth in the performance bond and specified in 107.13, when the owner grants final acceptance as specified in 105.9.1.6.

109 Measurement and Payment

109.1 Measurement of Quantities

109.1.1 General

1. The engineer will use the US standard system to measure all work completed under the contract. The engineer will determine quantities of materials the contractor furnishes and work the contractor performs using measurement methods and computations conforming to standard engineering practice, modified to meet owner requirements. The engineer will document these measurements using owner procedures.
2. The engineer will measure the work as the contract basis of payment subsection for individual items specifies. The owner will measure the actual quantities of work the contractor acceptably completes and make final payment based on those actual measured quantities except as follows:
   A. If the measurement subsection for a bid item specifically restricts the quantity measured for payment or allows for use of conversion factors.
   B. If the owner executes a change order modifying the method of measurement for specific bid items, the engineer will measure the quantities of applicable bid items for payment using the change order methods.
3. If the contract allows, the engineer may weigh or determine an area or volume and convert to area, volume, of weight for payment. The engineer will determine the conversion factors. The

owner and contractor must agree on the conversion factor before the engineer converts a pay quantity.

4. If the method of measurement or the basis of payment for a bid item is not specifically outlined in the special provisions or detailed specifications of this contract use the method of measurement and basis of payment described in the *Standard Specifications for Highway and Structure Construction*.

109.1.2 Area

1. If the contract designates payment for a measured area, the engineer will measure the length and width of the area actually constructed within engineer-designated limits, or the final dimensions measured along the surface of the completed work within the neat lines the plans show or the engineer designates. The engineer will use the method or combination of methods of measurement that reflect, with reasonable accuracy, the actual surface area of the finished work as the engineer determines.

109.1.3 Volume

1. For material specified for measurement by volume in the vehicle, haul the material in engineer-approved vehicles. Ensure that the vehicle body type allows for ready and accurate measurement of the contents.
2. The engineer will determine the approved capacity of vehicles to the nearest 0.1 cubic yard. Unless all owner-approved vehicles on a job have the same capacity, mark each vehicle with a plainly legible identification mark showing the approved capacity. Do not change capacity markings without the engineer's consent.
3. The engineer will measure the material in the vehicle at the point of delivery. The engineer will make no adjustment for the settlement of material during transit. The engineer may reject loads not hauled in owner-approved vehicles.

109.1.4 Weight

1. If weighing materials in the hauling vehicle, check gross weights and determine the vehicle tare weight whenever the engineer directs.
2. For aggregates and asphaltic mixtures measured by weight, weigh the material on platform scales or other engineer-approved scales. Use WisDOT-tested scales or ensure that owner-authorized testing firms or agencies test the scales as frequently as the engineer deems necessary.
3. Submit load tickets daily as work is completed.

109.2 Scope of Payment

1. The owner will use the US standard unit prices the schedule of prices shows to pay for the work.
2. The owner will pay for the quantity of work acceptably completed and measured for payment as the basis of payment subsection for each bid item specifies. Within the contract provide means to furnish and install the work complete and in-place. Payment is full compensation for everything required to perform the work under the contract including, but not limited to, the work elements listed in the basis of payment subsection. Payment also includes all of the following not specifically excluded in that basis of payment subsection:
   A. Furnishing and installing all materials as well as furnishing the labor, tools, supplies, equipment, and incidentals necessary to perform the work.
   B. All losses or damages, except as specified in 107.10, arising from one or more of the following:
      a. The nature of the work.
      b. The action of the elements.

c. Unforeseen difficulties encountered during prosecution of the work.

C. All insurance costs, expenses, and risks connected with the prosecution of the work.

D. All expenses incurred because of an engineer-ordered suspension.

E. All infringements of patents, trademarks, or copyrights.

F. All other expenses incurred to complete and protect the work under the contract.

3. The owner may withhold payments due under the contract until the contractor proves to the owner that the contractor has paid for all labor, equipment, and materials used in the work. Provide signed releases and waivers of debts and claims as specified in 105.9.1.5. The owner may directly pay a subcontractor to satisfy a valid public improvement lien, pursuant to the requirements of Wisconsin statutes 779.15.
4. The owner may, at its election, withhold payment of any payment request filed by the contractor in the event the surety given by the contractor becomes insolvent, or is placed in the hands of a receiver, or has its right to do business in a state revoked as provided by law. Payment will be withheld until the contractor shall give a good and sufficient bond in lieu of the bond so executed by such surety.
5. The owner may elect to not pay for contract change orders and agreements and extra work that have not been authorized in writing by the City Manager or Director of Administration.
6. If the contractor does not complete the project as specified in 105.9.1 by the completion date, the owner will not pay for additional costs required by the failure to complete the work by the completion date and necessary to complete work under the contract, due to weather or other factors, except for excusable compensable delays listed in 108.13.3.

109.3 Payment for Altered Quantities

1. If the measured quantity for a bid item varies from the quantity given in the proposal, the owner will pay at the original contract bid price for the quantity measured as 109.1.1 item 2. The owner will adjust payment for revisions in plans or quantities of work requiring change orders as specified in 104.3.
2. The owner will not pay the contractor for loss of expected reimbursement or anticipated profits suffered or claimed by the contractor. The owner will not make revisions to the contract bid prices except as specified in 104.3.

109.4 Price Adjustments for Contract Revisions

109.4.1 General

1. If the owner revises the contract under 104.3, the owner will adjust the contract price using the sequence specified in 109.4.2 through 109.4.4. This price adjustment includes payment for performing the revised work, delay costs, and all other associated costs the engineer deems reasonable and not expressly precluded in 109.4.5. The owner may, at anytime, direct the contractor to perform all or part of the revised work under force account.

109.4.2 Contract Bid Prices

1. Before proceeding to another pricing method, the engineer will attempt to price revised work using contract bid prices.

109.4.3 Negotiated Prices

1. The owner and contractor will negotiate the price of a contract revision for one or more of the following:
   A. Adjustments in contract bid prices are necessary due to a significant change as specified in 104.3.2.3.

   B. The substitution of equipment, methods, or materials as specified in 108.11.5.
   C. The owner and contractor cannot agree on a revised price under 109.4.2.
2. Provide an estimate of the proposed unit prices or lump sum price for the contract revision. Include the cost of performing the revised work, delay costs, all other associated costs, plus a reasonable allowance for profit and applicable overhead. The engineer may request that the contractor justify the estimate by providing one or more of the following:
   A. Labor requirements by trade in hours for each task.
   B. Equipment costs and time requirements.
   C. Material costs.
3. Provide the justification within 5 business days after the owner's request. The owner will respond to the estimate within 5 business days after receipt of the contractor's justification. The owner and the contractor can mutually agree to extend these 5-day requirements.
4. If the owner negotiates with the contractor but does not agree on a price adjustment, the engineer may direct the contractor to perform all or part of the revised work under force account.

109.4.4 Payment for Extra and Force Account Work

1. The owner will pay the contractor for labor, insurance, materials, and equipment, as full compensation for performing force account work, delay costs, and all other associated costs. At the end of each workday, the contractor's representative and the inspector shall compare records of the work done under force account. The owner will make no force account payment before the contractor submits an itemized statement of the costs for that work. Payment will be made as follows:
   A. For labor costs:
      a. The owner will pay the contractor's labor costs, at prevailing wage rates or at wage rates previously agreed upon with the owner in writing, for personnel directly involved in producing and supervising the force account work. The owner will only pay for hours that personnel are actually engaged in force account work.
      b. The owner will pay no part of wages or benefits for personnel connected with the contractor's forces above the classification of foreman and having only general supervisory responsibility for the force account work.
      c. The owner will pay the contractor based on actual invoiced costs for property damage, liability, and workers compensation insurance premiums, unemployment insurance contributions, and social security taxes on force account work. Furnish satisfactory evidence of the rates actually paid.
   B. For material costs:
      a. The owner will pay the contractor based on actual invoice costs, including applicable taxes and actual freight charges, for engineer-approved materials the contractor uses in force account work. The owner will pay up to an additional 10 percent markup of these costs. If the contractor uses materials from the contractor's stock, the owner and the contractor must agree on the price. Do not incorporate materials into the work written without agreement.
      b. The owner reserves the right to furnish materials as it deems appropriate. Make no claims for costs, overhead, or profit on materials that the owner provides.
   C. For equipment costs:
      a. The owner will pay the contractor's costs for equipment the engineer deems necessary to perform the force account work for the time the engineer directs or until the contractor completes the force account work, whichever happens first. The owner will

pay the contractor for equipment only during the hours that it is operated. Report equipment hours to the nearest ½-hour.

b. For rental of equipment owned and operated by persons other than the contractor or their subcontractors, the owner will pay the contractor based on the actual paid invoice. Provide an invoice that includes all costs for furnishing and operating the equipment. Obtain the owner's written approval of the rental rates before starting the force account work.

D. The owner may pay the contractor for labor, insurance, and equipment costs based on the unit prices for authorized extra or force account work in the contract. Pay material costs as specified in 109.4.4 item 1.B.

2. The owner will pay for force account work based on the engineer's review of the actual invoice costs the contractor submits. The owner will approve payment for costs the engineer deems reasonable based on experience or prevailing market rates. The engineer may request that the contractor provide additional evidence to support costs the engineer questions. The owner will only pay for costs the engineer approves.
3. No additional allowance will be made for general superintendent's services, the use of small tools, or other costs of which no specific allowance is provided in 109.4.4.

109.4.5 Non-Allowable Charges for Adjustment of Contract Prices

1. Whether contract revision price adjustments are based on contract bid prices, agreed lump sum prices, negotiated prices, or force account, the owner will not reimburse the contractor for the following:
   A. Profit in excess of that specified in 109.4.2 through 109.4.4.
   B. Loss of anticipated profit.
   C. Home office overhead.
   D. Consequential damages, including loss of bonding capacity, loss of bidding opportunities, and insolvency.
   E. Indirect costs.
   F. Attorneys fees, claims preparation expenses, or costs of litigation.
   G. Interest.

109.4.6 Price Adjustments for Delay Costs

109.4.6.1 General

1. For a compensable delay under items B through E of 108.13.3 item 2, the owner will pay for the costs specified here in 109.4.6.2 through 109.4.6.6. The owner will not pay for non-allowable charges specified in 109.4.5 nor duplicate payment made under 109.4.2 through 109.4.4.
2. The owner will only pay the contractor for costs the contractor actually incurs. The owner will make no payment for delay costs before the contractor submits an itemized statement of those costs.

109.4.6.2 Extended Field Overhead

1. The owner will pay the contractor for extended field overhead costs that include costs for general field supervision, field office facilities and supplies, and for maintenance of field operations.
2. General field supervision costs include, but are not limited to, field supervisors, assistants, watchman, and clerical and other field support staff. Compute these labor costs as specified

in 109.4.4 item 1.A.a. For salaried personnel, calculate the daily wage rate actually paid by dividing the weekly salary by 5 days per week.

3. Field office facility and supply costs include, but are not limited to, field office trailers, tool trailers, office equipment rental, temporary toilets, and other associated facilities and supplies. Compute these costs on a calendar-day basis using actual costs incurred due to the delay to provide these services.
4. Maintenance of field operations costs include, but are not limited to, telephone, electric, water, and other similar expenses. Compute these costs on a calendar-day basis using actual costs incurred due to the delay to maintain these services.

109.4.6.3 Extended Labor

1. Compute labor costs during delays as specified in 109.4.4 item 1.A. for all non-salaried personnel remaining on the project.

109.4.6.4 Escalated Labor

1. To receive payment for escalated labor, demonstrate that the owner-caused delay forced the work to be performed during a period when labor costs were higher than planned at the time of bid. Provide adequate support documentation for the costs, allowances, and benefits specified in 109.4.4 item 1.A.

109.4.6.5 Equipment Stand-By or Equipment Demobilization

1. The owner will pay the contractor for equipment stand-by, other than small tools, that must remain on the project during delays. The owner will pay the contractor's transportation costs to remove and return equipment not required on the project during delays.

109.4.6.6 Materials Escalation or Material Storage

1. The owner will pay the contractor for increased material costs or material storage costs due to the delay. Obtain the engineer’s approval before storing material due to a delay.

109.5 Eliminated Work

1. If the owner eliminates work, the owner will pay the direct costs incurred as of the date the work was eliminated. The owner will not pay for bidding costs or other non-allowable charges specified in 109.4.5.
2. The owner may pay for, and take ownership of, materials or supplies the contractor has already purchased.
3. Submit a certified statement, including paid invoices, covering all direct costs incurred as of the date the work was eliminated. The owner will execute a change order as follows:
   A. For incurred direct costs that have no value to other contract work, the owner will reimburse the contractor in full for those costs.
   B. For incurred direct costs that are distributed over other contract work, the owner will prorate reimbursement based on the value of the eliminated work compared to the total value of associated contract work.
   C. Restocking and cancellation charges.
   D. A markup for unrecoverable overhead paid as 7% of the contract price of the work actually eliminated. The work actually eliminated is calculated as the net value of the eliminated work and replacement work having the same essential functions as the eliminated work.

109.6 Progress Payments

109.6.1 General

1. The contractor will first prepare a payment request and submit payment request to the engineer. Then the owner will review the payment request and make a progress payment based on the engineer's estimate of the quantities of work completed. Payment will be at the contract or agreed unit or lump sum prices. The owner may suspend progress payments if the contractor does not comply with the owner or engineer's directions as the contract specifies. The owner will notify the contractor immediately whenever progress payments are suspended.
2. The owner's payment of an estimate before final acceptance of the work does not constitute the owner's acceptance of the work, and does not relieve the contractor of responsibility for:
   A. Protecting, repairing, correcting, or renewing the work.
   B. Replacing all defects in the construction or in the materials used in the construction of the work under the contract, or responsibility for damage attributable to these defects.
3. The contractor is responsible for all defects or damage that the engineer may discover on or before the engineer's final acceptance of the work. The engineer is the sole judge of these defects or damage, and the contractor is liable to the owner for not correcting all defects or damage. The owner may reduce progress payment amounts until the contractor corrects all defects or damage.
4. The owner will take ownership of all material and work covered by progress payments. However, the contractor remains solely responsible for all materials and work covered by progress payments and for the restoration of damaged work. Also, by making the progress payment, the owner waives no requirement, right, or term of the contract as specified in 107.13.

109.6.2 Frequency

1. The owner will make monthly progress payments or for such longer periods as mutually agreed upon. Progress payments will be made quarterly at minimum.
2. The owner will make payments within 30 days of receipt of payment request by owner.

109.6.3 Preparation of Progress Payment Estimate

1. The owner will compute quantities to reflect the approximate quantity of work completed, or substantially completed, under the pertinent contract bid items to the date of the progress payment estimate. The owner will adjust quantities to cover contingencies and costs for finishing or maintaining the work. If the engineer bases the progress payment estimate on contract quantities, the owner will adjust quantities to cover variations between the contract and final quantities.
2. The owner will make no payment except final payment for a sum less than $500.00.
3. The owner may correct quantities and adjust progress payments upon discovery of an error in any previous progress payment.

109.6.4 Retainage

1. The owner will withhold retainage from progress payments. Retained percentages will be in conformance with Wisconsin statutes 66.0901(9) for public works projects.
2. Compute retainage as follows:
   A. The owner will retain 5% of the progress payment estimate until work has been completed covering 50% of the estimated total bid amount plus the value of any change orders.
   B. The owner will make further partial payments in full to the contractor once work has been completed covering 50% or greater of the estimated total bid amount plus the value of any change orders unless the engineer certifies that the job is not proceeding satisfactorily. At

the discretion of the owner, the retained percentage may be reduced and payment made for amounts previously retained.

C. When the progress of the work is not satisfactory and work has been completed covering 50% or greater of the estimated total bid amount plus the value of any change orders, the owner may retain additional amounts up to 10% of the value of the work completed.
D. When the work is substantially complete, the owner may pay the contractor amounts retained. The owner will retain at all times an amount sufficient to cover the estimated cost of the work still to be completed for work which cannot be completed because of weather conditions, lack of materials, or other reasons which in the judgment of the owner are valid reasons for noncompletion.

109.7 Acceptance and Final Payment

1. After the owner gives written notice that the project is complete as specified in 105.9.1.4 and reviews required document submittals and materials test reports, the engineer will issue the semi-final estimate.
2. Within 30 calendar days after receiving the semi-final estimate, submit to the engineer a written statement of agreement or disagreement with the semi-final estimate. For an acceptable statement of disagreement, submit an item-by-item list with reasons for each disagreement. If the contractor does not submit this written statement within those 30 days, the owner will process the final estimate for payment. The owner and the contractor can mutually agree to extend this 30-day submission requirement.
3. If the contractor submits an acceptable statement of disagreement, the owner will withhold payment of the final estimate and determine the validity of the contractor's disagreement. After considering the contractor's statement, the owner may revise the final estimate based on the engineer's judgment of the validity of the contractor's disagreement.
4. The owner may correct progress estimates and payments in the final estimate and payment.
5. The contractor is responsible for negligence or faulty materials or workmanship which are discovered within 1 year after the date of completion and acceptance, unless otherwise specified in the special provisions. Upon written notice, replace all defects in the construction or materials and pay for damage attributable to these defects. A guaranty fund, equal to 1% percent of the contract amount, will be withheld from the final amount due the contractor, for a period of 1 year.

109.8 No Assignment of Payments

1. The owner will pay the contractor all payments due under the contract, or any part of the contract. The owner will recognize no contractor-executed assignment or order directing payment of all, or any portion of, the funds to any other person or persons.

200 Sewer Construction

201 Definitions and Acronyms

201.1 Acronyms

1. Interpret the acronyms used in sections 201 through 213 as follows:

NAVD88 The North American Vertical Datum of 1988

201.2 Definitions

1. Interpret definitions used in sections 201 through 213 as follows:
   Cover Material. Material which is to be used around and over the sewer pipe and above the pipe bedding.

202 General Requirements for Sewer Construction

202.1 Scope

1. This section describes general requirements for sewer construction.

202.2 General Requirements

202.2.1 Erosion and Sediment Control

1. Furnish, install, and maintain construction site pollutant control practices and follow all requirements specified in 302 and 303.

202.2.2 Project Closeout Requirements – Record Drawings

1. Provide a digital copy of as-built sanitary sewer system plans for each project to the Village of North Fond du Lac or Sanitary District Owner and the City of Fond du Lac, to be approved by the owner, before final acceptance will be granted. Make submittal to the attention of the City of Fond du Lac Director of Public Works.
2. Acceptable formats include AutoCAD files or ESRI geodatabase or shape files; geodatabase files are preferred. Similar digital files can be accepted with prior approval from the Fond du Lac Outlying Sewer Group Technical Standards Committee. Handwritten plan sheets, Adobe PDFs, or similar formats are not acceptable.
3. Use the Fond du Lac County Coordinate System with NAVD88 datum elevations on record drawings. Redline and label all changes to the plan details on the record drawings. Required information includes the following:
   A. The final location, size, and rim elevation of sanitary sewer manholes, lift stations, and cleanouts.
   B. Pipe size, material, direction of flow, and invert elevation.
   C. Location of sanitary wyes and laterals end or connection.
4. City of Fond du Lac projects are exempt from the requirements in 202.2.2.

202.3 Materials

202.3.1 Rejection

1. The owner may reject pipe for failure to conform to any of the specification requirements or for any of the following reasons:
   A. Any of the following which are sufficient to impair the strength, durability, or serviceability of the pipe in the opinion of the engineer:

a. Any visible damage.
b. Fractures.
c. Cracks.
d. Chips.
e. Defects that indicate imperfect proportioning, mixing, or molding.
f. Variations in alignment.
g. Damaged ends or gaskets.
h. Misplaced reinforcement.

B. Extensive patching or painting of any surface of pipe.

202.3.2 Pipe and Fitting Markings

1. Clearly mark sewer pipes as follows at intervals of 5 feet or less:
   A. Manufacturer's name or trademark.
   B. Nominal pipe size.
   C. Pipe classification.
   D. The legend, i.e. "SDR-35 PVC Sewer Pipe".
   E. ASTM designation.
   F. Extrusion date, period of manufacture, or lot number.
2. Clearly mark fittings as follows:
   A. Manufacturer's name or trademark.
   B. Nominal size.
   C. The material designation.
   D. ASTM designation.

202.3.3 Insulation

1. Furnish expanded or extruded polystyrene foam insulation for frost prevention with a minimum thickness of 2 inches, a minimum "R" value of 8.7 (at 75 degrees Fahrenheit mean temperature), and a minimum compressive strength of 40 psi.

202.3.4 Tracer Wire Systems

202.3.4.1 Tracer Wire

1. For direct burial installations, furnish green colored 12 AWG tracer wire specified below:
   a. Copper-clad steel wire with a minimum 280 lb. break load, a minimum 30 mil insulation thickness, and complying with **ASTM B910 / B910M, ASTM B170,** and **ASTM D1248**.
   b. Solid copper wire with a minimum 197 lb. break load, a minimum 30 mil insulation thickness, and complying with **ASTM B3, ASTM B170,** and **ASTM D1248**.
2. For directional drilling or boring installations, furnish green colored 10 AWG, copper-clad steel tracer wire with a minimum 1,150 lb. break load, a minimum 45 mil insulation thickness, and complying with **ASTM B1010 / B1010M, ASTM B170,** and **ASTM D1248.**
3. For pipe bursting installations, furnish green colored 7x7 stranded, copper-clad steel tracer wire with a minimum 4,700 lb. break load, a minimum 50 mil insulation thickness, and complying with **ASTM B1010 / B1010M, ASTM B170,** and **ASTM D1248**.

202.3.4.2 Tracer Wire Connectors

1. Furnish 3-way or 4-way lockable connectors designed for direct bury installations at intersections. Use dielectric silicone filled connectors to seal out moisture and corrosion, designed to prevent any exposure of uninsulated wire, and listed below:
   a. SnakeBite Locking Connectors by Copperhead Industries.

2. Furnish inline splice tracer wire connectors for pipes installed using open trench construction methods consisting of weather resistant tubing, a non-hardening viscous dielectric silicone sealant, designed for 14 to 10 AWG solid copper wire or copper-clad steel wire, and listed below:
   a. DryConn Direct Bury Silicone Tube connectors by King Innovation.
   b. Direct Bury Splice Kits by 3M.
   c. SnakeBite Locking Connectors by Copperhead Industries.
3. Furnish inline splice tracer wire connectors for pipes installed using trenchless construction methods consisting of a solid brass lug with set screws, heat shrink weather resistant tubing, and listed below:
   a. Pipe Burst In-line Splice SC-PB-01 by Copperhead Industries.
4. Furnish main to service tracer wire connectors consisting of a mechanical dual lug connector with a high impact polypropylene housing and a non-hardening viscous dielectric silicone sealant, able to connect the service tracer wire to the main tracer wire without having to cut the main tracer wire, designed for 14 to 10 AWG solid copper wire, and listed below:
   a. DryConn Direct Bury Lug Aqua connectors by King Innovation.
   b. Mainline-to-Service connector 3WB-01 by Copperhead Industries.

202.3.4.3 Tracer Wire Ground Rods

1. Furnish drive-in magnesium grounding anode rods with a minimum of 20 feet of 12 AWG red colored insulated copper-clad steel wire connected to anode (minimum 1.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the sewer.

202.3.4.4 Tracer Wire Access Points

1. Furnish traffic rated tracer wire access points with a cast iron collar, a lockable green colored lid, and listed below:
   a. SnakePit Roadway by Copperhead Industries.

202.3.5 Portland Cement

1. Deliver all cement to the job site in original packages bearing the type and brand name or stamp of the manufacturer. Bulk cement may be used at ready-mixed concrete plants only. Do not use cement containing lumps or crusts.
2. Furnish cement conforming to ASTM specifications as follows:
   A. Type I portland cement; **ASTM C150**.
   B. Type IS portland blast-furnace slag cement; **ASTM C595**, except maximum slag content is 30%.

202.3.6 Air-Entraining Admixtures

1. Furnish air-entraining admixtures conforming to **ASTM C260**.

202.3.7 Aggregates for Portland Cement Concrete

1. Furnish coarse and fine aggregates conforming to **ASTM C33** except as modified in 202.3.7.

202.3.7.1 Fine Aggregate

1. Furnish fine aggregate consisting of sand composed of clean, hard, tough, durable grains of approved inert materials from natural deposits and conforming to the gradation requirements in ***Table 202-1***.

Table 202-1

Fine Aggregate

U.S. Standard Sieve Size	Percent Passing by Weight
⅜-inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

202.3.7.2 Coarse Aggregate

1. Furnish coarse aggregates conforming to **ASTM C33**, Size 67 for No. 1 and **ASTM C33**, Size 4 for No. 2 except as modified in 202.3.7.
2. Furnish coarse aggregates consisting of clean, hard, tough, durable crushed rock, crushed gravel or gravel free from adherent coatings, soft, flat or elongated particles and free from vegetation or other deleterious substances and conforming to the gradation requirements in ***Table 202-2*** and ***Table 202-3***.
3. Gradations not meeting the requirements of ***Table 202-2*** and ***Table 202-3*** may be accepted if the composite gradation of Size No. 1 combined with Size No. 2 meets the gradation of Size No. 467 of **ASTM C33**.

Table 202-2
No. 1 Crushed Stone

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	90-100
⅜-inch	20-55
No. 4	0-10
No. 8	0-5

Table 202-3
No. 2 Crushed Stone

U.S. Standard Sieve Size	Percent Passing by Weight
2-inch	100
1½-inch	90-100
1-inch	20-55
¾-inch	0-15
½-inch	0-5

202.3.8 Water for Concrete

1. Use drinking water from municipal water supplies whenever possible. Where municipal water is not available, water which is free of oil, acid, excessive alkalinity, organic matter and other harmful ingredients may be used with the approval of the engineer.

202.3.9 Cellular Concrete

1. Produce cellular concrete by mixing a predetermined quantity of preformed foam with a concrete slurry mixture of type I portland cement and water. Provide cellular concrete with the compressive strength and wet density of the resulting concrete mix as specified in the special provisions. Fine aggregate may be added to the slurry mixture to obtain the specific concrete density and strength requirements.
2. Use a foam generator, approved by the foaming agent manufacturer, to produce a predetermined quantity of preformed foam. Inject foam into the mixer and blend with a concrete slurry. Two types of foam generating systems, batch and continuous generating, are acceptable. Use a foaming agent to generate the preformed foam that complies with **ASTM C869** when tested according to **ASTM C796**.
3. Concrete admixtures may be used with the foaming agent according to the manufacturer's recommendations.
4. Use equipment to mix and pump cellular concrete specifically designed for this purpose.

202.4 Construction

202.4.1 Existing Sewers

1. The contractor is responsible for maintaining an active sanitary and storm sewer system at all times including during rain events. If pumping is required, it is incidental to the cost of construction unless specified otherwise.

202.4.2 Shipment and Storage of Pipe and Fittings

1. Package, handle, and ship pipes and fittings according to manufacturer's instructions and specifications. Replace any pipe or fitting damaged in shipment as directed by the engineer.
2. Store pipes and fittings in the supplier's yard or on the project site according to manufacturer's recommendations.

202.4.3 Connecting to Existing Pipe

1. Uncover the existing pipes to which new sewers are to be connected to verify or determine the location, elevation, material, and size of existing pipes to permit adjustments in line and grade prior to installing new pipes.

202.4.4 Line and Grade for Open-Cut Construction

1. Use a laser beam to facilitate the installation of the sewer mains unless the engineer approves an alternate method.
2. The owner will provide line and grade stakes for construction.
3. Make staking requests a minimum of 3 working days prior to the time the stakes are needed.
4. Preserve all stakes and markings as specified in 105.5 item 2.

202.4.5 Laying of Pipe

1. Begin laying pipes in finished trenches at the lowest point and proceed towards the upper end, also lay the pipe so the spigot or tongue ends point in the direction of flow. Do not use any other procedure without permission of the engineer.
2. Thoroughly clean dust, dirt, and other foreign matter from joining surfaces of the bell or groove end of pipe and the spigot or tongue ends before lowering pipes into trenches.
3. Lower and place the pipes to avoid unnecessary handling in the trench or damage to the pipe. Provide a firm bearing beneath the entire length of each section and make it substantially true to the line and grade required.

4. Lay pipes with ends abutting. Take care when shoving the pipes together so the joints are properly adjusted and not overly large. Fit and match the pipes so that if set firmly in line and grade they form a sewer with a smooth and uniform invert.
5. During the laying of sewer lines and appurtenances, take due care to protect pipe, fittings, and joints from disturbance or damage.
6. Perform pipe cutting in a neat workmanlike manner without damage to the pipe and so as to leave a smooth end.
7. After installing the pipe, seal lift holes with suitable concrete or other engineer-approved plugs.
8. Connect to new or existing pipes, catch basins, manholes, and inlets conforming to 211.4.
9. During all intermissions in construction of the sewer, cover or bulkhead the open face of the last pipe so as to prevent sand, water, earth or other materials from entering the pipe.
10. Provide joint ties on concrete storm sewer system infall and outfall pipes. Tie the last 3 pipe joints or, if using apron endwalls, the endwall and the next 2 pipe joints. Ties are not required on installations with masonry endwalls unless the plans show otherwise.

202.4.6 Laying Pipe in Cold Weather

1. The engineer reserves the right to order pipe-laying discontinued whenever, in the opinion of the engineer, there is a danger of the quality of work being impaired because of cold weather.
2. Heat the pipe and jointing material so as to prevent freezing of joints.
3. Do not lay pipe on or in frozen ground.

202.4.7 Cleaning of Sewer Pipes

1. Clean out all new or re-laid sewer pipes of accumulations of silt, debris, and other foreign matter.

202.4.8 Testing and Cleaning

1. Perform testing and cleaning of sanitary and storm sewer pipes, laterals, force mains, manholes and other appurtenances as specified in 212.

202.4.9 Sanitary Sewer Main and Laterals Insulation

1. Protect all sanitary sewer main and laterals constructed within 5 feet of the ground surface or within 2 feet of a catch basin or inlet with insulation. The minimum width of insulation varies with the depth of ground cover as shown in ***Table 202-4***. The width of insulation is not required to exceed the trench width when the width in ***Table 202-4*** exceeds the constructed trench width.

Table 202-4
Minimum Width of Insulation

Depth of Sewer (Feet)	Minimum Width of Insulation (Feet)
2.0	8
2.5	7
3.0	6
3.5	5
4.0	4
4.5	3
5.0	2

2. Prior to placement of the insulation, place bedding material to a height 6 inches over the top of the pipe, level and compact. Place the insulation on the cover material with the long side parallel to the centerline of the pipe. Place the insulation in a staggered arrangement so as to eliminate continuous transverse joints. Install the first lift of backfill material consisting of 6 inches of bedding material end or side dumped onto the insulation and spread in such a manner that the construction equipment does not operate directly on the insulation. Compact this layer with equipment that exerts a compact stress of 70 to 80 psi. Once this layer has been compacted to the specified density, the remaining layers of backfill may be constructed utilizing conventional procedures.

202.4.10 Tracer Wire

1. Provide tracer wire for force mains, pipes installed using trenchless construction methods, or at other locations identified on the plans or special provisions.
2. Secure the tracer wire to the pipe every 5 feet using a minimum of 2 wraps of tape around the pipe. Place the tracer wire in the same orientation to all installed pipe.
3. Provide 36 inches of additional wire at all terminations.
4. Install tracer wire systems as a continuous wire, except where using approved connectors. Do not loop or coil wire.
5. Properly ground tracer wire at all dead ends and stubs.
6. Locate all new tracer wire installations using typical utility locating equipment in the presence of the engineer prior to acceptance.

202.4.11 Concrete

1. Use portland cement concrete composed of a mixture of portland cement, fine and coarse aggregates, and water as required for the class of concrete specified.
2. For concrete containing No. 1 and No. 2 coarse aggregate, use air-entrained concrete with between 4% and 7% air content by volume. For concrete which contains only No. 1 coarse aggregate, use air-entrained concrete with between 4.5% and 8% air content by volume.
3. Ensure that concrete delivered at air temperatures lower than 45 degrees Fahrenheit has a minimum temperature of 50 degrees Fahrenheit. Ensure that the maximum temperature of concrete produced at no time during its production or transportation exceeds 90 degrees Fahrenheit. The engineer reserves the right to order concreting discontinued when the air temperature falls below 35 degrees Fahrenheit.

202.4.12 Concrete Classification

1. Furnish classes of concrete to be used for the different items of construction, except when otherwise specified, according to ***Table 202-5***.

Table 202-5
Concrete Classification

Class of Concrete	Minimum Bags of Cement Per Cubic Yard	Type of Cement Required	Size of Coarse Aggregate
C	6.0	Type I or Type IS	No. 1 and No. 2 or No. 1
D	5.5	Type I or Type IS	No. 1 and No. 2 or No. 1
Backfill Concrete	2.25	Type I or Type IS	No. 1
Cellular Concrete	8.0	Type I	None

2. Furnish class C concrete for manholes or other structures constructed in open cut, concrete collars, and outside drops. Grade A concrete meeting the requirements of Section 501 of the

Standard Specifications for Highway and Structure Construction may be used in place of class C concrete.

3. Furnish class D concrete for concrete envelope, cradles, and caps.
4. For cast in place structures, furnish grade A concrete meeting the requirements of Section 501 of the *Standard Specifications for Highway and Structure Construction*.
5. For high early strength concrete, furnish grade C concrete meeting the requirements of Section 501 of the *Standard Specifications for Highway and Structure Construction*.

202.4.13 Protection of New Concrete

1. Provide adequate equipment for heating concrete materials and protecting concrete when the temperature is below 35 degrees Fahrenheit. Do not use frozen materials or materials containing ice or snow. Ensure that all reinforcement, forms, fillers, and ground with which the concrete is to come in contact are free from ice and snow. Ensure that all concrete placed in forms has a temperature of 50 degrees Fahrenheit or higher after placement. Provide adequate means for maintaining this temperature for 3 days.
2. In hot weather, take suitable precautions to avoid drying of the concrete prior to finishing operations. Provide for the use of windbreaks, sunshades, fog sprays, or other devices as directed by the engineer. Ensure that concrete deposited in hot weather does not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Ensure that concrete temperatures are less than 80 degrees Fahrenheit unless higher temperatures are permitted by the engineer.

202.4.14 Concrete Testing

1. Perform testing according to the following standards:
   A. Make and store compression test specimens of concrete (6 x 12-inch cylinders) in the field according to **ASTM C31**.
   B. Perform the compression test on 6 x 12-inch cylinders according to the test method in **ASTM C39**.
   C. Determine the slump according to **ASTM C143**.
   D. Determine the weight per cubic foot, yield, air content, and cement content by measurement in a standard measure conforming to **ASTM C138**. The air content may be determined by the pressure method according to **ASTM C231** or the volumetric method according to **ASTM C173**.

202.4.15 Ready-Mixed Concrete

1. Furnish ready-mixed concrete according to **ASTM C94** except as modified in 202.4.15.
   A. Mix concrete which is mixed completely in truck-type mixers between 70 and 100 revolutions at designated mixing speed. Make all revolutions after 100 at agitating speed.
   B. Deposit all concrete on the job site within 1½ hours after the introduction of the mixing water.
   C. Do not retemper rejected loads of concrete or adjust with additional ingredients.
   D. Furnish a duplicated delivery ticket by the ready-mix plant with each load of concrete delivered to the job, one copy to be retained by the contractor and the other given to the inspector of the job.
   E. Use batch hopper scales which have been tested and approved by the local Sealer of Weights and Measures, WisDOT, or an approved testing service at intervals not exceeding 12 months. An approval for the hopper scales or portable plants is required after each movement of the plant.

F. The engineer reserves the right to require that portland cement concrete be produced in a plant which complies with the requirements of the National Ready Mixed Concrete Association certification plan.

202.4.16 Use of High Early Strength Concrete

1. When the contractor, at their own request, uses high early strength concrete to shorten the time required prior to placing load on the structure, the added cost shall be at the contractor's expense.

202.4.17 Crack and Damage Survey

1. When required, perform a crack and damage survey as specified in 607.

202.4.18 Site Restoration

1. Perform site restoration, including paving and landscaping, according to the *Standard Specifications for Highway and Structure Construction* if no other specifications are provided for the site restoration work in other sections of the contract.

202.5 Basis of Payment

1. Work specified in 202 is incidental to the contract, unless noted otherwise.
2. The owner will measure the polystyrene insulation bid items by the square foot or by linear foot of a specified width acceptably completed. Payment for the polystyrene insulation bid items is full compensation for providing required materials and for installing and backfilling.

203 Site Preparation

203.1 Scope

1. This section includes all plant, labor, equipment, and appliances as required or necessary to clear and prepare the work site for further construction as shown and specified.

203.2 General Requirements

1. Perform site preparation in such a manner as not to harm lawns; trees; shrubs; landscape work; fences; sanitary and storm sewer pipes and structures; hydrants; water mains; electrical and communication conduits, wires, and structures; pavement; sidewalks; and curb and gutter that are to remain in place. Provide adequate protection for vehicle and pedestrian traffic in the vicinity of any open excavation. Maintain such protection as long as necessary to prevent damage from the contractor's operations. Repair any damage that may occur at no cost to the owner.
2. When damage is done to water laterals (services), sanitary sewer laterals (house connections), or any other underground facilities belonging to the owner, which facilities are not being removed or abandoned, repair damage to the satisfaction of the engineer. If the contractor cannot, or does not wish to, make such repairs, the owner will make the repairs and charge the contractor for the actual cost of such repairs on a time and material basis. The owner will deduct the cost of repairs of said damages from payments due the contractor.

203.3 Construction

203.3.1 General

1. Perform all clearing and grubbing and perform all demolition and removal work as required and shown for the proper construction and completion of the work.

203.3.1.1 Clearing and Grubbing

1. Clear the site of all trees, stumps, logs, tree trimmings, roots, brush, heavy sod, vegetation, rocks in excess of 6 inches, debris, and other obstruction of whatever kind or character as required to perform the work.
2. Perform clearing and grubbing as specified in 606. Do not remove or damage trees that do not interfere with the work, and properly treat any damaged trees that can be saved.
3. After clearing and grubbing, strip the topsoil. The topsoil may be stockpiled as required for reuse, or it may be removed from the site of the work and replaced with acceptable imported topsoil. If the topsoil is stockpiled, take care to prevent mixing with the subsoil. Temporarily seed or otherwise stabilize, to the satisfaction of the engineer, all soil stockpiles existing for more than 7 days. Remove and dispose excess topsoil from the site of the work.

203.3.1.2 Demolition and Removal

1. Demolish and remove all structures including superstructures, foundation walls, footing, slabs, and other on-grade or below-grade construction. Clean excavations caused by removal of existing structures of all waste and debris.
2. Perform sawing as specified in 605.
3. A drop weight or other type of machinery for breaking pavement may be used when such usage does not become a nuisance or a source of damage to underground or adjacent utilities or structures. Before employing a drop weight, verify that there are no nearby underground or adjacent utilities or structures that could be damaged by its use. The owner reserves the right to order the discontinuance of the use of a drop weight at any time.

203.4 Basis of Payment

1. Work specified in 203 is incidental to the contract, unless noted otherwise.
2. The owner will pay separately for clearing and grubbing as specified in 606.4.
3. The owner will pay separately for sawing as specified in 605.3.

204 Trenching

204.1 Scope

1. This section describes excavating, bedding, covering, and backfilling, for the construction of sewers and appurtenances.

204.2 General Requirements

1. Submit test reports which include moisture density relationship, and gradation results prepared by a certified testing laboratory acceptable to the engineer for bedding, cover, and backfill materials as specified in 106.2.2. Submit a labeled jar containing a sample of each material with the results. Do not use any material unless it has been accepted by the engineer.
2. The standard test to define maximum densities of all compaction work shall be **ASTM D1557**. Express all densities as a percentage of the maximum density obtained in the laboratory by the foregoing standard procedure. The engineer may perform density tests on fills and backfills as placed by the contractor. The contractor shall permit the engineer to sample, test, and inspect in-place materials at times selected by the engineer and without additional compensation or additional time.

204.3 Materials

204.3.1 Bedding Materials

1. Furnish crushed stone chips made from crushing limestone, dolomite ledge rock, or other rock materials of regional significance. Provide material that is hard, tough and durable. Ensure that the crushing process produces material of which 85% to 100% of the particles have at least one machine fractured face. Crushed pea gravel will be acceptable if it meets this criteria. Conform to the gradation requirements in ***Table 204-1*** or ***Table 204-2***.

Table 204-1
⅜-Inch Crushed Stone Chips

U.S. Standard Sieve Size	Percent Passing by Weight
½-inch	100
⅜-inch	90-100
No. 8	0-15
No. 30	0-3

Table 204-2
¾-Inch Crushed Stone Chips (ASTM C33 – Size No. 67)

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	90-100
⅜-inch	20-55
No. 4	0-10
No. 8	0-5

204.3.2 Cover Material for Pipe

1. Furnish cover material consisting of durable particles ranging in size from fine to coarse in a substantially uniform combination. Unwashed bank-run sand and crushed bank-run gravel will be considered generally acceptable under this specification. Conform to the gradation requirements in ***Table 204-3***.
2. Bedding material may be substituted for cover material in sewer installation.

Table 204-3
Cover Material

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	85-100
⅜-inch	50-80
No. 4	35-65
No. 40	15-30
No. 200	5-15

204.3.3 Backfill Materials

1. Furnish granular material for backfilling consisting of durable particles ranging from fine to coarse in a substantially uniform combination. Ensure that sufficient fine material is present to fill all the voids of the coarse material. Ensure that no stones over 3-inch sieve size are present.

Some fine clay or loam particles are desirable, but may not be present in the form of lumps. Conform to the gradation requirements in ***Table 204-4, Table 204-5***, or ***Table 204-6***.

Table 204-4
Crushed Stone Screenings

U.S. Standard Sieve Size	Percent Passing by Weight
½-inch	100
No. 4	75-100
No. 100	10-25

Table 204-5
1¼-Inch Dense Base

U.S. Standard Sieve Size	Percent Passing by Weight
1¼-inch	95-100
¾-inch	70-93
⅜-inch	42-80
No. 4	25-63
No. 10	16-48
No. 40	8-28
No. 200	2-12

Table 204-6
¾-Inch Dense Base

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	95-100
⅜-inch	50-90
No. 4	35-70
No. 10	15-55
No. 40	10-35
No. 200	5-15

204.3.4 Excavated Material Used As Backfill

1. Furnish excavated material to be used as backfill consisting of loam, clay, or other materials which, in the judgement of the engineer, are suitable for backfilling. Unsuitable backfill materials include vegetable or other organic material, all types of refuse, large pieces or fragments of concrete, and such other material that in the judgement of the engineer are unsuitable for backfilling. Do not use frozen backfill material.

204.3.5 Aggregate Slurry Backfill

1. Aggregate slurry backfill consists of a concrete mix with the cement deleted. Furnish aggregate slurry backfill material mixed in the following quantities:
   A. 1360 lbs. sand **(ASTM C33 fine aggregate)**
   B. 750 lbs. No. 1 stone **(ASTM C33 size number 67)**
   C. 1150 lbs. No. 2 stone **(ASTM C33 size number 4)**

D. 25 gals. (+0 to -0.5 gal.) water per cubic yard

2. Mix the material with water to inundate the aggregate sufficient to provide an approximate 3-inch slump. Deposit the mix in the trench directly from a concrete transit mix truck. Just prior to placing the slurry, run the mixture at mixing speed to insure a uniform mixture.

204.3.6 Lean Concrete Mix Backfill

1. Furnish lean concrete mix backfill conforming to the requirements of aggregate slurry backfill with the addition of a minimum of 1 bag of cement per cubic yard.

204.3.7 Geotextile Bags and Filter Basins

1. Furnish geotextile filter bags and geotextile filter basins fabricated using type R fabric as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*.
2. Furnish polymer approved by the WDNR and meeting the criteria in *WDNR Conservation Practice Standard 1051* unless directed otherwise by the engineer.

204.4 Construction

204.4.1 General Requirements

204.4.1.1 Work Limits

1. Keep the length of trench excavated in advance of the pipe laying to a minimum, and in no case allow it to exceed 50 feet unless otherwise authorized. Do not exceed a total length of open trench of 100 feet for each main pipe laying operation unless otherwise authorized. Do not obstruct more than one street crossing by the same trench at any one time unless otherwise authorized.
2. Do not exceed a length of unrestored work area and total unfinished trench construction of 800 feet for each main pipe laying operation unless otherwise authorized. Trench construction will not be considered completed until all restoration is completed. A section of trench will not be considered as finished until excavation, construction, backfilling, compaction, surface restoration and replacement, and cleanup operations have been completed.

204.4.1.2 Control of Water

1. Provide all necessary machinery, appliances, and equipment to keep excavation free from water during construction, and dewater and dispose of the water so as to minimize discharge of turbid water to surface water and not to cause injury to public or private property, or to cause a nuisance or a menace to the public.
2. Before dewatering is started, obtain acceptance from the engineer for the method, installation, and details of the dewatering system proposed to use.
3. Have on hand at all times sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outage, and have available at all times competent workmen for the operation of the pumping equipment. Do not shut down the dewatering system between shifts, on holidays or weekends, or during work stoppages without written permission from the engineer.
4. Control groundwater such that softening of the bottom of excavations or formation of “quick” conditions or “boils” is prevented. Design and operate dewatering systems so as to prevent the removal of the natural soils.
5. During excavating, construction of sewers and appurtenances, and backfilling, keep excavations free of water. Draw the static water level down a minimum of 1 foot below the

bottom of the excavation so as to maintain the undisturbed state of the natural soils and allow the placement of any fill or backfill to the required density. Install and operate the dewatering system so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. Perform the release of groundwater to its static level in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted fill or backfill, and prevent flotation or movement of all sewers and appurtenances.

204.4.1.3 Trench Dewatering

1. Use a sediment control/capture mechanism at the discharge of the pump hose on all trench dewatering pumps. Discharging into an inlet that has inlet protection installed does not count as having sediment control/capture mechanism installed.
2. Perform all trench dewatering in conformance with *WDNR Technical Standard 1061*. Geotextile bags and geotextile filter basins require a polymer additive for effective treatment with clay loam, silty clay, and clay soils.

204.4.1.4 Dewatering Permits

1. Submit and obtain any required WNDR permits for dewatering or pumping of groundwater, including *Dewatering Operations WPDES General Permit*.
2. Do not install or operate dewatering wells, for which the single or aggregate capacity exceeds 70 gallons per minute, unless the contractor obtains a high capacity dewatering well permit from WDNR.

204.4.1.5 Contaminated Soils and Groundwater

1. Immediately notify the engineer if any contaminated soils or groundwater are exposed or suspected during excavation.
2. If historic contaminated soils or groundwater are expected notify the engineer a minimum of 3 days prior to excavating in or adjacent to the potential impacted areas so a representative can be on-site during the excavation.
3. If prior approval was obtained for the disposal of the contaminated soil, contaminated excavated soil may be placed directly onto trucks for hauling to a landfill designated by the owner. If no prior approval has been obtained, then place the soils on a 6-mil polyethylene sheet and, upon completion of work for the day, covered with a 6-mil polyethylene sheet. Ensure that the cover prevents exposure to storm water runoff and reduces public exposure. If the soils cannot be stockpiled on-site, work with the owner to find a suitable temporary storage location until appropriate testing and analysis can be completed and until approval for disposal at a landfill is obtained. Use a licensed operator, driver, and truck for handling the contaminated soil to deliver the material to an approved facility. The contractor may be required to use liners in the trucks used to transport the material. Adequately dewater all soil prior to hauling to a landfill. The owner will not be responsible for additional charges from the landfill due to the contractor hauling improperly dewatered materials. Excavating, placing material on polyethylene sheeting, covering materials, and maintaining stockpiles are considered incidental to the contract, unless specified otherwise. Landfill tipping fees will be paid for by the owner, unless specified otherwise.
4. Temporarily store contaminated liquids collected from excavation and stockpiles until the liquid can be characterized and approved for disposal at a designated facility or discharged to the City of Fond du Lac sanitary sewer system. Ensure that liquid storage containers are watertight and located in an area approved by the engineer. Clearly label and date storage containers.

5. No extra payment will be made to the contractor for delay of work due to encountering contaminated soils or groundwater. Dewatering, pumping, and storing contaminated groundwater are considered incidental to the contract, unless specified otherwise. Disposal fees will be paid for by the owner, unless specified otherwise.
6. The owner will submit and obtain any required WNDR permits for pumping of contaminated groundwater, including *Contaminated Groundwater from Remedial Action Operations WPDES General Permit*.

204.4.1.6 Clay or Bentonite Trench Dams

1. Install clay or bentonite trench dams, as directed by the engineer, at the boundaries of contaminated soil or groundwater areas to prevent contaminant migration along the trench. Construct the dam 3 feet in length, the width of the trench, and to a point 4 feet below the finish surface elevation and to a minimum of 2 feet above the top of the pipe.
2. Excavating, constructing forms, providing clay or bentonite, compacting, and backfilling clay or bentonite dams is considered incidental to the contract, unless specified otherwise.

204.4.1.7 Removal of Obstructions

1. Remove all rock, stones, debris and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the work for a depth of at least 6 inches below the bottom of the pipe. Remove material from the site of the work and dispose of in a manner acceptable to the engineer.

204.4.1.8 Sheathing, Shoring, and Bracing

1. Provide all necessary sheathing and shoring including all labor, material, equipment and tools required or as necessary to maintain the excavation in a condition to furnish safe working conditions, to permit the safe and efficient installation of all items of contract work, and to protect adjacent property. The contractor shall be held liable for any damage, which may result, to neighboring property from excavation or construction operations. Nothing in 204.4 shall be deemed to allow the use of protective systems less effective than those required by the OSHA and the State of Wisconsin.
2. The engineer may order sheeting and bracing to be left in place at the completion of the work. The contractor will be paid for such materials left in place in open cut trenches on order of the engineer as extra work, but the owner will make no payment for the placing of same.

204.4.1.9 Portable Trench Box and Sliding Trench Shield

1. Portable trench boxes and sliding trench shields approved by the State of Wisconsin may be used as long as in the judgment of the contractor, job conditions warrant such use. Use of the shield does not relieve the contractor of any liability for damages to persons or property occurring from or upon the work of constructing the sewer or appurtenances occasioned by negligence or otherwise including:
    a. A failure on the part of the contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of the ground.
    b. Disturbance of the completed work or any of the surface or subsurface structures.
2. Take care when a trench box or shield is moved ahead so as not to pull the already jointed pipe apart or leave voids around the pipe wall.
3. When required by the engineer, provide an acceptable method of rechecking line, grade, and horizontal location of the pipe after the shield has been moved ahead. If the pipe has moved, reset it to the proper line and grade.

4. Where a concrete cradle or envelope is required, provide a suitable spacer between the concrete and the shield. Use tar paper or other suitable material to prevent a bond between the spacer and the concrete, so as to permit moving of the shield without disturbing the pipe, cradle or envelope.
5. Use trench shields or boxes with a width such that a minimum 6-inch horizontal clearance is maintained between the pipe and shield at all times.
6. Fill any voids between the trench box or shield and the undisturbed trench wall within the bedding section (bottom of trench to top of initial backfill) with bedding material, immediately after the box or shield is positioned.

204.4.1.10 Unstable Foundations

1. When the trench bottom is wet, soft, or spongy so that, in the opinion of the engineer, it will not provide a proper foundation for the pipe, over excavate the trench until a firm foundation is obtained. Backfill the over excavated portion of the trench with such material and in such a manner as may be required by the engineer. All over excavation and associated backfilling will be paid for as extra work, except as specified in 204.4.2.7 item 4 and item 8 and when the unstable foundation is a result of the contractor's operations in which case it shall be provided for at the contractor's expense.
2. Where the distance to stable ground is excessive the owner reserves the right to order, in writing, as extra work such other types of foundation as the engineer deems necessary.

204.4.1.11 Over Excavation

1. Whenever the excavation is carried beyond the lines and grades shown on the plans or standard detail drawings, or as determined by the engineer, the contractor shall at their own expense, backfill all such excavated space with such material and in such a manner as may be required by the engineer. Thoroughly compact the over excavated space beneath and around concrete structures when backfilling or, if deemed necessary by the engineer, backfill with concrete at the contractor's expense.

204.4.2 Excavation

204.4.2.1 General

1. Unless otherwise indicated, use open cut excavation with an unrestricted trench for sewers and appurtenances. When a restricted trench is specified or indicated, provide sheeting, shoring, and bracing to limit the width of the trench to the width of the bedding section. The contractor may use any method of excavation that will not damage or endanger adjacent structures, utilities, or property, or disturb the natural soils at or below the bottom of the excavation.
2. Begin excavation for the trench at the downstream end of the proposed sewer and proceed toward the upstream end.
3. Excavate the trenches to the required alignment and grades indicated on the plans and as laid out in the field by the engineer.
4. Keep trenches dewatered at all times.
5. If the contract specifies or the engineer allows, the contractor may construct sewers by tunneling or jacking instead of open trenches. Adhere to the construction details, construction specifications, and engineer’s decision.

204.4.2.2 Trench Width

1. The maximum width of trench measured at the top of the pipe must not exceed the outside diameter of the pipe exclusive of bells and collars, plus 24 inches, and such maximum width is inclusive of all trench timbers unless otherwise indicated. Always provide sufficient space between the pipe and the sides of the trench to allow for preparing the foundation, laying the pipe, and placing and compacting the backfill. Maintain a minimum of 6 inches between the pipe and the trench wall, unless indicated otherwise. Maintain a minimum of 1 foot between the pipe and the trench wall for corrugated steel pipe and pipe arch. Keep the trench walls vertical from the bottom of the trench to the top of the pipe, wherever possible.
2. Where the normal trench width below the top of the pipe is exceeded for any reason, the contractor, at their own expense, shall furnish an adequate section for the actual trench width. This may be accomplished by furnishing a stronger pipe, a better bedding section, or providing concrete encasement, whichever is an adequate section as determined by the engineer. When the pipe specified is strong enough for the actual trench width, as determined by the engineer, no further provisions need be made for this greater trench width.
3. Where wide trench construction is specified, the width of the trench at the top of the pipe is not limited. Extend the bedding section width for wide trench construction 2½ diameters on either side of the pipe or to the trench wall, whichever is less.

204.4.2.3 Excavated Materials

1. Stockpile all excavated material to be used as backfill in a manner that will not endanger the work, cause an obstruction, or block drainage.
2. Remove excavated material not to be used for backfill from the site of the work as soon as excavated. The owner has prior claim to all surplus excavated material. If the owner exercises such claim, the material shall be deposited by the contractor, at such points as designated by the engineer up to 3 miles from the site of the work. If the owner wishes to use a site greater than 3 miles from the site of the work an adjustment to the contract price will be made with a change order. After delivery to such designated location spread and level the material. If the owner does not wish to claim any or all excavated material, obtain a site for disposal of the material.

204.4.2.4 Materials Type

1. The engineer will classify the materials of excavation either as earth excavation or as rock excavation.
2. Earth excavation includes all clay, silt, loam, sand, gravel, slate, hard pan, pavements of all kinds, soft sandstone or limestone, loose stone, all boulders measuring less than one cubic yard in volume, all old sewers and manholes being abandoned and lying in the path of new construction, and all storm sewer laterals and catch basins requiring removal to make way for new sewer construction.
3. Rock is any hard, solid material in ledges, bedded deposits, and unstratified masses, and conglomerate deposits or any other material so firmly cemented they present the characteristics of solid rock, and the engineer determines it is impracticable to excavate this material without blasting or using rippers. Rock also includes removing rock boulders having a volume of one cubic yard or more.

204.4.2.5 Rock Excavation

1. When rock excavation is required perform the work as specified in 609.

204.4.2.6 Tunnel Excavation

1. Locate tunnel shafts as shown on the plans or as approved by the engineer. Provide excavation of sufficient size to permit the construction of the sewer to the lines, grades and dimensions called for by the plans.
2. Adequately sheet and brace all tunnel excavations. No payment will be made for bracing or sheeting left in place in tunnels.
3. Should the soil be so unstable as to require extraordinary measures to protect the work such as liner plates and/or air pressure, the measures to be adopted and the costs of the extra work shall be agreed upon in advance.

204.4.2.7 Bedding - Constructing Foundation

1. Construct the foundation in the excavation to prevent subsequent settlement or rupture of the sewer pipe or catch basin, manhole, or inlet base.
2. Do not lay the pipe or catch basin, manhole, or inlet base in rock, wet conditions, or on a firm earth subgrade.
3. Lay pipe or catch basin, manhole, or inlet bases on a backfilled granular foundation or bed. When placing the pipe on backfilled granular foundation, excavate the trench to at least 4 inches below the elevation established for the bottom of the pipe and a minimum of 3 inches below the bell. For sewer pipe 18 inches in diameter or less, use ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 204-1***. For pipe larger than 18 inches in diameter, use ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 204-1*** or ¾-inch crushed stone chips meeting the gradation requirements of ***Table 204-2***. When placing precast concrete box sections or catch basin, manhole, or inlet bases on backfilled granular foundation, excavate the trench to at least 6 inches below the elevation established for the bottom of the box section or base and backfill with ⅜-inch crushed stone chips or ¾-inch crushed stone chips. If excavation has been carried deeper than 6 inches below the pipe barrel or catch basin, manhole, or inlet base, fill the excess depth with backfill concrete or No. 1 crushed stone meeting the gradation requirements of ***Table 202-2***. Compact the material before laying the pipe on the backfilled granular material.
4. In wet, but otherwise stable trenches, the contractor may, if acceptable to the engineer, over excavate the bottom of the trench and install not less than 3 inches of ¾-inch crushed stone chips. Compact the ¾-inch crushed stone chips using a power operated tamper.
5. In rock excavation increase the minimum depth of the bedding section below the pipe to 6 inches and fill with ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 204-1.*** Place, tamp, and level bedding material to provide a proper, uniform-bearing cushion under the pipe.
6. Take care to insure that pipe does not rest directly on the bell but is uniformly supported through the entire length.
7. After laying the pipe, place bedding material around the sides of the pipe, except reinforced concrete pipe, up to a level 12 inches above the top of the pipe. Place this material by hand or equally careful means. When reinforced concrete pipe is installed, extend the bedding stone to the spring line of the pipe and add cover material up to a level 12 inches above the top of the pipe. Where horizontal elliptical pipe is being laid, take special care to insure proper bedding of the pipe, making certain that the space under the bottom half of the pipe is completely filled with the bedding material and that such material is properly compacted to prevent settlement of the pipe after the trenches are backfilled.
8. Excavate recesses to receive bells as necessary.

9. If the contract details types of bedding or required excavation widths others than those described in 204.4.2.2 and 204.4.2.7, conform to the construction details.
10. If the foundation material encountered lacks satisfactory bearing strength, lay the sewer in a concrete cradle supported on a masonry foundation carried to a soil of satisfactory bearing strength or supported on a structure designed to carry the weight of the sewer and its load to firm bearing. A cap section may be substituted for the concrete cradle when sheathing and shoring is not below the spring line of the pipe and it is left in place below the top of cap. Start and stop the concrete cradle, cap or envelope, in all cases, at pipe joints. Do not start or stop concrete cradle, cap, or envelope behind the bell of the pipe. Use class D concrete to construct concrete cradles, caps, and envelope.
    a. **CONCRETE CRADLE**: Set the pipe in bedding concrete placed in a flat bottom trench. Use a minimum bedding concrete thickness under the pipe of 4 inches for pipes with diameters 6 inches to 42 inches, inclusive; 6 inches for pipes with diameters 48 inches to 60 inches, inclusive; and 8 inches for pipe with diameter greater than 60 inches. Extend the concrete up one-fourth the outside diameter of the pipe barrel at the sides. Use a minimum cradle width equal to the outside diameter of the pipe plus 12 inches. Use solid concrete masonry units to support the pipe at the correct grade. After the concrete has set fill the remaining portion of the bedding section to a depth of 6 inches over the pipe with ¾-inch crushed stone chips, meeting the gradation requirements of ***Table 204-2***, compacted to 90% of the maximum dry density.
    b. **CONCRETE CAP**: Bed the pipe in ¾-inch crushed stone chips, meeting the gradation requirements of ***Table 204-2***, compacted to 95% of the maximum dry density placed on a flat trench bottom. Ensure that the bedding, and not the pipe, supports the concrete cap. Use a minimum ¾-inch crushed stone chips thickness under the pipe of 4 inches under the barrel and 3 inches under the bell. Extend the crushed stone chips up one-half the outside diameter of the pipe barrel at the sides. Cover the top half of the pipe with a concrete cap having a minimum thickness at the crown of 4 inches or one-fourth the pipe diameter, which ever is greater. Use a minimum cap width equal to the outside diameter of the pipe plus 12 inches. Fill the remainder of the bedding section with ¾-inch crushed stone chips compacted to 90% of the maximum dry density.
    c. **CONCRETE ENCASEMENT**: Set the pipe in bedding concrete placed in a flat bottom trench. Use a minimum thickness of bedding concrete of 4 inches under the barrel and 3 inches under the bell. Extend concrete to undisturbed earth at the walls of the trench. Support the pipe on solid concrete masonry units. Use multiple pours of concrete to prevent flotation of the pipe.

<u>204.4.2.8 Backfilling</u>

1. Do not commence trench backfill until pipe has been properly bedded.
2. Carefully deposit backfill material in uniform layers.
3. Debris, frozen material, large clods or stones, organic matter, or other unstable materials may not be used for backfill.
4. When the trench is under or within 2 feet of any future pavement, gravel shoulder or sidewalk, fill the remainder of the sewer trench with crushed stone screenings meeting the gradation requirements of ***Table 204-4***, 1¼-inch dense base meeting the gradation requirements of ***Table 204-5***, or ¾-inch dense base meeting the gradation requirements of ***Table 204-6*** up to the subgrade elevation. Install backfill at a 1:1 slope to the bottom. Install a 2-foot lift for the first lift and 10-inch lifts for subsequent lifts. Compact using a vibratory compactor to 95% modified proctor.

5. The contractor may use material from the trench excavation that meets the granular backfill requirements with the approval of the engineer. If the contractor decides to use the excavated material, they must supply a gradation analysis showing that it meets the minimum requirements of granular backfill.
6. Suitable excavated material may be used as backfill when the trench is greater than 2 feet from any future pavement, gravel shoulder or sidewalk. Install a 2-foot lift for the first lift and 12-inch lifts for subsequent lifts. Compact using a vibratory compactor to a minimum 80% and maximum 90% modified proctor. Top the backfill material with a minimum of 4 inches of topsoil suitable for seeding. Finish grade topsoil.
7. Use aggregate slurry backfill or lean concrete mix backfill when required on the plans and/or specifications.
8. Utilize special compaction methods around catch basins, manholes, or inlets to insure proper compaction. Simultaneously backfill around all sides so that appurtenances do not suffer damage and remain plumb.
9. Use concrete backfill to support sewers, laterals, and other utilities crossing trenches or when directed by the engineer.
10. Normally, jetting or flooding of trenches for compaction will not be permitted. However, if jetting or water flooding for consolidating the backfilling is directed or ordered by the engineer, do not apply the first flooding until after the backfill, to a height at least 2 feet above the top of the pipe or sewer, has been thoroughly compacted by tamping, and apply the second flooding during or after the subsequent filling of the trench. Avoid an excess of water in order to prevent undue pressure upon the pipe or sewer. When jetting or flooding is authorized remove such water from the trench by well-pointing or a sump pump located downstream from the section being jetted or flooded, in order to get excess water out of the trenches and to facilitate better settling of the granular backfill.
11. Carefully draw and remove all sheeting and braces in a manner that will not disturb the completed work. Carefully refill all openings left from the pulled sheeting with an engineer-approved backfill material and compact.
12. Do not walk or work on completed pipes, except as necessary to tamp or backfill, until the trench has been backfilled to at least 2 feet above the top of the pipe.
13. Backfill the trenches to the surface within 24 hours after installation and haul away all surplus materials.
14. Conduct backfilling in every case in a manner which will insure that the pipes and appurtenances are not damaged in any way. To this end, place backfilling materials with a minimum drop. In case of breakage or disturbance to the sewer pipe or appurtenances, the contractor will be required at their own expense to re-excavate, repair, and replace in-kind.
15. Do not backfill sewers, where they do not terminate in a manhole, until the ends have been surveyed for position and grade by the engineer. In case the contractor fails to observe this requirement, the contractor shall uncover the end of such sewer to permit surveying and refill the trench, at no additional cost to the owner.
16. Leave streets, sidewalks, and other places disturbed or affected by the excavation in, as near practicable, the same condition as they were prior to being disturbed; and keep said streets, sidewalks, and places disturbed in good condition, satisfactory to the engineer throughout the project. Maintain trench disruptions located in the traveled way of public streets or sidewalks that remain open to through pedestrian or vehicular traffic with temporary asphalt, concrete pavement, or suitable hard surface approved by the engineer until permanent pavement is installed.

204.4.3 Finish

1. Uniformly grade all areas covered by the work to the elevations shown on the plans or as required for restoring the surface to its original condition. Finish to the degree that is ordinarily obtainable from a blade grader.

204.5 Basis of Payment

1. Work specified in 204 is incidental to the contract, unless noted otherwise.
2. The owner will pay separately for rock excavation as specified in 609.5.
3. If the contract does not include the rock excavation item, the owner will pay for the removal of hard solid rock and boulders larger than one cubic yard as extra work.
4. The owner will pay separately for the removal and disposal of contaminated soils as specified in 612.4.

205 Boring and Jacking

205.1 Scope

1. This section describes furnishing and installing casing pipes and carrier pipes of various sizes using boring and jacking.

205.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2. Include information on the name of the pipe manufacturer, the dimensions of the pipe, and details on the materials and method of pipe manufacture or fabrication.
2. Submit a jacking plan for all boring and jacking operations as specified in 106.2.2. Identify the following on the plan:
   A. Installation operations including the method and equipment to be used, the location and size of the jacking pits, and the limits of the proposed jacking.
   B. Methods of maintaining and adjusting line and grade.
   C. Drilled/bored diameter.
   D. Drill hole stabilization procedures.
   E. Temporary dewatering measures.
   F. Mitigation procedures if sinkholes or settlement occurs above the pipe or excessive movement of settlement monitors is observed.
   G. Size and location of the auger head relative to the casing.
   H. Estimated jacking thrust required.
   I. Method of monitoring casing elevation.
   J. Record keeping system to document casing advance and jacking pressures.

205.3 Materials

205.3.1 General

1. Furnish casing pipe consistent with the diameter the bid item indicates and conforming to the following:
   A. Steel casing pipe
   B. Fiberglass reinforced polymer mortar pipe **ASTM D3262**
2. For steel casing pipe, provide field-welded butt joints or interlocking joints.
   A. For butt-joint casing, furnish pipe conforming to **ASTM A53 Grade B** or **ASTM A139 Grade B**.
   B. For interlocking joint casing, furnish pipe conforming to **ASTM A1097** and the following:
      a. Maintain pipe roundness to within 1% of specified diameter.

b. Maintain outside circumference to within 1% of nominal specified circumference, or ¾ inches, minimum.
c. Maintain wall thickness to within 5% of specified thickness.
d. Provide pipes fabricated using the rolled and welded cylinder method and the double submerged arc welding process in sections not less than 8 feet long, except as needed to achieve the final finished length of pipe.
e. Provide complete penetration butt-welded connectors square to ends of pipe sections.
f. Perform welding according to **ANSI/AWS D1.1**.
g. Examine connections at time of shipment. Reject sections with defects.
h. Ship pipe with protective wax coating over machined surfaces.

3. Unless otherwise tested or approved by the engineer, only use encasement pipe or uncased carrier pipe that is new and has smooth interior and exterior walls.

205.3.2 Carrier Pipe

1. Conform carrier pipe to be installed within casing pipe to the same requirements as pipe to be installed by open cut excavation unless noted otherwise.

205.3.3 Casing Pipe

1. Use casing with a minimum inside diameter not less than 4 inches larger than the maximum diameter of the carrier pipe.
2. Provide steel casing pipe with a minimum wall thickness as required by permit requirements or the contractor's method of construction, whichever is greater, but in no case less than the values in ***Table 205-1***.

Table 205-1
Casing Pipe Wall Thickness

Nominal Casing Diameter (Inches)	Nominal Wall Thickness (Inches)
6	Use 6 inch Ductile Iron AWWA C151 Pipe
8	Use 8 inch Ductile Iron AWWA C151 Pipe
10	Use 10 inch Ductile Iron AWWA C151 Pipe
12	Use 12 inch Ductile Iron AWWA C151 Pipe
15	Use 15 inch Ductile Iron AWWA C151 Pipe
18	0.3125 (5/16)
20	0.375 (3/8)
24	0.375 (3/8)
30	0.469 (15/32)
36	0.531 (17/32)
42	0.625 (5/8)
48	0.688 (11/16)
54	0.781 (25/32)
60	0.844 (27/32)
66	0.938 (15/16)
72	1.000 (1)
84	1.156 (1-5/32)
96	1.312 (1-5/16)

205.3.4 Corrosion Protection

1. Provide corrosion protection for steel casing pipes by installing anode bags or coating the inside and outside of the casing pipe. Furnish corrosion protection listed below as required on the plans or directed by the engineer:
   A. Sacrificial anode bags as specified in 414.3.
   B. Steel pipe coating listed below:
      a. Hot dip galvanizing.
      b. Epoxy conforming to the requirements of **AWWA C210**.

205.3.5 Casing Spacers

1. Furnish casing spacers designed to guide and support the carrier pipe in the casing. Standard casing spacers consist of a 14-gauge **AISI Type 304** stainless steel attachment band with a PVC or EPDM liner and not less than 4 10-gauge **AISI Type 304** stainless steel risers. Equip each riser with a removable ultra-high molecular weight polymer or glass-reinforced plastic runner. Use **AISI Type 304** stainless steel attachment hardware. Provide a minimum spacer width of 8 inches. Furnish a standard casing spacer listed below:
   A. Model SSI by Advance Products & Systems, LLC.
   B. Model CCS by Cascade Waterworks Manufacturing.
   C. CSS8 by CCI Piping Systems.
   D. CSS12 by CCI Piping Systems.

205.3.6 Casing End Seals

1. Furnish pull-on or wrap around EPDM or neoprene casing end seals designed to seal the space between the casing and carrier pipes at the ends of the casing pipe. Furnish an end seal listed below:
   A. Model AC End Seals by Advance Products & Systems, LLC.
   B. Model AW End Seals by Advance Products & Systems, LLC.
   C. Model CCES by Cascade Waterworks Manufacturing.
   D. Model ESC by CCI Piping Systems.
   E. Model ESW by CCI Piping Systems.
   F. Model “C” Pull-on End Seals by Garlock.
   G. Model “W” End Seals by Garlock.
   H. J-Four Pull-On End Seal by Hoff Company.
   I. J-Four Rubber Wrap Around End Seal by Hoff Company.

205.3.7 Sand Slurry

1. Use sand slurry composed of fly ash, sand, and water proportioned as specified. Furnish materials conforming to the following:
   A. Class C or F fly ash conforming to the requirements of **ASTM C618**.
   B. Sand conforming to **ASTM C33** and graded so that 100% by weight will pass a standard No. 8 mesh sieve and at least 45% by weight will pass a standard No. 40 mesh sieve.
   C. Air-entraining admixture conforming to **ASTM C260** and listed below:
      a. Darex AEA by GCP Applied Technologies.
2. Use slurry for filling the space between the casing and carrier pipes.
3. **Design Mix**: Use a sand slurry mixture of 5 parts sand, one part fly ash, air entrainment (1 ounce per 430 pounds of sand), and water (1 gallon per 37.5 pounds of sand).

205.4 Construction

205.4.1 General

1. Construct a jacking pit of sufficient size to accommodate the backstop, jacks, pushing frame and pipe to be jacked. Use a pit with guide rails or timbers to keep the pipe in alignment and on grade. Provide a push frame to evenly distribute the jacking pressure to protect the ends of the pipe being jacked. Use a minimum of 2 hydraulic jacks. Fit the casing pipe with a hardened steel cutting edge.
2. Jack the casing upgrade, if possible, to facilitate drainage.
3. Ensure that all pipe is on site before starting jacking.
4. Investigate all sites for the possibility of having to manage groundwater problems that may occur due to seasonal changes or natural conditions.

205.4.2 Casing Installation

1. Push the casing into place as the soil is excavated from the inside of the pipe. Do not allow the excavation to precede the leading edge of the casing unless it is necessary to remove a large obstruction. Accomplish excavation for small diameter casing using a boring auger. Accomplish excavation for large diameter casings by hand or mechanical means. Once the jacking operation is started continue it without interruption until completion.
2. Do not exceed forces recommended by the manufacturer for joining or pushing pipe.
3. Ensure that the casing pipe in its final position is straight and true in alignment and grade.
4. Ensure that there is no space between the earth and the outside of the casing.
5. If it is necessary to over excavate, identify the location and pressure grout after the casing is in place.
6. Ensure that the final alignment of the casing pipe is within 3 inches of the line and grade.
7. Do not allow the bore head to extend more than 1 inch ahead of the casing.

205.4.3 Steel Casing Pipe Joints

205.4.3.1 Field-Welded Butt Joints

1. Joint steel casing pipes with a continuous weld for the full circumference. Provide watertight welded butt joints capable of resisting all jacking stresses. A qualified welder must perform all welding.

205.4.3.2 Interlocking Joints

1. Provide integrated interlocking joints. Apply silicone sealant and ensure joint is watertight.

205.4.4 Fiberglass Reinforced Polymer Mortar Pipe Joints

1. Clean ends of pipe and joint components. Apply joint lubricant to the bell interior surface and the elastomeric seals. Use only lubricants approved by the pipe manufacturer.

205.4.5 Corrosion Protection

1. Install sacrificial anode bags as specified in 414.4.
2. Protect coatings from damage during installation.

205.4.6 Boring Without Casing Pipe

1. Install pipe by boring without a casing pipe when shown on the plans or with written permission of the engineer.
2. Limit bores without a casing pipe to a maximum of 16 feet in length. Ensure that all joints are located outside the bore.
3. Place bedding before pushing in pipe. Backfill between pipe and bored hole by pumping or blowing in sand.

205.4.7 Tracer Wire

1. Place tracer wire in the casing pipe and attach to the carrier pipe.
2. If tracer wire is attached externally to bored pipe, attach a minimum of 2 separate and continuous tracer wires. Ensure the conductors are located on opposite sides of pipe.

205.4.8 Augering Fluids

1. Use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Do not use other chemicals or polymer surfactant in the drilling fluid without written consent of the engineer.
2. Certify in writing to the engineer that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds, or fire hydrants. Any water source used other than potable water may require a pH test.

205.4.9 Excess Material and Fluids

1. Monitor the pumping rate, pressures, viscosity, and density of the boring fluids to ensure adequate removal of soil cuttings and the stability of the bore hole. Contain excess drilling fluids, slurry, and soil cuttings at entry and exit points in pits until they are recycled or removed from the site. Ensure all boring fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, and federal regulatory agencies.
2. When jacking and boring in suspected contaminated ground, test the boring fluid for contamination and dispose of appropriately. Remove any excess material upon completion of the bore. If it becomes evident the soil is contaminated, contact the engineer immediately. Do not continue boring without the engineer’s approval.

205.4.10 Boring Failure

1. If any obstruction is encountered, which prevents completion of the installation in conformance with the design location and specifications, the pipe may be taken out of service and left in place at the discretion of the engineer. Immediately fill the product left in place with excavatable, flowable fill. Submit a new installation procedure and revised plans to the engineer for approval, before resuming work at another location.
2. If damage is observed to any property, cease all work until a plan of action to minimize further damage and restore damaged property is submitted and approved by the engineer.

205.4.11 Carrier Pipe Installation

1. After the casing has been installed and accepted by the engineer, install the carrier pipe. Position spacers to adequately support the carrier pipe throughout the casing. Install a casing spacer within 1 foot of each end of the casing, on each side of each pipe joint, and at a maximum spacing of 6 feet, at a minimum. Assemble and locate casing spacers in strict conformance with manufacturer's recommendations. Size the casing spacers such that the carrier pipe will meet the line and grade as indicated on the drawings and be centered as close as possible in the casing.
2. Push and pull the carrier pipe into place in such a manner that there is no opportunity for a joint to be opened or over inserted. Adjust the carrier pipe length so that the end extends past the end of the casing 12 to 18 inches.
3. Fill the space between the casing and carrier with a sand slurry when required on the plans or directed by the engineer.

4. After the carrier pipe is installed seal the end of the casing using an end seal.

205.4.12 Sand Slurry Application

1. Pump or pour sand slurry into the void between the casing and carrier pipe by means of a filler pipe. Install the filler pipe at the top of the seal at the low end of the casing and install a vent pipe at the seal on the other end of the casing. Use PVC pipes for filler and vent pipes and extend up to an elevation above the highest part of the casing or to ground level. Install the filler pipe such that the top of the filler pipe is located at an elevation approximately 6 inches higher than the vent. Add sand slurry to the void between the casing pipe and carrier pipes until the slurry flows from the vent pipe. After 24 hours, remove the filler and vent pipes at the end seals.

205.4.13 Pressure Grouting

1. Use qualified mechanics under supervision of experienced foremen to perform pressure grouting, where required.
2. Use an apparatus for mixing and placing cement grout of a type acceptable to the engineer and capable of effectively mixing and stirring the grout and forcing it into the holes or grout connections in a continuous, uninterrupted flow at any specified pressure up to a maximum of 15 pounds per square inch. Provide gauges, with an accurate meter reading in cubic feet to tenths of a cubic foot, for controlling the amount of mixing water used in the grout. In addition to the grout mixer, provide holdover mechanical agitator tanks. Pump all grout with a duplex piston–type pump.
3. Prior to grouting, thoroughly wash clean systems and holes to be grouted. No washing will be required for grouting soil voids outside pipe cylinders or casing pipes. Complete grouting without stoppage once started. In case of breakdown of equipment, the contractor, at the engineer's option, shall wash out the grouting system. Maintain grout pressure until grout has set.

205.4.14 Settlement Monitoring at Railroad Tracks

1. For crossings under railroad tracks, monitor rail elevations prior to, during, and immediately after boring and jacking operations. Perform monitoring using a method approved by the engineer and the railroad.
2. Submit a settlement monitoring plan as specified in 106.2.2. Identify the following on the plan:
   A. Type of probes or monitoring.
   B. Location of settlement monitoring probes, plates, or measurements.
   C. Frequency and duration of monitoring.
3. Record elevations with an accuracy of 0.01 feet.
4. Immediately report to railroad any settlement $^{3}/_{16}$ inches or greater. Immediately stop work and report to railroad any settlement ⅜ inches or greater.

205.5 Testing

1. When there is any indication the installed product has sustained damage and may leak, stop the work, notify the engineer, and investigate damage. The engineer may require a pressure test and reserves the right to be present at the test. Perform pressure test within 24 hours, unless otherwise approved by the engineer. Furnish a copy of the test results to the engineer for review and approval. Allow the engineer up to 72 hours to approve or determine if the product installation is not in compliance with specifications. The engineer may require non-compliant installations to be filled with excavatable, flowable fill.
2. Perform testing of carrier pipes as specified in 212.

205.6 Basis of Payment

1. The lump sum price for the mobilization and demobilization of boring and jacking equipment bid item is full compensation for installing and removing the boring and jacking equipment; for providing access to the site; for maintaining site drainage; for providing dust abatement; for providing construction utilities; for excavating the boring pit and receiving pit; for providing and removing sheeting and shoring; for granular backfill material; for backfilling; and for restoring the site. Measure the mobilization and demobilization of boring and jacking equipment bid item as follows:
   A. The first 60% will be measured after the equipment is set up and ready for use.
   B. The remaining 40% will be measured after the equipment has been removed from the site and clean up has been completed.
2. The owner will measure the casing pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe. Payment for the casing pipe bid items is full compensation for dewatering; for removing and disposing excess material; for laying pipe; for filling the space between casing and carrier pipe; for furnishing and installing stainless steel casing pipe spacers; for end seals; for corrosion protection; for settlement monitoring; for cleaning out; and for restoring the site.
3. The owner will measure the carrier pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe. Payment for the carrier pipe bid items is full compensation for laying pipe; for sealing joint; for cleaning out; for testing pipe; and for restoring the site.
4. If conditions warrant removal of any materials installed during a failed bore path, as determined by the engineer, it will be at no cost to the owner.

206 Directional Drilling

206.1 Scope

1. This section describes installing sewer pipes and appurtenances of various sizes using directional drilling.

206.2 General Requirements

1. Submit a drilling plan for each installation as specified in 106.2.2 and 206.4.1.
2. Record the ground elevation at the point of measurement and the alignment and depth of the pipe every 10 feet and at all changes in direction and changes in grade. Reference all depth measurements to the center line of the pulling head. Document the alignment and depth information on a set of as-built drawings. Convert depth measurements to elevations using the project vertical datum.
3. Perform directional drilling in conformance with *WDNR Conservation Practice Standard 1072*.

206.3 Materials

206.3.1 Drilling Fluid

1. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds, or fire hydrants. Any water source used other than potable water may require a pH test.
2. Furnish drilling products on the WDNR approved horizontal directional drilling products list.

206.4 Construction

206.4.1 Drilling Plan

1. Include the following information on the drilling plan:
   A. A detailed schedule.
   B. Working plans showing the general arrangement of the contractor's work areas, storage areas, and laydown areas showing locations of drill entry and exit work shafts, slurry work shafts and plants, drilling equipment, and pollution prevention measures among other features. Show the layout profile and supports for any work shafts, trenches, or other excavations required to drill and install the pipe on the working plans.
   C. Composition and plan for safe disposal of drilling fluids and additives.
   D. Methods for maintaining borehole stability and for controlling seepage and lost ground at the borehole junctures with work shaft walls.
   E. Temporary dewatering measures, spill response materials maintained on-site, and spill response procedures.
   F. Mitigation measures for inadvertent releases including the following:
      a. Site personnel response training.
      b. List of materials and equipment to be used and staging location.
      c. Description of site-specific plans for access.
      d. Immediate and extended response and control plans.
      e. Description of requirements before drilling resumes after an inadvertent release.
      f. Restoration methods.
      g. Location-specific contact information for agencies and response teams.
   G. A contingency plan detailing the contractor's proposed response to obstructions encountered along the hole alignment, unanticipated conditions, changes, and other problems arising due to the selected construction procedure or other conditions to ensure completion of the project accordingly.
   H. Record information of the pilot hole drilling.

206.4.2 Guidance System

1. Use a manufactured guidance system that provides a continuous and accurate determination of the location of the drill head during the drilling operation. Use a guidance system that conforms to the following requirements:
   A. Capable of tracking the drill head at all depths up to 50 feet and in any soil condition.
   B. Provides immediate information on the tool face, azimuth, and inclination.
   C. Calibrated to the manufacturer's specifications.
   D. Accurate at sensing the drill head's position within plus or minus 1 foot horizontally and plus or minus 0.25 foot vertically.
2. Do not proceed with directional drilling unless the guidance system is operating correctly. Calibrate the guidance system in the presence of the engineer. Dig a verification pit 10 feet from the initial point of entry, unless a different location is approved by the engineer. Measure the depth and alignment at the verification pit and ensure that the guidance system accuracy requirements are met.

206.4.3 Site Survey

1. Accurately survey the entire directional drill route. Mark the entry and exit locations as shown on the contractor's directional drilling plan. Field verify the location and elevation of all existing utilities that will be crossed during the directional drilling operation. Survey the directional drill route for any surface geo-magnetic variations or abnormalities if the contractor is using a magnetic guidance system.

206.4.4 Trenchless Installation

206.4.4.1 Pilot Hole

1. Drill a pilot hole at the alignment and grade shown on the construction drawings.
2. Take readings with the guidance system after each successive drill pipe but not more than 10 feet.
3. At no time allow the deflection radius of the drill pipe to exceed the maximum specified deflection of the sewer pipe to be installed.
4. Upon approval of the pilot hole location, ream the pilot hole larger. Ream the pilot hole to the diameter recommended by the pipe manufacturer or a maximum of 1.5 times larger than the largest outside diameter of pipe, whichever is smaller.
5. Select the drilling fluid based on the existing soils. Use a drilling fluid acceptable to the pipe manufacturer. Monitor returns continuously during drilling operations. Inspect the drill path immediately upon noted loss of drilling fluid.

206.4.4.2 Pipe Installation

1. Pull the pipe through the drilled hole using constant tension throughout the operation. Use a pulling device with a direct reading gauge to indicate the pulling tension.
2. Select wall thickness for the pipe that will withstand the pulling forces exerted on the pipe. Use a minimum wall thickness for the pipe listed in the piping system specifications.
3. Do not allow the actual tension to exceed the safe pulling tension of the pipe.
4. Allow HDPE pipe to relax for 24 hours prior to making the final connections.

206.4.5 Tracer Wire

1. Attach tracer wire to the pulling eye and the top of the sewer pipe. Ensure the conductors are located on the opposite sides when installed externally.

206.4.6 Borehole Abandonment

206.4.6.1 General

1. Abandon boreholes, installed pipe, and/or partially installed pipe that fails to meet the requirements of 206 and backfill with grout. Rejection criteria includes failure to drill the borehole to within the required tolerances, failure to maintain the borehole open for insertion of the pipe, and failure to install the pipe properly without damage, collapse, or parting the joints.

206.4.6.2 Sand-Grout Mix

1. Completely grout abandoned boreholes and pipe with a sand-cement grout mix conforming to the following requirements and approved by the engineer:
   a. Furnish grout consisting of a mixture of water and portland cement, with mineral fillers or admixtures as necessary to achieve a non-shrink, non-bleed, flowable grout.
   b. Achieve a minimum 28-day compressive strength of 5000 psf.
2. Furnish sand for grout consisting of clean natural silica sand, graded such that 100% of the material passes the No. 20 sieve and not more than 20% passes the No. 200 sieve.

206.4.6.3 Grouting

1. Inject grout into the borehole through drill rods or pipes extending to the end of the borehole or pipe. Inject grout at a pressure sufficient to overcome the hydrostatic pressure of the drilling fluid, but not high enough to cause heave or damage to the overlying or

adjacent structures. Inject grout until the borehole or pipe is flushed of all drilling fluid and the return flow at the collar of the boring or pipe shows undiluted grout.

2. Plug the boring or pipe to maintain the grout in the boring or casing until the grout has set. Inject additional grout as necessary to fill voids left as a result of shrinkage or bleeding of the grout.

206.5 Basis of Payment

1. Work specified in 206 is incidental to the contract, unless noted otherwise. Include all costs involved with directional drilling work for the sewer installation in the unit price for the work it is associated with as specified in 207.5, 208.5, and 210.5.
2. The contractor is responsible for any damage resulting from any drilling fluid-induced blow out or any inadvertent return.

207 Pipes

207.1 Scope

1. This section describes excavating required trenches or tunnels, laying or constructing sanitary sewer and storm sewer pipe inside, and then backfilling and cleaning out as necessary.

207.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2.

207.3 Materials

207.3.1 General

1. Furnish pipe consistent with the size the bid item indicates and materials conforming to the following:
   A. Round reinforced concrete pipe **ASTM C76**
   B. Horizontal elliptical reinforced concrete pipe **ASTM C507**
   C. Precast reinforced concrete box sections **ASTM C1433**
   D. Polyvinyl chloride sewer pipe and fittings (15 inches and smaller) **ASTM D3034**
   E. Polyvinyl chloride pressure pipe and fittings **AWWA C900**
   F. Polyvinyl chloride sewer pipe and fittings (18 inches to 48 inches) **ASTM F679**
   G. Polyvinyl chloride corrugated exterior, smooth interior sewer pipe and fittings (8 inches to 36 inches) **ASTM F949**
   H. Fiberglass reinforced polymer mortar pipe **ASTM D3262**
   I. Double wall polypropylene pipe (12 inches to 36 inches) **ASTM F2881** or **AASHTO M330**
   J. Triple wall polypropylene pipe (12 inches to 60 inches) **ASTM F2764**
   K. Corrugated polyethylene with smooth inner liner pipe (12 inches to 36 inches) **ASTM F2306** or **AASHTO M294 type S**
   L. Ductile iron pipe **AWWA C151**
   M. Corrugated steel pipe and pipe arch **AASHTO M36**
2. Manufacture precast reinforced concrete pipe in a plant listed on the WisDOT approved products list under precast concrete and block fabricators.
3. Furnish hot-dipped aluminum coated corrugated steel pipes conforming to the material requirements of **AASHTO M274** or **ASTM A929**.
4. Install all sewer pipes conforming to the manufacturer’s recommended bury depth chart.

5. Furnish fittings of the material and construction corresponding to and with a joint design compatible with the adjacent pipe. Provide approved couplings for transition to other types of pipe.
6. Pipe handling holes are permitted only on reinforced concrete pipe 21 inches or larger in diameter. The owner reserves the right to prohibit handling holes where deemed undesirable.

207.3.2 Joints

1. Furnish joint materials conforming to the following:
   A. Joints for concrete pipe and manholes, using rubber gaskets **ASTM C443**
   B. Joints for concrete box, using rubber gaskets **ASTM C1677**
   C. Elastomeric seals (gaskets) for joining plastic pipe **ASTM F477**
   D. Fiberglass pipe joints using flexible elastomeric seals **ASTM D4161**
   E. Joints for drain and sewer plastic pipes using flexible elastomeric seals **ASTM D3212**
   F. Joints for plastic pressure pipes using flexible elastomeric seals **ASTM D3139**
   G. Rubber gasket joints for ductile iron pressure pipe and fittings **AWWA C111**
   H. Corrugated steel coupling bands **AASHTO M36**
2. Furnish elastomeric gaskets for non-pressure sanitary sewer pipes which provide a continuous watertight conduit having an infiltration rate not exceeding 50 gallons per inch of pipe diameter per mile per day.
3. Furnish nitrile or fluorocarbon gaskets when specified on the plans for areas with anticipated contaminated soil or groundwater.
4. Legibly mark individual gaskets to identify them as to size and manufacturer of pipe and to distinguish oil-resistant types from other types. Raised, indented or indelible ink lettering is required. Color-coding or cross-section configuration is not acceptable as legible identification.

207.3.3 Reinforced Concrete Pipes (Round and Horizontal Elliptical)

1. Furnish pipe of the class noted on the plans and/or specifications.
2. Furnish tongue and groove type reinforced concrete pipe or bell and spigot type reinforced concrete pipe with rubber gaskets.
3. Furnish joint ties as specified in 202.4.5 item 10 or where noted on the plans.
4. Do not stack pipe more than 2 pipe segments high.

207.3.4 Reinforced Concrete Box Sections

1. Ensure that design table and depth of earth cover are as noted on the plans and/or in the special provisions.
2. Furnish joint ties as specified in 202.4.5 item 10 or where noted on the plans.
3. Supply box sections shown on plans and specified to have manhole risers above them with a 24 inch round opening cast in the roof.
4. Do not stack pipe more than 2 pipe segments high.

207.3.5 Polyvinyl Chloride Pipes

1. Store pipes in the supplier’s yard and on the project site in conformance with **AWWA M23** and manufacturer’s recommendations.
2. Do not stack pipe higher than 4 feet or on the bell ends.
3. Cover PVC pipe, which is stored outside for a prolonged period, with an opaque material to protect it from the sun’s ultraviolet radiation. Do not use PVC pipe that has been subjected to excessive ultraviolet radiation identified by color fading or chalking. The determination as to the acceptability of the pipe rests solely on the engineer’s decision.

4. Do not use pipe that has been contaminated in any way with petroleum products on the inside or outside of the pipe.

207.3.6 Ductile Iron Pipes

1. Furnish thickness class 52 pipe, unless specified otherwise.
2. Furnish pipe which is cement-mortar lined in conformance with **AWWA C104 (ANSI A21.4)**.
3. Furnish pipe with an asphaltic coating on the exterior of the pipe.
4. Do not stack pipe higher than 4 feet in height.

207.3.7 Corrugated Steel Pipe and Pipe Arch

1. Furnish pipe with a minimum thickness of 16-guage for pipes 24 inches and smaller, 14-guage for 30- and 36-inch pipes, 12-guage for 42-, 48-, and 54-inch pipes, and 10-guage for 60-inch pipes.
2. Furnish pipe arch with a minimum thickness of 16-guage for pipes with 21-inch equivalent diameter and smaller, 14-guage for 28x20-inch and 35x24-inch pipes, 12-guage for 42x29-, 49x33-, 57x38-, and 64x43-inch pipes, and 10-guage for 71x47-inch pipes.

207.3.8 Sanitary Sewer Pipe Materials

1. Furnish sanitary sewer pipes as follows:
   A. Use SDR 35 PVC sewer pipe conforming to **ASTM D3034** for all sanitary sewer pipes with a diameter of 15 inches or less unless indicated otherwise on the plans.
   B. Use PS46 PVC sewer pipe conforming to **ASTM F679** for all sanitary sewer pipes with a diameter larger than 15 inches unless indicated otherwise on the plans.
   C. Alternate sanitary sewer pipe materials are permitted where the pipe material is not specified in the plan or profile. Qualifying quantities are labeled as "(Size) Sanitary Sewer Main" in the schedule of prices. Include the costs for a larger diameter manhole in the prices bid for sanitary sewer main whenever the use of an alternate material will require a manhole of a larger diameter than that required for SDR 35 PVC pipe. The accepted alternative materials are limited to the following:
      a. For pipes 18 inches to 36 inches, corrugated exterior, smooth interior PVC sewer pipe.
      b. For pipes 30 inches or larger, fiberglass reinforced polymer mortar pipe.
      c. For pipes 30 inches to 60 inches, triple wall polypropylene pipe.
      d. For pipes 30 inches or larger, reinforced concrete pipe. Reinforced concrete pipes may only be used where specifically indicated on the plans.
2. Do not use SDR 35 PVC sewer pipe where the height of cover from the top of pipe to the existing ground elevation or proposed subgrade, whichever is less, is less than 2 feet.
3. Do not use SDR 35 PVC sewer pipe when bury depths exceed 20 feet. If depths exceed 20 feet, use SDR 26 PVC sewer pipe, PS115 PVC sewer pipe, or concrete pipe.

207.3.9 Storm Sewer Pipe Materials

1. Furnish storm sewer pipes as follows:
   A. Use reinforced concrete pipe of the class listed on the plans or schedule of prices unless indicated otherwise on the plans. Provide Class III or higher if no class specified.
   B. Alternate storm sewer pipe materials are permitted where there is a minimum of 4 feet of cover to finished grade over entire length of pipe from structure to structure. Qualifying quantities are labeled as "(Size) Storm Sewer Pipe" in the schedule of prices. The accepted alternative materials are limited to the following materials and limited to the sizes specified in 207.3.1:
      a. SDR 35 PVC sewer pipe and fittings

   b. PS46 PVC sewer pipe and fittings
   c. PVC corrugated exterior, smooth interior sewer pipe and fittings
   d. Fiberglass reinforced polymer mortar pipe
   e. Double wall polypropylene pipe
   f. Triple wall polypropylene pipe
   g. Corrugated polyethylene with smooth inner liner pipe
2. Furnish storm sewer culvert pipes of the materials shown on the plans. Storm sewer culverts are limited to the following materials unless indicated otherwise:
   a. Reinforced concrete pipe of the class listed on the plans or schedule of prices.
   b. Corrugated steel pipes.
3. Furnish storm sewer trash guards on endwalls when shown on the plans.
4. Do not use SDR 35 PVC sewer pipe when bury depths exceed 20 feet. If depths exceed 20 feet, use a SDR 26 PVC, PS115 PVC sewer pipe, or concrete pipe.
5. Do not use corrugated polyethylene pipe when the pipe slope is less than 0.5%.

207.3.10 Culvert End Markers

1. Furnish culvert end markers found on the WisDOT approved products list for pavement marking, delineators, and markers.
2. Provide culvert end markers conforming to the requirements of Section 633 of the *Standard Specifications for Highway and Structure Construction*.

207.4 Construction

207.4.1 General

1. Verify the location, elevation, material, and size of all connections to existing upstream structures and pipes prior to installing new sanitary and storm sewer pipes to allow for any necessary adjustments to the planned pipe slope so that the pipe is not back pitched at the upstream connection point(s). Backfill or adequately fence or barricade excavations to verify existing pipes to protect pedestrians and vehicular traffic as directed by the engineer.
2. Excavate trenches and tunnels for all sanitary and storm sewers as specified in 204.4.

207.4.2 Connection to Existing Sanitary Sewer

1. Before constructing a sanitary sewer, plug or provide a bulkhead in the existing sewer immediately downstream of the point of connection except as needed to maintain existing active sewers. Leave this bulkhead in place until the new sewer has been cleaned of accumulated water and debris and has been accepted.

207.4.3 Constructing Foundation

1. Construct foundations for all sanitary and storm sewers as specified in 204.4.2.7.

207.4.4 Laying Polypropylene and Polyethylene Pipes

1. Install polypropylene and polyethylene pipes in conformance with manufacturer's specifications.

207.4.5 Round and Horizontal Elliptical Reinforced Concrete Pipe Joints

1. Seal joints using rubber gaskets conforming to the requirements of **ASTM C433**. Place the gasket over the spigot end or tongue of the entering pipe.
2. Immediately before making the joint, lubricate the outside of the gasket and the inside of the bell or groove of the last pipe with an approved lubricant. Take care that the gasket and ends of the pipe are clean and free of sand or gravel. Introduce the spigot or tongue of the pipe being

laid with the gasket in place into the bell or groove of the previously-laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home. The engineer may order the use of a jack or "come-along", if deemed necessary to insure that the joint is completely tight.

207.4.6 Reinforced Concrete Box Sections Joints

1. Seal joints using rubber gaskets conforming to the requirements of **ASTM C1677**. Place the gasket over the tongue of the entering pipe.
2. Immediately before making the joint, lubricate the outside of the gasket and the inside of the groove of the last pipe with an approved lubricant. Take care that the gasket and ends of the pipe are clean and free of sand or gravel. Introduce the tongue of the pipe being laid with the gasket in place into the groove of the previously-laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home. The engineer may order the use of a jack or "come-along", if deemed necessary to insure that the joint is completely tight.
3. Additional measures may be taken by the contractor to ensure a watertight system.

207.4.7 Polyvinyl Chloride Pipe Joints

1. Ensure that PVC pipes have watertight joints conforming to the requirements of **ASTM D3212**. For PVC pressure pipe, seal joints using an elastomeric gasket conforming to the requirements of **ASTM D3139**.
2. Lubricate the outside of the gasket and the inside of the bell or groove of the pipe with an approved lubricant. Introduce the spigot or tongue of the pipe being laid into the bell or groove end of the previously laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

207.4.8 Fiberglass Reinforced Polymer Mortar Pipe Joints

1. Unless otherwise specified, field connect the pipe with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain water tightness. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings. Use elastomeric seals conforming to the requirements of **ASTM D4161**.
2. Clean ends of pipe and couplings components. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer. Carefully set the pipes to line and grade.

207.4.9 Polypropylene Pipe Joints

1. Ensure that polypropylene pipes have watertight joints conforming to the requirements of **ASTM D3212**. Use gaskets conforming to the requirements of **ASTM F477**. Ensure that the spigot of each pipe has 2 factory-installed flexible elastomeric seals.
2. Lubricate the outside of the gasket and the inside of the bell or groove of the pipe with an approved lubricant. Introduce the spigot or tongue of the pipe being laid into the bell or groove end of the previously-laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

207.4.10 Polyethylene Pipe Joints

1. Ensure that polyethylene pipes have watertight joints conforming to the requirements of **ASTM D3212**. Use gaskets conforming to the requirements of **ASTM F477**. Ensure that the spigot of each pipe has factory-installed flexible elastomeric seals.

2. Lubricate the outside of the gasket and the inside of the bell or groove of the pipe with an approved lubricant. Introduce the spigot or tongue of the pipe being laid into the bell or groove end of the previously-laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

207.4.11 Ductile Iron Pipe Joints

1. Seal joints using rubber gaskets conforming to the requirements of **AWWA C111**.
2. Immediately before making the joint, lubricate the gasket and the pipe with an approved lubricant. Take care that the gasket and ends of the pipe are clean and free of sand or gravel. Provide a beveled plain end. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

207.4.12 Corrugated Steel Pipe and Pipe Arch Joints

1. Ensure that corrugated steel pipe and pipe arch joints have coupling bands conforming to the requirements of **AASHTO M36** and are made of the same base metal as the pipe.
2. Use bands that are a minimum 7 inches wide for diameters of 8 inches to 30 inches, inclusive; a minimum 12 inches wide for pipe with diameters 36 inches to 60 inches, inclusive; and a minimum 24 inches wide for pipe with diameters greater than 60 inches. Construct such bands as to lap on an equal portion of each of the pipe sections to be connected, and preferably connect at the ends by galvanized angles having minimum dimensions of 2 x 2 x 0.1875-inches.
3. Provide 7-inch bands with at least 2 galvanized bolts not less than ½-inch diameter. Provide 12-inch bands with 3½-inch diameter galvanized bolts. Provide 24-inch bands with at least 5½-inch diameter galvanized bolts. Other equally effective methods of connecting the pipe may be used if approved by the engineer. Couplings bands may be two numerical thicknesses lighter than that used for the pipe but not less than 0.052 inches thick (18-gauge).

207.4.13 Placing Apron Endwalls

1. Excavate the foundation for the apron endwall to the required width and grade. For metal aprons with toe plates, excavate a trench to allow placing the toe plate against the inner face of the trench if the apron is in its final position. After securing the apron to the pipe, backfill and firmly compact the trench.
2. Place the concrete apron endwall with its tongue or groove fully entered in the groove or tongue of the pipe.
3. Use the same backfill for the apron as required for the pipe unless the engineer directs otherwise.

207.4.14 Storm Sewer Trash Guards

1. Furnish prefabricated grates with ¾-inch bars for endwalls spanning less than 24 inches, 1-inch bars for endwalls spanning 27 inches to 48 inches inclusive, and 1¼-inch bars for endwalls spanning greater than 48 inches. Weld the bars to ⅜ x 2-inch connector plate. Connect the connector plate at 3 points to the endwall on pipes 30 inches or less and at 4 points on pipes 36 inches and greater. Furnish ⅝-inch anchor bolts.
2. Galvanize or epoxy coat trash guards. Use an epoxy system consisting of a prime or shop coat of organic or inorganic zinc-rich paint, an intermediate shop coat of high-build epoxy paint and a protective shop coat of urethane paint. Do not coat structural steel which is to be welded before welding is complete. Use a white-colored epoxy and dark green-colored urethane coating.

207.4.15 Concrete Masonry Endwalls

1. Construct concrete masonry endwalls according to Section 504 of the *Standard Specifications for Highway and Structure Construction*.

207.4.16 Culvert End Markers

1. Provide flexible culvert end markers at the locations the plans show. Use white posts and apply black non-reflective sign tape to both sides of the top 9 inches.
2. Install posts in front of the object being marked as referenced from the direction of travel by the approaching roadway traffic. Use only one marker where two or more apron endwalls are adjacent to each other.

207.4.17 Bulkhead Sewers

1. Construct a bulkhead at both ends of pipes stubbed for future service consisting of an 8-inch cement brick and mortar wall or a waterproof cap or plug.

207.4.18 Separation Distances

1. Lay proposed sanitary and storm sewer mains and manholes at least 8 feet horizontally from any existing or proposed water main. Measure the distance center to center. Should specific conditions prevent this separation, notify the engineer for specific instructions regarding the treatment of the separation. It may be necessary to install **AWWA C900** PVC pressure pipe, joints, and fittings or **AWWA C151** ductile iron pipe, joints, and fittings with a minimum pressure class of 150 psi for sanitary and storm sewers in the congested areas and perform the low pressure air test as specified in 212.3.1.
2. Whenever a sanitary or storm sewer crosses a water main, lay the sanitary or storm sewer at least 18 inches above the water main, 6 inches below the water main, or re-lay the water main with fittings to cross over the sewer. Measure the distance from the top of the bottom pipe to the bottom of the top pipe.

207.4.19 Backfill

1. Backfill all sanitary and storm sewers as specified in 204.4.2.8.

207.5 Basis of Payment

1. The owner will measure the sanitary and storm sewer bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe from structure to structure; to the end of apron endwalls excluding the length of the apron endwall; or to the end of the installed pipe. Structures include catch basins, manholes, inlets, other drainage structures or junctions. The measurement will be made from inside wall of structure to inside wall of structure. The length measured does not include any construction through catch basins, manholes, and inlets.
2. Payment for the sanitary and storm sewer bid items is full compensation for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for bypass pumping; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for sealing joint; for joint ties; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the site.
3. Apply contract unit prices, without adjustment, to the quantities of sanitary and storm sewer pipes constructed at elevations not greater than 1 foot below what the plans show. If the engineer orders the construction of the sewer pipes or portions of the pipes at elevations greater than 1 foot below what the plans show, then the owner will pay for this work as specified extra work. If the engineer orders the construction of the sewer pipes or portions of the pipes at elevations greater than 1 foot

above what the plans show, then the owner may request an adjustment to the contract prices for this work.

4. Work performed 7 inches or less below the pipe bottom to form a satisfactory foundation as specified is incidental to the work. The owner will pay for work required at depths greater than 7 inches below the pipe bottom as extra work.
5. The owner will pay separately for connections to existing pipes, catch basins, manholes, and inlets as specified in 211.5.
6. No additional compensation will be provided for relaying pipe or any other work necessary to provide an adequate slope and connection to the existing pipe caused by a failure to adequately verify the location, elevation, material, and size of all connections to existing upstream structures and pipes.
7. The owner will measure the sanitary sewer spot repair bid item by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe from connection point to existing pipe to connection point to existing pipe. Payment for the sanitary sewer spot repair bid item is full compensation for excavating; for providing and removing sheeting and shoring; for bypass pumping; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for sealing joint; for making connections to the existing pipe; for backfilling; and for restoring the site.
8. The owner will measure the apron endwall bid items as each individual unit acceptably completed. Payment for the apron endwall bid items is full compensation for excavating; for providing and removing sheeting and shoring; for bypass pumping; for providing bedding material and granular backfill material; for constructing the foundation; for laying endwalls; for sealing joint; for joint ties; for backfilling; for cleaning out; and for restoring the site.
9. The owner will measure the concrete masonry endwall bid item as each individual unit acceptably completed. Payment for concrete masonry endwalls is full compensation for excavating; for materials, including reinforcement; for forms; for placing, including reinforcement; and for finishing, curing, protecting and heating.
10. The owner will measure the culvert end marker bid item as each individual unit acceptably completed. Payment for culvert end markers is full compensation for providing the marker including non-reflective tape and soil anchor.
11. The owner will measure the bulkhead sewer bid items as each individual bulkhead acceptably completed. Payment for the bulkhead sewer bid items is full compensation for excavating; for sealing the open ends of sewer pipes; for providing granular backfill material; for backfilling; for cleaning out; and for restoring the site.

208 Force Mains

208.1 Scope

1. This section describes excavating required trenches or tunnels, laying or constructing sanitary sewer and storm sewer force mains inside, and then backfilling and cleaning out as necessary.

208.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2. Provide the pressure rating and recommended minimum bending radius for PVC pressure pipe and ductile iron pipes.

208.3 Materials

208.3.1 Pipes

1. Furnish pipe consistent with the size the bid item indicates and materials conforming to the following:
   A. Polyvinyl chloride pressure pipe and fittings **AWWA C900**
   B. Ductile iron pipe **AWWA C151**
2. Install all sewer pipes conforming to the manufacturer's recommended bury depth chart.

208.3.2 Joints

208.3.2.1 General

1. Do not exceed manufacturer recommendations for joint deflection.
2. Furnish pipe with restrained joints and retrained joint gaskets when specified on the plans.
3. Furnish nitrile or fluorocarbon gaskets when specified on the plans for areas with anticipated contaminated soil or groundwater.
4. Legibly mark individual gaskets to identify them as to size and manufacturer of pipe and to distinguish oil-resistant types from other types. Raised, indented or indelible ink lettering is required. Color-coding or cross-section configuration is not acceptable as legible identification.

208.3.2.2 PVC Pipe Joints

1. Furnish PVC pressure pipe with bell and spigot type joints with the bell being integrally formed with the pipe.
2. Furnish factory-installed elastomeric gaskets conforming to the requirements of **ASTM F477**.
3. Furnish joints for PVC pressure pipe and fittings conforming to the requirements of **ASTM D3139**.

208.3.2.3 Polyvinyl Chloride Pipe Restrained Joints

1. Furnish PVC restrained pipe joints on 4-inch to 24-inch diameter pressure pipe consisting of a PVC coupling with beveled edges, 2 sealing gaskets, and 2 restraining grooves; plain end pipe with a restraining groove at each end; and nylon splines for each groove. Provide joints capable of providing full restraint for the thrust generated at the working pressure of the pipe.
2. Furnish PVC restrained pipe listed below:
   a. AquaSpring C900 Certa-Lok RJ PVC Pipe by Westlake Pipe & Fittings.
3. Furnish restrained joint gaskets listed below:
   a. Eagle Loc 900 by JM Eagle.

208.3.2.4 Ductile Iron Pipe Mechanical and Push-on Joints

1. Furnish mechanical and push-on joints for ductile iron pipe and fittings conforming to the requirements of **AWWA C111 (ANSI A21.11)**.
2. Furnish high strength low-alloy steel bolts for mechanical joints conforming to the requirements of **AWWA C111 (ANSI A21.11)**.

208.3.2.5 Ductile Iron Pipe Restrained Joints

1. Furnish restrained joints conforming to the applicable requirements of **ANSI A21.11 (AWWA C111)**. Provide joints with a minimum deflection of not less the 5 degrees for pipes 12 inches in diameter and smaller and 3 degrees for pipes 14 inches in diameter through 30 inches in diameter. Provide joints capable of providing full restraint for the thrust generated at the rated working pressure of the pipe.
2. Furnish restrained joint pipe listed below:

a. TR FLEX Restrained Joint Pipe by McWane Ductile.
b. Fastite Joint Pipe with Fast-Grip Gasket by American Cast Iron Pipe Company.
c. Flex-Ring Joint Pipe by American Cast Iron Pipe Company.
d. Lok-Ring Joint Pipe by American Cast Iron Pipe Company.
e. TR FLEX Restrained Joint Pipe by U.S. Pipe.
f. Bolt-Lok Restrained Joint Pipe by U.S. Pipe.

3. Furnish restrained joint gaskets listed below:
   a. MJ Field-Lok Gasket by U.S. Pipe.
   b. Field Lok 350 Gasket by U.S. Pipe.

208.3.3 Fittings

1. Furnish fittings with mechanical and push-on joints conforming to the requirements of **AWWA C110 (ANSI A21.10)** or **AWWA C153 (ANSI A21.53)** and made by a manufacturer listed below:
   A. Tyler Union.
   B. American Flow Control by American Cast Iron Pipe Company.
   C. Sigma Corporation.
2. Provide fittings with cement mortar lining according to **AWWA C104 (ANSI A21.4)**. Use standard thickness cement-mortar lining, unless noted otherwise. Use an asphaltic coating on the exterior of the fitting for buried service.
3. Provide fittings with 350 psi pressure rating for 4-inch to 24-inch diameter fittings and 250 psi pressure rating for 30-inch to 48-inch diameter fittings.
4. Provide approved couplings for transition to other types of pipe.

208.3.4 Polyvinyl Chloride Pipes

1. Furnish DR 25 pipe with a pressure rating of 165 psi, unless noted otherwise. Provide pipe with the same outside diameter as ductile iron pipe.
2. Store pipes in the supplier's yard or on the project site in conformance with **AWWA M23** and manufacturer's recommendations.
3. Do not stack pipe higher than 4 feet or on the bell ends.
4. Cover PVC pipe, which is stored outside for a prolonged period, with an opaque material to protect it from the sun's ultraviolet radiation. Do not use PVC pipe that has been subjected to excessive ultraviolet radiation identified by color fading or chalking. The determination as to the acceptability of the pipe rests solely on the engineer's decision.
5. Do not use pipe that has been contaminated in any way with petroleum products on the inside or outside of the pipe.

208.3.5 Ductile Iron Pipes

1. Furnish thickness class 52 pipe, unless specified otherwise.
2. Furnish pipe which is cement-mortar lined in conformance with **AWWA C104 (ANSI A21.4)**.
3. Furnish pipe with an asphaltic coating on the exterior of the pipe.
4. Do not stack pipe higher than 4 feet in height.

208.3.6 Thrust Blocking

1. Construct thrust blocks using solid 16 x 8 x 4-inch cement blocks (half course solids) or poured in place concrete having a minimum 28-day compressive strength of 2,000 psi. Use concrete mixes with a minimum cement content of 4.5 bags of cement per cubic yard of concrete. Use concrete with a 4-inch to 5-inch slump. Provide a bearing area for the thrust blocking as shown on the standard detail drawings or as required by the engineer.

208.3.7 Mechanical Joint Restraint

1. Furnish mechanical joint restraint consisting of multiple gripping wedges incorporated into a single restraint/gland ring for use in place of the standard mechanical joint retainer gland and listed below:
   A. Megalug Series 1100 by EBAA Iron Sales, Inc. for ductile iron pipe.
   B. Megalug Series 2000PV by EBAA Iron Sales, Inc. for PVC pipe.

208.3.8 Push-On Joint Restraint

1. Furnish push-on joint restraint listed below consisting of the 2 **ASTM A536** ductile iron restraint rings and high strength, low alloy steel connection rods. Mount 1 ring to the spigot pipe end with second ring mounted just behind the bell end of the pipe. Fasten the 2 restraint rings together using the low alloy steel connection rods.
   A. Megalug Series 1700 by EBAA Iron Sales, Inc. for ductile iron pipe.
   B. Megalug Series 1600 by EBAA Iron Sales, Inc. for PVC pipe.
   C. Uni-Flange Series 1390 by The Ford Meter Box Company, Inc. for PVC pipe.

208.3.9 Polyethylene Wrap and Tape

1. Furnish polyethylene wrap consisting of linear low-density polyethylene film with a minimum tensile strength of 3,600 psi and a nominal thickness of 8 mils and meeting the requirements of **AWWA C105 (ANSI A21.5)**.
2. Furnish tape for securing the wrap with a minimum thickness of 8 mils, a minimum width of 1 inch, and consisting of a thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, asphaltic coating, and polyethylene.

208.4 Construction

208.4.1 General

1. Excavate trenches and tunnels for all force mains as specified in 204.4.
2. Use push-on joints for force main and fittings unless specified otherwise on the plans.
3. Set fittings on hardwood blocking 2 x 6 x 18-inch with the long side of the block set perpendicular to the force main.
4. Use mechanical joint pipe and fittings where specified or when accepted by the engineer.
5. Unless otherwise indicated use grooved or flanged joints on exposed ductile iron pipe and fittings.

208.4.2 Constructing Foundation

1. Construct foundations for all force mains as specified in 204.4.2.7.

208.4.3 Polyvinyl Chloride Pipe Joints

1. Seal joints using an elastomeric gasket conforming to the requirements of **ASTM D3139**.
2. Lubricate the outside of the gasket and the inside of the bell or groove of the pipe with an approved lubricant. Introduce the spigot or tongue of the pipe being laid into the bell or groove end of the previously laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

208.4.4 Ductile Iron Pipe Joints

1. Seal joints using rubber gaskets conforming to the requirements of **AWWA C111**.
2. Immediately before making the joint, lubricate the gasket and the pipe with an approved lubricant. Take care that the gasket and ends of the pipe are clean and free of sand or gravel.

Provide a beveled plain end. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

208.4.5 Thrust Restraint Systems

1. Provide a thrust restraint system for all pressure piping to prevent movement caused by hydraulic thrust and pressure.
   A. Provide restrained joints for exposed pressure piping.
   B. Restrain horizontal buried pressure piping, unless noted otherwise, by thrust blocking. Cast thrust blocks against solid undisturbed ground and install so as to prevent contact or interference with pipe or fitting joints. Wrap fittings in plastic to prevent the concrete from bonding to the surface of the fitting. If adequate support against undisturbed soil cannot be obtained, use restrained joints.
   C. Provide an acceptable type of restrained joint for vertical buried pressure piping.

208.4.6 Protection of Buried Metal Surfaces

1. Unless specified otherwise, protect all ductile iron pipe, fittings, valves, and appurtenances installed underground from corrosion by use of 2 layers of polyethylene wrap installed in conformance with **AWWA C105 (ANSI A21.5)**.
2. Keep metal surfaces clean of mortar, cement, clay, sand or other foreign material.

208.4.7 Backfill

1. Backfill all force mains as specified in 204.4.2.8.

208.5 Basis of Payment

1. The owner will measure the force main bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe. Payment is full compensation for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for bypass pumping; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for sealing joint; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the site.
2. No additional compensation will be provided for installing fittings, caps, bends, tracer wire, tracer wire terminal boxes, thrust blocking or joint restraint for force mains unless included separately on the schedule of prices.
3. Apply contract unit prices, without adjustment, to the quantities of sanitary and storm sewer pipes constructed at elevations not greater than 1 foot below what the plans show. If the engineer orders the construction of the sewer pipes or portions of the pipes at elevations greater than 1 foot below what the plans show, then the owner will pay for this work as specified extra work. If the engineer orders the construction of the sewer pipes or portions of the pipes at elevations greater than 1 foot above what the plans show, then the owner may request an adjustment to the contract prices for this work.
4. Work performed 7 inches or less below the pipe bottom to form a satisfactory foundation as specified is incidental to the work. The owner will pay for work required at depths greater than 7 inches below the pipe bottom as extra work.
5. The owner will pay separately for connections to existing pipes as specified in 211.5.
6. No additional compensation will be provided for relaying pipe or any other work necessary to provide an adequate slope and connection to the existing pipe caused by a failure to adequately verify the location, elevation, material, and size of all connections to existing upstream structures and pipes.

209 Catch Basins, Manholes, and Inlets

209.1 Scope

1. This section describes constructing or reconstructing manholes, catch basins, and inlets and similar structures made of concrete, concrete masonry, or concrete block with necessary reinforcement, metal frames, grates and lids, including required excavation and backfilling.

209.2 General Requirements

1. Submit manufacturer's data and shop drawings for the manholes, catch basins, inlets, frames, and covers as specified in 106.2.2. Include a “plan view”, a “section view”, and a list of materials (base section, riser sections, cone section, adjustment, casting, etc.) necessary to construct the structure in the field on all shop drawings. List elevations for the rim and all pipe inverts. Showing only a measurement from either the top or bottom of the structure is insufficient to allow for proper review of the drawings. Shop drawings not conforming to these requirements will be rejected by the engineer without review.
2. Structures delivered to the site that do not comply with approved shop drawings will immediately be rejected by engineer.
3. Furnish precast concrete catch basins, manholes, and inlets unless specified otherwise.

209.3 Materials

209.3.1 Concrete

1. Furnish materials conforming to the following:
   A. Precast concrete manholes **ASTM C478**
   B. Precast square and rectangular structures **ASTM C913**
   C. Precast field inlets **ASTM C478** and **ASTM C76**
   D. Concrete brick and block masonry units **ASTM C139**
2. Furnish precast catch basins, manholes, and inlets manufactured at a facility on the WisDOT pre-qualified list for precast concrete fabricators.
3. Provide precast reinforced concrete sanitary and storm manhole base, wall, and flat top thicknesses as shown in the standard detail drawings.
4. Provide eccentric cone type precast sanitary manholes. Flat tops may be used only with the permission of the engineer. Provide eccentric con type precast storm manholes, whenever possible. Flat tops may be utilized when eccentric cones are not feasible.
5. Provide a minimum 3-inch vertical ring integrally cast with the top of the precast eccentric cone.
6. Clearly mark each precast reinforced concrete manhole riser and top section with the name or trademark of the manufacturer and the date of manufacture. Indent this marking into the manhole section or paint on with waterproof paint.
7. Precast reinforced concrete manhole risers and flat top sections are subject to rejection by the engineer for failure to conform to any of the specification requirements. In addition, individual sections of manhole risers and tops may be rejected because of any of the following reasons:
   A. Fracture cracks passing through the walls, except for a single end crack that does not exceed the depth of the joint.
   B. Defects that indicate imperfect proportioning, mixing, or molding.
   C. Surface defects indicating honey-combed or open texture.
   D. Damaged ends, where such damage would prevent making a satisfactory joint.
   E. Manhole steps out of line or improperly spaced.
   F. The interval diameter of the manhole section varies more than 1% of the nominal diameter.

   G. Any continuous cracking having a surface width of 0.01 inches or more and extending for a length of 12 inches or more, regardless of the position in the section wall.
8. Furnish concrete bricks and block masonry units listed on the WisDOT approved products list for precast concrete and block fabricators.
9. Furnish 7¾-inch thick concrete block for manholes, curved to fit a 4-foot inside diameter manhole, notched to fit manhole steps, and with corbel blocks to fit manhole ring as shown in the standard detail drawings. Use mortar consisting of 1 part portland cement and 2 parts mortar sand.
10. Concrete block for the entire manhole may only be used where specified or with permission of the engineer. Provide a ½-inch cement mortar back-plaster.
11. When the size or number of connections precludes the practical use of a precast bottom section, concrete block may be used up to approximately 8 inches above the top of the pipe.

209.3.2 Cast in Place Structures

1. Cast in place catch basins, manholes, inlets, or endwalls may only be used where specified or with permission of the engineer.
2. Furnish cast in place structures meeting the requirements of Section 504 and Section 611 of the *Standard Specifications for Highway and Structure Construction*.

209.3.3 Clay or Shale Bricks

1. Furnish bricks conforming to the following:
   A. Bricks **ASTM C32 Grade MS**

209.3.4 Mortar

1. Furnish a bagged mortar mix unless approved otherwise by the engineer. Furnish a product found on the WisDOT approved products list for prepackaged utility mortar.
2. When non-bagged mortar mixes are allowed, conform to the requirements of Section 519 of the *Standard Specifications for Highway and Structure Construction.*

209.3.5 Joints

1. Furnish joints conforming to the following:
   A. Butyl rubber sealant **ASTM C443**
   B. Butyl rubber gaskets **ASTM C443, ASTM C478**, and **ASTM C497**
2. When an embedded bell gasket manhole is used, provide manholes with bell and spigot style joints with an embedded gasket. Use embedded gaskets with wedge shaped ribbed rubber material that is cast into the inner portion of the bell of the manhole.
3. Provide gasket of a proper volume to fill the annular space of the joint and be placed firmly against the lower third of the vertical slope of the joint.
4. Use preformed butyl rubber sealants 1 inch high by 1½ inches wide or sized according to manufacturer's recommendations for the type of application.

209.3.6 Steps

1. Furnish steps conforming to the following:
   A. Copolymer polypropylene **ASTM D4101 Type II Grade 49108**
   B. Steel bar **ASTM A615 Grade 60**
2. Use manhole steps made with an approved plastic such as copolymer polypropylene reinforced with a deformed ½-inch diameter reinforcing bar.
3. Ensure that all manhole steps are approved by the owner and OSHA.

209.3.7 Sanitary Pipe to Manhole Connectors

1. Furnish pipe to manhole connectors for sanitary sewers consisting of a molded rubber boot of appropriate size conforming to **ASTM C923** and listed below:
   A. Kor-N-Seal by Trelleborg Pipe Seals Milford, Inc.
   B. Quik-Lok by A-Lok Products, Inc.
2. Ensure that all connectors come complete with all required stainless steel hardware.

209.3.8 Storm Pipe to Manhole Connectors

1. Furnish pipe to manhole connectors for storm sewers consisting of a molded rubber boot of appropriate size conforming to **ASTM C923** and listed below for PVC pipe, polypropylene pipe, and corrugated polyethylene pipe:
   A. Kor-N-Seal by Trelleborg Pipe Seals Milford, Inc.
   B. Quik-Lok by A-Lok Products, Inc.
2. Ensure that all connectors come complete with all required stainless steel hardware.

209.3.9 Adjustment Rings

1. Furnish materials conforming to the following:
   A. Precast concrete adjustment rings **ASTM C478**
   B. Polyethylene adjustment rings **ASTM D4976**
   C. Expanded polypropylene adjustment rings **ASTM D3575** and **ASTM D4819**
   D. Rubber adjustment rings **ASTM D573**
2. Furnish high density polyethylene rings listed below:
   A. Manhole adjustment and grade rings by Ladtech, Inc.
3. Furnish expanded polypropylene rings listed below:
   A. Pro-Ring by Cretex Specialty Products. Use with manufacturer recommended sealant.
4. Furnish rubber rings listed below:
   A. INFRA-RISER by EJ. Use with manufacturer recommended polyurethane sealant.
5. Use plastic or rubber adjustment rings for new catch basins, manholes, and inlets.
6. Furnish concrete adjustment rings manufactured at a facility on the WisDOT pre-qualified list for precast concrete fabricators.
7. Submit the mix design, testing results, and certifications of any concrete rings used on the project.

209.3.10 Manhole Frames and Covers

1. Furnish materials conforming to the following:
   A. Gray iron **ASTM A48 Class 35B**
   B. Ductile iron **ASTM A536 Grade 80-55-06**
2. Ensure that castings are true to pattern in form dimensions, free from pouring faults, sponginess, cracks, blowholes, and other defects in positions affecting strength and value for the service intended. Ensure that castings are boldly filleted at angles and the risers are sharp and perfect. Sandblast castings or otherwise effectively clean scale and sand so as to present a smooth, clean, and uniform surface.
3. For sanitary sewer manhole frames and covers, furnish Neenah R-1550 frames with a solid Type B lid, with concealed pick holes, self-sealing with a continuous flat “T” seal gasket, and which fits securely in a machined bearing surface. Non-rocking covers are not allowable.
4. For storm sewer manhole frames and covers, furnish Neenah R-1550 frames with a solid Type B lid and open pick holes. Non-rocking covers are not allowable.
5. For storm sewer manhole frames and covers which are specified on the plans as “open grate” or “OG”, furnish Neenah R-2050 frames with a type D grate. Non-rocking covers are not allowed.

6. For Type H catch basins, furnish Neenah Foundry R-3067 frames. Use a frame with a 5.75-inch curb box with a 2-inch radius (R-3067-7007). Furnish a Neenah Foundry R-3067-C frame for catch basins located in driveways or immediately adjacent to a curb ramp. Furnish diagonal type R grates except where a different grate is shown on the plans. Include Neenah EnviroNotice lettering “Dump No Waste - Drains to Fresh Water” and “loon and fish logo” cast into the top of the curb box for each R-3067 frame.
7. For Type A catch basins, furnish Neenah Foundry R-3235 frames. Furnish diagonal type R grates except where a different grate is shown on the plans.
8. Furnish Neenah Foundry R-5901-E frames with a type G grate for 2-foot diameter field inlets. Furnish Neenah Foundry R-5901-G frames with a type G grate for 2.5-foot diameter field inlets. For field inlets with beehive grates, furnish Neenah Foundry R-2560-E frames and beehive grate.
9. Furnish Neenah R-1580 or Neenah R-1689 manhole frames when indicated on the plans as an adjustment to an existing structure.
10. Manhole frames and covers, which are not Neenah Foundry, shall be approved by the engineer as specified in 108.11, have equivalent dimensions, and meet all of the requirements of 209.3.10.

209.3.11 Non-Shrink Grout

1. Furnish a non-shrink grout product listed on the WisDOT approved products list for non-shrink grout.

209.3.12 Chimney Seals

1. Unless otherwise indicated in the plans and specifications, chimney seals will not be required.

209.3.13 Liquid Bonding Admixture

1. Furnish liquid bonding admixtures conforming to the requirements of **ASTM C1509 Type II** and listed below:
   A. Akkro-7T by Euclid Chemical.

209.4 Construction

209.4.1 General

1. Excavate trenches for all catch basins, manholes, and inlet bases as specified in 204.4.
2. Limit the excavation to the size required for the structure to be constructed and sheath and brace as necessary to protect the workers and prevent loss of ground.
3. The proposed elevations for the structures, as shown on the plans, are subject to revisions in order to fit field conditions, and the engineer may adjust the grades from those shown on the plans.
4. Install manholes at the end of each line, at all changes in grade, size or alignment, and at all pipe intersections.
5. Place manholes at intervals not greater than 400 feet for sanitary sewers with diameters of 15 inches or less and not greater than 500 feet for sanitary sewers between 18 inches and 30 inches. See plans for actual locations.
6. Pour a bench to a minimum height of 0.8 x the diameter of the sewer for all manhole inverts for pipes 12 inches or less. Provide a minimum bench height of 12 inches for manhole inverts for sewer pipes between 15 and 24 inches. Pour a bench to the spring line of the largest adjoining sewer at a minimum for manhole inverts for sewer pipes greater than 24 inches. For all manhole inverts for sanitary sewer pipes 12 inches or less, pour bench to spring line whenever a lesser height bench is allowed for adjoining pipes. Provide full sweep curvature into main line flow at

all side connecting mains. Provide a bench slope of 3 inches per foot for sanitary sewer manholes. Provide a bench slope of 1 inch per foot for storm sewer manholes.

7. Install steps in all manholes in excess of 4 feet deep. Install manhole steps in true vertical alignment at intervals of 16 inches with an allowable tolerance of 1 inch plus or minus.
8. Embed all manhole steps into the riser or eccentric cone wall a minimum of 3 inches and project uniformly from the inside face of the wall 5 inches to the centerline of the step.
9. Give a smooth troweled finish to surfaces which will be exposed to the flow of water or sewage inside the manhole.
10. At dead end manholes, include a minimum of 4 foot length, full depth manhole invert with 1-inch slope.
11. Provide a minimum depth of 4 feet from top of base to flow line of grate for all storm structures unless indicated otherwise. Fill structures with sumps with concrete to the lowest invert elevation unless indicated otherwise.

209.4.2 Constructing Foundation

1. Construct foundations for all catch basin, manhole, or inlet bases as specified in 204.4.2.7.

209.4.3 Manhole Bases

1. **Precast Manholes with Integral Base**: Excavate deep enough so that after the bottom has been placed thereon, set to grade and plumbed, there remains a 6 inches minimum depth of bedding material below the bottom of the base. Backfill the annular space between the manhole excavation and the outside wall of the manhole section with bedding material conforming to 204.3.1 up to the spring line of the incoming pipe. Do not pour the invert until the manhole is completely built and backfilled. Provide flow channel of the same size as the largest diameter of the adjoining sewers and shape as shown in the standard detail drawings.
2. **Field Poured Base for Precast Manholes**: Set the precast manhole bottom barrel section on solid concrete blocks with a minimum of 12 inches of clearance between existing sewer pipes and stone bedding. Pour the manhole base using class C concrete. Provide concrete base with a minimum thickness of 12 inches and extend the barrel section 4 inches into the base.
3. **Field Poured Base for Concrete Block Manholes**: Provide concrete base of class C concrete with a minimum thickness of 12 inches below the invert of the outlet sewer. Substantially conform the manhole base to the required shape and dimensions; back form the excavation, if necessary, to achieve this end. If excavation in stable soil has been carried below the required depth, fill such excess depth with concrete. Do not deposit excess concrete around the manhole in such a manner that will interfere with future connections. Support the pipe on brick or solid concrete blocks for the pouring of the concrete base. Extend the concrete of the base under flexible pipe to where it rests in undisturbed soil. End this concrete support for rigid pipe in a vertical plane flush with the face of the bell.

209.4.4 Concrete Walls and Chimneys

1. Precast Concrete Manholes:
   A. Set manhole base on graded bedding material, conforming to 204.3.1, making sure that boots or pipe connections match design elevations. Level top of manhole base section in both directions.
   B. Provide manholes that have manhole walls constructed at the specified diameter as shown on the plans and schedule of prices. The minimum allowed inside diameter is 48 inches.
   C. Use appropriate lifting slings that will adequately lift weight of units. The use of an appropriately rated spreader bar is preferred. When lifting manhole bases and risers, make sure chain or cable lengths are long enough to prevent contact with tongue and groove

area, and are kept at appropriate lifting angles. Use wooden blocks between sling and manhole wall, if necessary.

D. Clean and inspect tongue and groove surfaces. Surfaces should be clean from all dust and debris. On tongue-up manholes, place butyl material next to the vertical surface or tongue. Wrap material completely around unit overlapping ends. Knead the ends together to form a uniform splice. Make sure all protective paper is removed. Lower bell end of the next section making sure steps are aligned into final position. If bell is up, place butyl material next to vertical surface of groove and follow above procedure. All sections, as shown on the shop drawings, should be completed in this manner.

E. Concealed pick holes are required for manhole barrel sections. Lifting holes penetrating through the manhole sidewalls are not permitted. Seal lifting holes by inserting a rubber plug or other approved material into the hole and filling it with non-shrink mortar.

F. Backfill around manhole equally to prevent tipping. Compact fill in lifts as specified in 204.4.2.8.

2. Concrete Block Manholes:

A. Provide manholes with manhole walls constructed of concrete block constructed at the specified diameter as shown on the plans and schedule of prices up to the beginning of the corbel section. From this point, corbel in the manhole at approximately ½ inch horizontal to 1 inch vertical to the diameter of the manhole frame. Keep the face of the manhole in which the steps are installed vertical.

B. In the construction of manholes, take care to provide walls with smooth interior faces and with the masonry being laid up in a workmanlike manner. Construct concrete block masonry in horizontal courses with vertical joints broken. Where concrete manhole block are used in manholes having inside diameters greater than 4 feet, use block 12 inches long (rather than the usual 16 or 18 inches) to produce more regular inside walls. Lay concrete block sidewalls with full mortar joints. Strike joints on interior walls smooth. Back-plaster concrete block manholes, from the base to the top of the cone, with a mortar coat ½ inch thick. Place such mortar coat on the outside face of the walls.

C. Backfill around manhole equally to prevent tipping. Compact fill in lifts as specified in 204.4.2.8.

209.4.5 Doghouse Manholes

1. Doghouse manholes are only allowed at locations shown on the plans or where approved by the engineer.
2. Provide a field poured concrete base or a precast concrete base on a compacted granular bed.
3. Clean existing sewer pipes of all debris where the manhole is to be placed.
4. Wrap existing sanitary pipes with neoprene gasket material and seal with pipe silicone to create a watertight barrier prior to placement of concrete base. Use a liquid bonding admixture immediately prior to the placement of the concrete base.
5. Construct an invert and bench as shown in the standard detail drawings.
6. Provide precast concrete manhole walls and chimneys. Concrete block walls are only allowed with the approval of the engineer.
7. Submit construction details and material submittals for review and approval by the engineer prior to construction.

209.4.6 Sanitary Pipe to Manhole Connections

1. Cast sanitary pipe to manhole connectors into the precast concrete manhole base section whenever possible. Locate the connector in the manhole section to allow for a minimum of 2

inches of concrete below the bottom of the sewer main. Size the connector specifically for the type of pipe being used and install according to manufacturer's recommendations.

2. When the connection is made out in the field, core the concrete manhole section per manufacturer's installation instructions. Make the seal between the connector and the pipe by compressing the connector against the outside circumference of the pipe by means of a stainless steel take down band.

209.4.7 Pipe Connections

1. Place pipe in masonry for inlet or outlet connections flush on the inside of the structure wall. Carefully construct the masonry around pipes to prevent leakage around their outer surfaces.
2. Extend pipe through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections with sewers.
3. Make adequate provisions to support pipe outside the structure walls to prevent shearing off of said pipe after backfilling and tamping is completed.

209.4.8 Drop Pipe

1. Provide an outside drop pipe for sanitary sewer pipes entering a manhole where the invert elevation of the entering sewer is 2 feet or more above the spring line of the outgoing sewer.
2. Provide drop pipe of the same diameter as the incoming sewer unless indicated otherwise.
3. Use a 90 degree elbow fitting with a spigot end at the bottom of the drop unless the plans or engineer specifies the use of a wye fitting with a spigot end and a 45 degree bend.
4. When an outside drop connection is to be made on an existing manhole, construct footing of the drop with the same thickness as the manhole base and connect by means of a minimum 4 ½-inch diameter reinforcing bars drilled into the existing manhole base. Place an additional 4 ¼-inch diameter reinforcing bars as dowels into the new footing and extend as the vertical part of the drop is constructed of monolithic concrete. In addition, tie the drop to the existing manhole with ½-inch diameter reinforcing bars or steel strapping at a maximum spacing of 2 feet with a minimum of 2 ties to prevent any separation of the drop from the manhole wall. Encase the entire drop connection with a minimum 4 inch thick envelope of class C concrete.
5. Submit construction details and materials submittals for review and approval by the engineer prior to construction.

209.4.9 Manhole Chimneys and Adjustment Rings

1. Use plastic or rubber adjustment rings for all new manholes.
2. Conform the adjustment rings to pavement slope using wedge shapes, and other thickness adjustment rings as required. Install wedge rings at the top of the ring stack. A maximum ¼-inch thick solid adjustment shim ring may be used over the wedge ring.
3. Use plastic or rubber adjustment rings for catch basins and inlets. Install catch basin adjustment rings such that 1½ inches to 2 inches of concrete may be vibrated under the frame during the installation of the curb and gutter.
4. Secure grade riser rings and adjustment rings with engineer-approved butyl rubber sealant or using the manufacturer's recommended method.
5. For polyethylene rings, a ⅜-inch diameter, continuous bead of butyl rubber adhesive is required to be installed between each ring. A double ring of sealant is required between the concrete manhole and adjacent ring. A double ring of sealant is also required between the casting and adjacent rings unless concrete is to be vibrated between the casting and rings for concrete paving. For concrete paving, include a double ring of adhesive, ¼ inch thick, between the top solid shim ring and the first polyethylene ring below the shim with the ring adjustment.

6. Where asphalt pavement is constructed, place adjustment rings so the manhole casting rim is no more than ¼ inch below pavement grade, as measured with a 10-foot straight edge, and conforms to the pavement slope.
7. Provide a minimum of 4 inches of adjustment and a maximum of 8 inches of adjustment on new or rebuilt manholes. Do not exceed a total adjustment ring and frame height of 17 inches.
8. Provide a minimum of 3 inches of adjustment and a maximum of 6 inches of adjustment on catch basins and field inlets.

209.4.10 Manhole Frames and Covers

1. Set sanitary manhole frames on flexible joint sealant. Adjust to required alignment and grade while adjacent concrete is plastic. Hand vibrate concrete adjacent to fixtures to fill voids and openings between fixtures and support structures. Fill remaining voids beneath the base of these fixtures with an engineer-approved non-shrink grout before opening to traffic.
2. Set storm structure frames on flexible joint sealant or on full mortar beds. Adjust to required alignment and grade while adjacent concrete is plastic. Hand vibrate concrete adjacent to fixtures to fill voids and openings between fixtures and support structures. Fill remaining voids beneath the base of these fixtures with an engineer-approved non-shrink grout before opening to traffic.
3. Set the frames, grates, and lids accurately so the complete installation will be at the correct elevation required to fit the adjoining surfaces. Make sure the grates or lids are not in place while striking off and finishing the adjoining concrete.
4. Ensure that surfaces of contact between frames and covers are sufficiently true so that no rattling occurs when vehicles pass over the cover. If rattling does occur, remove the cover and machine so as to eliminate the rattling.

209.4.11 Adjust Catch Basin, Manhole, and Inlet Covers

1. Adjust existing covers, including frames, grates, or lids to the required elevation.
2. Remove all of the adjustment rings to the existing precast or block structure unless directed otherwise by the engineer. When adjusting brick structures remove all adjustment rings and remove all bricks as needed to provide a solid surface for the frame.
3. One precast concrete ring may be used when adjusting existing manholes if the required adjustment exceeds 12 inches. Use a minimum 6 inch thick concrete ring and a minimum of 6 inches of plastic rings at all adjustments over 12 inches.
4. Adjustment includes replacement of up to 18 inches of concrete rings and mortar with plastic rings. Manhole adjustments greater than 18 inches will be considered rebuilding the manhole.
5. Protect the existing cover at a proposed adjust and reuse unless indicated otherwise. If the existing cover is broken, at no fault of the contractor, then replace the cover with a new cover meeting owner specifications at no cost to the contractor.
6. Provide a new cover, including frames, grates, or lids when indicated on the plans.

209.4.12 Rebuild Existing Manholes

1. Rebuild existing manholes as indicated on the plans. Rebuilding manholes includes removal of the existing cover, adjustment rings, bricks, blocks, and precast barrel sections, cone sections or flat tops as necessary. Rebuilding manholes also includes the addition of new precast barrel sections, cone sections, and flat tops; replacement of existing precast barrel sections, cone sections or flat tops as necessary to meet the elevations shown on the plans; adjustment rings; cover; reconnecting existing pipes; and repairing existing blocks as necessary.

209.4.13 Salvage and Move Catch Basins

1. If the plans show, salvage existing catch basin, frame, and grate and move to proper location indicated by engineer to align with the proposed curb and gutter. Excavate, remove existing pipe as necessary, backfill, and provide any adjustment rings necessary to meet the elevations shown on the plans.

209.4.14 Clean Out

1. Thoroughly clean all catch basins, manholes, and inlets of an accumulation of soil, debris, or foreign matter of any kind. Ensure that catch basins, manholes, and inlets are clear of such accumulations at the time of final inspection.

209.5 Basis of Payment

1. The owner will measure the catch basins, manholes, and inlets bid items as each individual unit acceptably completed. Payment for the catch basins, manholes, and inlets bid items is full compensation for providing materials, including masonry, sealant, conduit and sewer connections, steps, and other fittings; for installing drop pipes; for providing new covers, including adjustment rings, frames, grates or lids, and other required materials and for installing and adjusting each cover; for excavating, backfilling, and disposing of surplus material, and for cleaning out and restoring the site.
2. Apply contract unit prices, without adjustment, to the quantities of catch basins, manholes, and inlets constructed to elevations not greater than 1 foot below what the plans show. If the engineer orders the construction of the catch basins, manholes, and inlets at elevations greater than 1 foot below what the plans show, then the owner will pay for this work as specified extra work.
3. The owner will measure the adjust catch basin, manhole, and inlet covers bid items as each individual unit acceptably completed. Payment for the adjust catch basin, manhole, and inlet covers bid items is full compensation for providing required materials, including frames and grates or lids when the existing cover will not be reinstalled; and for removing, installing or reinstalling covers, and adjusting the covers. Replace covers rendered unusable by the contractor's operations, at no expense to the owner.
4. The owner will measure the rebuild manhole bid items as each individual unit acceptably completed. Payment for rebuilding manholes is full compensation for providing required materials, including masonry and fittings; for salvaging and reinstalling existing manhole sections and covers, including frames, grates, or lids; for necessary excavation, backfilling, disposing of surplus material, and for cleaning out and restoring the site.
5. The owner will measure the salvage and move catch basin bid item as by each individual unit acceptably completed. Payment is full compensation for removing the existing catch basin and cover including frames, grates, or lids; for cleaning, transporting, and storing; for installing and adjusting; and for providing other required materials. If additional pipe is needed it will be paid under the pertinent bid item for storm sewer pipes.

210 Laterals

210.1 Scope

1. This section describes excavating required trenches or tunnels, laying or constructing sanitary sewer and storm sewer lateral pipe inside, and then backfilling and cleaning out as necessary.

210.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2.

210.3 Materials

210.3.1 General

1. Furnish pipe consistent with the size the bid item indicates and materials conforming to the following:
   A. Polyvinyl chloride sewer pipe and fittings **ASTM D3034**
   B. Polyvinyl chloride pressure pipe and fittings **AWWA C900**

210.3.2 Storm and Sanitary Lateral Materials

1. Furnish SDR 35 PVC sewer pipe conforming to **ASTM D3034** for all laterals unless indicated otherwise on the plans.

210.3.3 Joints

1. Furnish joint materials conforming to the following:
   A. Elastomeric seals (gaskets) for joining plastic pipe **ASTM F477**
   B. Joints for drain and sewer plastic pipes using flexible elastomeric seals **ASTM D3212**
   C. Joints for plastic pressure pipes using flexible elastomeric seals **ASTM D3139**
2. Furnish elastomeric gaskets for non-pressure sanitary sewer pipes which provide a continuous watertight conduit having an infiltration rate not exceeding 50 gallons per inch of pipe diameter per mile per day.
3. Furnish nitrile or fluorocarbon gaskets when specified on the plans for areas with anticipated contaminated soil or groundwater.
4. Legibly mark individual gaskets to identify them as to size and manufacturer of pipe and to distinguish oil-resistant types from other types. Raised, indented or indelible ink lettering is required. Color-coding or cross-section configuration is not acceptable as legible identification.

210.3.4 Polyvinyl Chloride Pipes

1. Store pipes in the supplier's yard or on the project site in conformance with **AWWA M23** and manufacturer's recommendations.
2. Do not stack pipe higher than 4 feet or on the bell ends.
3. Cover PVC pipe, which is stored outside for a prolonged period, with an opaque material to protect it from the sun's ultraviolet radiation. Do not use PVC pipe that has been subjected to excessive ultraviolet radiation identified by color fading or chalking. The determination as to the acceptability of the pipe rests solely on the engineer's decision.
4. Do not use pipe that has been contaminated in any way with petroleum products on the inside or outside of the pipe.

210.3.5 Pipe to Pipe Connectors

1. Furnish a molded rubber boot and PVC hub of appropriate size and listed below:
   A. Inserta Tee by Advanced Drainage Systems, Inc.
2. Furnish a molded rubber boot of appropriate size and listed below:
   A. Kor-N-Tee by Trelleborg Pipe Seals Milford, Inc.
3. Ensure that connectors come complete with all required stainless steel hardware.
4. Contour the lateral insertion to conform to the shape of the inside of the sewer main.

210.3.6 Cleanout Frames and Covers

1. Furnish materials conforming to the following:
   A. Gray Iron **ASTM A48 Class 35B**
2. Ensure that castings are true to pattern in form dimensions, free from pouring faults, sponginess, cracks, blowholes, and other defects in positions affecting strength and value for

the service intended. Ensure that castings are boldly filleted at angles and that the risers are sharp and perfect. Sandblast castings or otherwise effectively clean scale and sand so as to present a smooth, clean, and uniform surface.

3. Furnish cleanout frames and covers listed below:
   A. Neenah R-1792-AL frames with a solid lid.
4. Manhole frames and covers, which are not Neenah Foundry, shall be approved by the engineer as specified in 108.11, have equivalent dimensions, and meet all of the requirements of 210.3.6.

210.4 Construction

210.4.1 General

1. Verify the location, elevation, material, and size of all connections to existing upstream structures and laterals prior to installing new sanitary and storm sewer laterals to allow for any necessary adjustments to the planned pipe slope so that the lateral is not back pitched at the upstream connection point(s). Backfill or adequately fence or barricade excavations to verify existing pipes to protect pedestrians and vehicular traffic as directed by the engineer.
2. Excavate trenches and tunnels for all sanitary and storm laterals as specified in 204.4.
3. Dye test to determine which laterals are active and provide for tracing the existing lateral with a utility locator, a lateral launched camera, potholing, or other engineer approved method.
4. Determine the point of connection to the existing lateral so that the new lateral may be laid perpendicular to the sewer main without extra horizontal deflections.
5. Determine the location of existing sanitary laterals at locations where the new sanitary sewer laterals will be laid to a new sanitary sewer main located in a different location than the existing sanitary sewer main using a utility locator, a lateral launched camera, potholing, or other engineer approved method to determine the point of connection to the existing lateral so that the new lateral may be laid perpendicular to the sanitary sewer main without extra horizontal deflections. Determine the location of the existing lateral prior to installing the sewer main. Coordinate with property owners if it is necessary to enter their property to locate existing laterals.
6. Separate any sanitary sewer laterals serving more than 1 lot and provide a lateral for each lot.

210.4.2 Constructing Foundation

1. Construct foundations for all sanitary and storm laterals as specified in 204.4.2.7.

210.4.3 Laying Lateral Pipes

1. Provide 6-inch diameter sanitary sewer laterals.
2. Provide 6-inch diameter storm sewer laterals unless shown otherwise on the plans.
3. Lay sanitary laterals perpendicular to the sanitary main without horizontal deflections.
4. Lay sanitary sewer laterals at a minimum of ¼-inch per foot, unless otherwise approved by the engineer.
5. Lay storm sewer laterals at ⅛- to ¼-inch per foot, unless shown otherwise on the plans or otherwise approved by the engineer.
6. For new sanitary sewer laterals, provide a minimum depth of 9 feet at a location 2 feet behind the property line or proposed sidewalk. If the sanitary main is not sufficiently deep enough to give this depth, then lay the laterals at a minimum grade of ⅛-inch per foot.
7. For re-laid sanitary sewer laterals, provide a minimum depth of 9 feet at a location 2 feet behind the back of curb or road shoulder. If the sanitary main is not sufficiently deep enough to give this depth, then lay the laterals at a minimum grade of ⅛-inch per foot.

8. Lay storm laterals to 2 feet behind the curb and gutter unless shown otherwise in existing developed areas and to a location 2 feet behind the property line or proposed sidewalk in new development.
9. Sanitary sewer laterals may not discharge directly into a manhole unless shown on the plans or approved by the engineer.
10. Use factory wyes for sanitary sewers 12 inches or less in diameter. Lateral connections for 15-inch diameter and larger sanitary sewers may be made using factory wyes or an Inserta Tee. Install wyes such that the wye points downstream and enters the sanitary main at an angle of not less than 5 degrees and no more than 45 degrees off horizontal.
11. For all existing sanitary sewer mains which are 12 inches or less in diameter, cut out a section of the existing sanitary main and install a factory wye or tee with a minimum 2-foot piece of PVC pipe on each side of the factory wye and use a shielded coupling on each end to attach to the existing sanitary main. In existing sanitary sewer mains where there is an extremely high flow, the engineer may approve an alternate method for lateral connection.
12. Use factory wyes, factory tees, or a pipe to pipe connector for storm sewers. Laterals installed perpendicular to the spring line of the sewer main may use Inserta Tee or Kor-N-Tee pipe to pipe connectors. Laterals installed vertically or at a 45 degree angle may use Inserta Tee pipe to pipe connectors.
13. Make connections to existing laterals as specified in 211.4.
14. Plug unconnected sanitary and storm laterals with a waterproof cap or plug. Except in existing developed areas, mark the location of the end of the lateral with a wooden 2 x 4-inch board extending at least 2 feet above the ground surface and painted green.

210.4.4 Polyvinyl Chloride Pipe Joints

1. Ensure that PVC pipes have watertight joints conforming to the requirements of **ASTM D3212**. For PVC pressure pipe, seal joints using an elastomeric gasket conforming to the requirements of **ASTM D3139**.
2. Lubricate the outside of the gasket and the inside of the bell or groove of the pipe with an approved lubricant. Introduce the spigot or tongue of the pipe being laid into the bell or groove end of the previously laid pipe. Carefully set the pipe to line and grade and then push or jack home. Take care that the entering pipe is completely home.

210.4.5 Molded Rubber Boot and PVC Hub Connections

1. Core the proper size opening into the sewer.
2. Insert the rubber sleeve into the cored hole with the gold line on the rubber sleeve perpendicular to the main line sewer. The upper segment should be on top of the wall and the lower segment should be on the inside of the pipe.
3. Apply Inserta Tee solution to the inside of the rubber sleeve and the outside of the PVC hub adaptor. Use caution, pipe lubricant may cause the hub adaptor to pop out.
4. Insert the PVC hub adaptor into the rubber sleeve. Make sure the red line on the PVC hub adaptor is in line with the gold line on the rubber sleeve.
5. Place a 4 x 4-inch board on top of the PVC hub adaptor.
6. The red horizontal line at the top of the hub adaptor is a depth mark. Using a board and hammer, drive the PVC hub adaptor into the rubber sleeve to where the red horizontal line on the PVC hub adaptor meets the top of the rubber sleeve.
7. Place the stainless steel band around the top of the rubber sleeve and tighten down.
8. Install pipe in normal manner.

210.4.6 Molded Rubber Boot Connections

1. Core a hole into the sewer main consistent with the model number for the lateral pipe outside diameter.
2. Inspect the inside surface of the cored hole. If there is porosity or wire to cement separation, use patching or hydraulic cement to smooth the surface.
3. Insert the Kor-N-Tee assembly into the hole and expand the wedge or toggle Korband.
4. Insert the lateral until it bottoms on the positive stop of the Kor-N-Tee.
5. Install the lateral pipe clamp in the molded groove and tighten to 60-inch pounds using a T-handle torque wrench.

210.4.7 Cleanouts

1. A concrete pad is required when cleanouts are installed within a paved vehicular traffic area.
2. Upon installation and backfilling, ensure each frost sleeve cap or frame and lid is flush with the ground surface and fully exposed. If it is determined the cleanout has not been installed correctly and to grade, replace or adjust cleanout and/or frost sleeve to the correct elevation.

210.4.8 Backfill

1. Backfill all sanitary and storm sewers as specified in 204.4.2.8.

210.5 Basis of Payment

1. The owner will measure the sanitary and storm lateral bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe, from centerline of the sewer main, to which the lateral is connected, to the end of the installed lateral or to the connection to the existing lateral.
2. Payment for the sanitary and storm lateral bid items is full compensation for materials, including all necessary bends and fittings; for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for bypass pumping; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for constructing risers; for sealing joint; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the site. Payment for sanitary sewer laterals also includes all work necessary to locate and connect to existing laterals. Payment for new laterals also includes plugs on the end of the lateral and marker posts when required.
3. The owner will measurer the vertical riser bid items by the linear foot or as each riser acceptably completed. The length measured equals the distance along the centerline of the pipe, from the top of the sewer main (on which the riser is built) to the top of the tee connection for laterals. Payment for the vertical riser bid items is full compensation for materials, including all necessary bends and fittings; for excavating; for providing and removing sheeting and shoring; for bypass pumping; for providing granular backfill material; for constructing the foundation; for laying pipe; for sealing joint; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the site. The owner will measure and pay for the horizontally laid portion of the lateral under the applicable sanitary and storm lateral bid items.
4. Apply contract unit prices, without adjustment, to the quantities of sanitary and storm sewer laterals constructed at elevations not greater than 1 foot below what the plans or details show. If the engineer orders the construction of the sewer laterals or portions of the laterals at elevations greater than 1 foot below what the plans or details show, then the owner will pay for this work as specified extra work. If the engineer orders the construction of the sewer pipes or portions of the pipes at elevations greater than 1 foot above what the plans show, then the owner may request an adjustment to the contract prices for this work.

5. Work performed 7 inches or less below the pipe bottom to form a satisfactory foundation as specified is incidental to the work. The owner will pay for work required at depths greater than 7 inches below the pipe bottom as extra work.
6. The owner will pay separately for connections to existing pipes, laterals, catch basins, manholes, and inlets as specified in 211.5.
7. The owner will measure the locate existing sanitary lateral bid item as each locate acceptably completed. Payment for the locate existing sanitary lateral bid item is full compensation for locating laterals and for restoring the site. The owner will only measure and pay at locations where the new sanitary sewer laterals will be laid to a new sanitary sewer main located in a different location than the existing sanitary sewer main. The owner will not measure or pay if the location of the new lateral can be determined during installation of the new sanitary sewer main.
8. No additional compensation will be provided for relaying laterals or any other work necessary to provide an adequate slope and connection to the existing lateral caused by a failure to adequately verify the location, elevation, material, and size of all connections to existing upstream structures and pipes.
9. The owner will measure the cleanout bid items as each individual unit acceptably completed. The cleanout bid items include the wye and vertical pipes to the top of the frame or cap. Payment for the cleanout bid items is full compensation for providing materials, including all necessary bends and fittings; for excavating; for providing and removing sheeting and shoring; for constructing foundation; for completing any necessary connections to the existing or proposed lateral; for frost sleeve and cap; for frame and lid; for backfilling; for compacting; for cleaning out; for concrete pad; and for restoring the site. The owner will measure and pay for the horizontally laid portion of the lateral under the applicable sanitary and storm lateral bid items.

211 Sewer Connections

211.1 Scope

1. This section describes constructing connections to existing sanitary and storm sewer mains and laterals by means of couplings, concrete collars, or coring into existing manholes, including all necessary excavating and backfilling.

211.2 General Requirements

1. Submit manufacturer's data for the fittings, couplings, connectors, bands, appurtenances, and mix designs as specified in 106.2.2.

211.3 Materials

1. Furnish materials conforming to the following:
   A. Flexible couplings **ASTM D5926** and **ASTM C1173**
   B. Shielded couplings **ASTM D5926** and **ASTM C1173**
   C. Repair couplings **ASTM D3034, ASTM F769,** and **ASTM F1336**
   D. Flexible pipe to manhole connectors **ASTM C923**
   E. Concrete collars **Class C concrete**
   F. External sealing band **ASTM C877**
2. Furnish shielded couplings listed below:
   A. Strong Back RC 6000 Series couplings by Fernco Inc.
   B. MAXADAPTOR couplings by Gripper Gasket, LLC.
3. Furnish flexible couplings used to connect sanitary laterals, storm sewer mains, and storm laterals to existing pipes listed below:
   A. Standard couplings by Fernco Inc.

B. Large diameter couplings by Fernco Inc.
C. Strong Back RC couplings by Fernco Inc.
D. MAXADAPTOR couplings by Gripper Gasket, LLC.

4. Furnish flexible pipe to manhole connectors complete with all required stainless steel hardware and listed below:
   A. Kor-N-Seal by Trelleborg Pipe Seals Milford, Inc.
   B. Quik-Lok by A-Lok Products, Inc.
5. Furnish a non-shrink grout product listed on the WisDOT approved products list for non-shrink grout.

211.4 Construction

211.4.1 General

1. Verify existing structures and pipes as specified in 207.4.1 item 1.
2. Excavate trenches and tunnels for all sewer connections as specified in 204.4.
3. Make all new sanitary sewer pipe connections to existing manholes by coring the manhole. Provide connections equipped with a pipe to manhole connector.
4. Place pipe in masonry for inlet or outlet connections flush on the inside of the structure wall. Carefully construct the masonry around pipes to prevent leakage around their outer surfaces.
5. Extend pipe through the walls and beyond the outside surfaces of the walls a sufficient distance to allow for connections with sewers.
6. Make adequate provisions to support pipe outside the structure walls to prevent shearing off of said pipe after backfilling and tamping is completed.
7. Connect new sanitary sewer pipe to existing pipe through the use of a bell and spigot, shielded coupling, flexible coupling, repair coupling, or concrete collar, or other method of connection approved by engineer, so as to achieve a watertight connection where inverts of pipe are held at the same elevation. Use a bell and spigot connection of similar pipe materials whenever possible. Use repair couplings to connect new PVC pipe to existing PVC pipe whenever a bell and spigot connection is not possible. Use shielded couplings in other situations to connect a new sanitary sewer main to an existing main. Use concrete collars only when approved by the engineer and when other connections are impractical.
8. Use shielded couplings or flexible couplings to connect new pipe to existing sanitary sewer laterals. Use repair couplings to connect new PVC laterals to existing PVC laterals.
9. Connect new storm sewer pipe to existing pipe through the use of a bell and spigot, shielded coupling, flexible coupling, repair coupling, PVC fittings, concrete collar, or other method of connection approved by engineer, so as to achieve a watertight connection where inverts of pipe are held at the same elevation. Use a bell and spigot connection of similar pipe materials whenever possible. Use repair couplings to connect new PVC pipe to existing PVC pipe whenever a bell and spigot connection is not possible. Use shielded couplings in other situations to connect a new storm sewer main to an existing main. Use concrete collars only when approved by the engineer and when other connections are impractical.
10. Use shielded couplings or flexible couplings to connect new pipe to existing storm sewer laterals. Use repair couplings to connect new PVC laterals to existing PVC laterals. Use concrete collars only when approved by the engineer and when other connections are impractical.

211.4.2 Constructing Foundation

1. Construct foundations for all pipes as specified in 204.4.2.7.

211.4.3 Connect to Existing Sanitary Manhole Openings

1. Use existing holes only when the existing pipe to manhole connector in good condition, at the correct invert elevation, and is the appropriate size.
2. Remove any existing pipes.
3. Slide the pipe into the connector.
4. Check for proper alignment and grade.
5. Tighten the stainless steel clamps.

211.4.4 Connect to Existing Storm Structure Openings

1. Use existing holes in storm structures when feasible.
2. Remove any existing pipes.
3. Adjust the size of the hole to an adequate size.
4. Connect pipes and construct masonry around the pipes.

211.4.5 Core into Existing Sanitary Manholes

1. Core the proper size hole into the existing manhole.
2. Provide full flow height manhole inverts and full sweep curvature into main flow line at all side connecting mains. Recast a minimum of 2 inches of concrete into the reconstructed invert. Bench modification includes removing or otherwise performing significant adjustment of existing manhole benches.
3. Install a pipe to manhole connector according to manufacturer's recommendations.
4. Slide the pipe into the connector.
5. Check for proper alignment and grade.
6. Tighten the stainless steel clamps.

211.4.6 Core Into Existing Storm Structures

1. Core the proper size hole into the existing manhole.
2. Remove entire blocks from existing block manholes.
3. Provide full flow height manhole inverts and full sweep curvature into main flow line at all side connecting mains. Recast a minimum of 2 inches of concrete into the reconstructed invert. Bench modification includes removing or otherwise performing significant adjustment of existing manhole benches.
4. Connect pipes and construct masonry around the pipes.

211.4.7 Flexible and Shielded Coupling Connections to Existing Pipes

1. Reconnect all existing live sewer pipes to the proposed sewer. When a new pipe is connected to an existing pipe, a watertight joint using a flexible or shielded coupling is required.
    A. Use the following installation instructions for Fernco couplings:
        a. Loosen the stainless steel clamps. Do not remove clamps from coupling.
        b. Slide coupling over one pipe end. Insert second pipe. Center pipe ends inside of coupling.
        c. Tighten clamps to 60 inch-lbs. of torque.
        d. Pressure test before backfilling or concealing joint. Bed and backfill as specified in 204.4.2.7 and 204.4.2.8.
    B. Use the following installation instructions for MAXADAPTOR couplings:
        a. Tighten both sides of the coupling; alternating back and forth.
        b. Slide coupling over one pipe end. Insert second pipe. Ensure gasket is centered and properly engaged inside securing cage.
        c. Tighten clamps to 80 inch-lbs. of torque.

211.4.8 Repair Couplings

1. Cut out and remove the existing pipe as required. Take care to cut as straight as possible.
2. Lay proper bedding as specified in 204.4.2.7.
3. Clean the pipe sections so they are clean from any dirt or debris.
4. Align and slide the repair coupling onto both ends of pipe.

211.4.9 Concrete Collars

1. Provide a watertight joint by wrapping the connection with an external sealing band. Place the concrete collar containing ready-mixed Class C concrete around the connection.
2. The collar should be 6 inches thick by 24 inches in width.
3. Remove any projections at the connection that might cut or damage the sealing band. Take special care when backfilling around the sealing band to help prevent disturbance to the connection.

211.5 Basis of Payment

1. The owner will measure the connect to existing manhole or structure bid items and the core and connect to existing manhole or structure bid items as each individual unit acceptably completed. Payment for the connect to existing manhole or structure bid items is full compensation for excavating; for sheeting and shoring; for by-pass pumping; for forming foundation; for flexible connector or masonry; for bench modifications; for providing granular backfill material, including bedding material; for backfilling; for removing sheeting and shoring; and for cleaning out and restoring the site.
2. The owner will measure the connect to existing main bid items as each individual connection acceptably completed. Payment for the connect to existing main bid items is full compensation for excavating; for sheeting and shoring; for by-pass pumping; for forming foundation; for couplings; for providing granular backfill material, including bedding material; for backfilling; for removing sheeting and shoring; and for cleaning out and restoring the site.
3. The owner will measure the connect to existing storm lateral bid item as each individual connection acceptably completed. Payment for the connect to existing lateral bid items is full compensation for excavating; for sheeting and shoring; for by-pass pumping; for forming foundation; for couplings; for providing granular backfill material, including bedding material; for backfilling; for removing sheeting and shoring; and for cleaning out and restoring the site.
4. The owner will measure the concrete collar bid items as each individual unit acceptably completed. Payment for the concrete collar bid items is full compensation for excavating; for sheeting and shoring; for by-pass pumping; for forming foundation; for concrete collars; for providing granular backfill material, including bedding material; for backfilling; for removing sheeting and shoring; and for cleaning out and restoring the site.
5. The connect to existing manhole, structure, pipe, and lateral items do not include the costs of any pipes. The owner will measure and pay for pipes and laterals as specified in 207.5 and 210.5.
6. No additional compensation will be provided for connections measured and paid under the sanitary sewer spot repair bid item.
7. Work performed to connect new sanitary sewer laterals to existing laterals is incidental to the work.
8. Sewer connections will be paid as either connect to existing main, connect to existing lateral, or as a concrete collar for each individual connection. Payment will not be made for a concrete collar and connect to existing at an individual connection.

212 Testing and Cleaning

212.1 Scope

1. This section describes the testing of sanitary and storm sewer pipes, laterals, force mains, manholes and other appurtenances, including low pressure air tests, water infiltration tests, exfiltration tests, deflection tests, closed circuit televising, and hydrostatic tests. This section also describes cleaning sanitary and storm sewers.

212.2 General Requirements

212.2.1 Responsibility for Performing Testing

1. Perform all tests, by the contractor, under the observation of the engineer unless the special provisions call for owner provided testing. The owner will notify the contractor not less than 24 hours in advance if testing is to be done by the owner.
2. Furnish the testing device and all labor, equipment, and materials for performing all tests.

212.2.2 Infiltration Testing

1. All sanitary sewers, except relays with active connected buildings' sewers, are required to pass a leakage test before they are accepted by the owner. The permitted leakage tests for sewers 36 inches or less in nominal size are the water infiltration test or the low pressure air test. The contractor may perform either of these tests. The permitted leakage test for sewers larger than 36 inches is the water infiltration or the water exfiltration test.
2. Conduct a visual inspection and test on all completed sewers larger than 36 inches when they are submerged by groundwater. Visually inspect all sanitary sewers larger than 36 inches not submerged by groundwater and test for exfiltration or perform low pressure air testing of individual joints.
3. The water infiltration or exfiltration test may be substituted for the low pressure air test when testing pressure pipe used for gravity service if the pressure pipe fails the low pressure air test.
4. The groundwater height above the installed pipe may be determined by attaching a transparent plastic tube to the provided opening in the manhole and using the plastic tube as a manometer.
5. The ends of branches, laterals, tees, wyes and stubs to be included in the test should be plugged to prevent leakage. When the lateral is connected to a saddle fitting installed on the man line under the same contract, include that section of the main sewer in the lateral test.
6. Repair or replace any section of sewer which fails to meet the test requirements and retest.
7. Repair all visible leaks, defective joints, and defective pipe even if the leakage test requirements are met.

212.2.3 Deflection Testing

1. Perform deflection tests on the entire length of all PVC, fiberglass reinforced polymer mortar, polypropylene, and polyethylene main line pipe.

212.2.4 Sewer Cleaning and Televising

1. Clean and televise all sanitary sewer mains. Clean and televise storm sewers when directed by the engineer.

212.2.5 Force Main Testing

1. Perform hydrostatic tests on the entire length of all force main pipe.

212.3 Procedure

212.3.1 Low Pressure Air Test

1. This test method is applicable to all gravity sewer lines made of thermoplastic pipe (including PVC, polyethylene, and polypropylene), reinforced thermosetting resin pipe, and reinforced plastic mortar pipe. Set up the apparatus for the low pressure air test per the standard detail drawing *Low Pressure Air Test*. The air test will be based upon an allowable leakage rate of 0.0015 cubic feet per minute per square foot of internal surface area.
2. Pipes with diameters of 36 inches and above will not be accepted by means of the low pressure air test. In all cases, ignore the length of the laterals.
3. Only after the sanitary sewers, including appurtenances and sanitary laterals, have been installed, backfilled, and cleaned, may the contractor proceed with an air test on the installed facilities.
4. The procedure is as follows:
   A. Flush and clean the section of sewer line to be tested prior to conducting the low pressure air test.
   B. Isolate the section of the sewer line to be tested by means of inflatable stoppers or other suitable plugs. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. One of the plugs should have an inlet tap, or other provisions for connecting a hose to a portable air control source.
   C. If the test section is below the groundwater level, determine the height of the groundwater above the top of the pipe at the upstream end of the test section. If the groundwater is 2 feet above the top of the pipe at the upstream end, then the air pressure test cannot be used. For every foot of groundwater above the pipe spring line, increase the gauge test pressures by 0.43 pounds per square inch.
   D. Connect the air hose to the inlet tap and portable air control source. The air equipment should consist of necessary valves and pressure gauges to control the rate at which air flows into the test section and to enable monitoring of the air pressure within the test section. Testing apparatus should be equipped with a pressure relief device set no higher than 9.0 psig to prevent the possibility of loading the test section with the full capacity of the compressor.
   E. Add air slowly to the test section until the pressure inside the pipe is raised to 4.0 psig greater than the average back pressure of any groundwater that may be over the pipe. Do not exceed 9.0 psig.
   F. After the pressure of 4.0 psig is obtained, regulate the air supply so the pressure is maintained between 3.5 and 4.0 psig (above the average groundwater back pressure) for a period of 2 minutes. This allows the temperatures to stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until temperature equilibrium is obtained. During this period, check all plugs with a soap solution to detect any plug leakage.
   G. Determine the rate of air loss by the time pressure drop method. After the 2-minute air stabilization period, air is slowly introduced into the section of pipe to be tested until the pressure is raised to approximately 4.0 psig. The air supply is then disconnected and the test pressure is allowed to decrease to 3.5 psig. The time required for the pressure to drop from 3.5 psig to 2.5 psig is determined by means of a stopwatch and this time interval is then compared to the specification from ***Table 212-1***, to determine if the rate of air loss is within the allowable time limit. If the time is equal or greater, than the times indicated in ***Table 212-1***, the pipe line will be deemed acceptable.
   H. Upon completion of the test, open the bleeder valve and allow all air to escape. Plugs should not be removed until all the air pressure in the test section has been released. No one should be allowed in the trench or manhole while the pipe is being decompressed.

Table 212-1
Minimum Specified Time Required for a 1.0 Psig Pressure Drop for Size and Length of Pipe Indicated

Pipe Diameter (Inches)	Minimum Time (Min:Sec)	Length for Minimum Time (Feet)	Time for Longer Length (Sec)	Specification Time for Length (L) Shown (Min:Sec)							
				100 Ft	150 Ft	200 Ft	250 Ft	300 Ft	350 Ft	400 Ft	450 Ft
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.694L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

212.3.2 Water Infiltration Test

1. The water infiltration test will be considered a valid leakage test only if the top surface of the groundwater is at least 2 feet above the top of the pipe for the entire test length of the tested section during the test measurement. The contractor may simulate this condition, at no cost to the owner by flooding the trenches, with prior approval of the engineer.
2. The maximum rate of infiltration of water into the sewer project, including manholes, is 50 gallons per day, per inch diameter, per mile of sewer for any section of the system.
3. The maximum infiltration rate for manholes tested separately and independently is 0.1 gallons per foot of diameter per foot of head per vertical foot of manhole per hour.
4. The maximum allowable infiltration, expressed in gallons per hour, is shown in ***Table 212-2*** for various pipe sizes.

Table 212-2
Allowable Limits of Infiltration Based on 50 Gal./In. Dia./Mile

Diameter of Sewer (Inches)	Infiltration Per Ft. Per Hr. (Gallons)	Diameter of Sewers (Inches)	Infiltration Per Ft. Per Hr. (Gallons)
4	0.0016	21	0.0083
6	0.0024	24	0.0095
8	0.0032	27	0.0107
10	0.0039	30	0.0118
12	0.0047	36	0.0142
15	0.0059	42	0.0166
18	0.0071	48	0.0189

212.3.3 Water Exfiltration Test

1. The water exfiltration test may only be used if the existing groundwater level is less than 2 feet above the crown of the pipe measured from the highest elevation of the sewer section being tested.

2. Any arrangement of testing equipment which will provide observable and accurate measurement of water leakage under the specified conditions will be permitted. The maximum rate of exfiltration of water out of the sewers, including manholes and appurtenances, is 50 gallons per day, per inch diameter, per mile of sewer for any section of the system.
3. The maximum exfiltration rate for manholes tested separately and independently is 0.1 gallons per foot diameter per vertical foot of manhole per foot of head per hour.
4. Fill the sewer test section a minimum of 4 hours and up to a maximum of 72 hours prior to the time of exfiltration testing to permit normal absorption into the sewer walls to take place. After the absorption period, re-fill the pipe to a minimum of 2 feet above the crown of the pipe or at least 2 feet above existing groundwater, whichever is higher.
5. The maximum allowable exfiltration, expressed in gallons per hour, is the same as for the infiltration test and is shown in ***Table 212-2***. The minimum test period is 15 minutes and the maximum may not exceed 24 hours.
6. The engineer reserves the right to waive the exfiltration test on any section of sewer based on the engineer's evaluation of the results of previous tests of the project. When exfiltration tests are waived, a credit will be taken.

212.3.4 Deflection Test

1. Use an approved go-no-go device. Use device conforming substantially to that shown on the standard detail drawing *Mandrel for Deflection Tests*. The dimensions of the testing device are shown in ***Table 212-3, Table 212-4,*** and ***Table 212-5***.
2. Conduct the test after all backfill has been placed and consolidated but before paving is constructed. If testing occurs within 30 days of placement of final backfill, deflection may not exceed 5%. When testing occurs after 30 days of placement of final backfill, the deflection may not exceed 7.5%.
3. For acceptance, the device must pass through the entire section between manholes in one pass when pulled by hand without the use of excessive force.

Table 212-3
Testing Device Dimensions for Polyvinyl Chloride Pipe

Nominal Size (Inches)	SDR 35 D3034 Minimum Diameter (Inches)		
	Base Inside Diameter	5% Deflection	7.5% Deflection
8	7.67	7.28	7.09
10	9.56	9.08	8.85
12	11.36	10.79	10.51
15	13.90	13.20	12.85
18	16.98	16.13	15.70
21	20.00	19.00	18.50
24	22.48	21.54	20.79
Nominal Size (Inches)	F949 Minimum Diameter (Inches)		
	Base Inside Diameter	5% Deflection	7.5% Deflection
8	7.66	7.27	7.08
10	9.55	9.07	8.83
12	11.34	10.77	10.49
15	13.86	13.17	12.82

18	16.96	16.12	15.69
21	20.16	19.16	18.65
24	22.63	21.50	20.94
30	28.20	26.79	26.08
36	34.18	32.47	31.61
Nominal Size (Inches)	F679 PS46 12454C Minimum Diameter (Inches)		
	Base Inside Diameter	5% Deflection	7.5% Deflection
18	16.98	16.13	15.70
21	20.00	19.00	18.50
24	22.48	21.36	20.79
27	25.33	24.06	23.43
Nominal Size (Inches)	F679 PS46 12364C Minimum Diameter (Inches)		
	Base Inside Diameter	5% Deflection	7.5% Deflection
18	17.06	16.20	15.78
21	20.10	19.09	18.59
24	22.59	21.46	20.89
27	25.45	24.17	23.54

Table 212-4
Testing Device Dimensions for Polyethylene Pipe

Nominal Pipe Diameter (Inches)	Base Inside Diameter (Inches)	Inside Diameter with 5% Deflection (Inches)	Inside Diameter with 7.5% Deflection (Inches)
8	7.76	7.37	7.17
10	9.69	9.21	8.97
12	11.63	11.05	10.76
15	14.54	13.82	13.45
18	17.45	16.58	16.14
24	23.27	22.10	21.52
30	29.08	27.63	26.90
36	34.90	33.16	32.28
42	40.72	38.68	37.66
48	46.54	44.21	43.05

Table 212-5
Testing Device Dimensions for Polypropylene Pipe

Pipe Type	Pipe Diameter (Inches)	Minimum Inside Diameter (Inches)	Inside Diameter with 5% Deflection (Inches)	Inside Diameter with 7.5% Deflection (Inches)
Dual Wall	12	11.90	11.31	11.01
	15	14.85	14.11	13.74
	18	17.93	17.03	16.59

	24	23.90	22.71	22.11
	30	29.79	28.30	27.56
Triple Wall	30	29.62	28.14	27.40
	36	35.40	33.63	32.75
	42	41.31	39.24	38.21
	48	47.31	44.94	43.76
	60	59.30	56.34	54.85

212.3.5 Sewer Cleaning

1. The intent of sewer line cleaning is to remove foreign materials from the sewers and restore the sewer to a minimum of 95% of the original carrying capacity. Some conditions may exist, such as broken pipe and major blockages, which will prevent cleaning from being accomplished. Should such conditions be encountered, the contractor will not be required to clean those specific sewer sections.
2. Use equipment conforming to the following:
   A. Use high-velocity jet cleaning equipment constructed for ease and safety of operation. Use equipment with a selection of 2 or more high-velocity nozzles capable of producing scouring action from 15 to 45 degrees in all size sewers designated to be cleaned. Use equipment carrying its own water tank.
   B. Use equipment capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer pipes and manholes.
   C. Mechanical cleaning equipment such as bucket machines may also be used at the contractor's discretion.
3. Use the following cleaning procedures:
   A. Use the cleaning equipment to move debris downstream.
   B. Remove all sludge, dirt, sand, rocks, grease, roots and other solid or semisolid materials resulting from the cleaning operation at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section is not permitted.
   C. Document all work done in a report. Include the following information of the report:
      a. Locations cleaned.
      b. Amount/type of material removed.
      c. Procedure used to perform cleaning.
4. Remove and dispose all solids or semisolids resulting from the cleaning operations at a site designated in the special provisions. If no site is listed in the special provisions, dispose at a landfill or other location to be approved by engineer. Remove all materials from the site by the end of each workday.
5. If the contractor desires to use City of Fond du Lac water, obtain water as specified in 107.18.

212.3.6 Sewer Televising

1. The intent of the sewer televising inspection is to observe and record the conditions of the sewer sections being inspected. Document the location of all laterals on the report.
2. Perform sanitary sewer main televising after installation of all laterals and at least 2 weeks prior to paving.
3. If the owner deems the televising of the sanitary sewer mains is not of good quality, the contractor will redo the section at their expense.
4. Use equipment conforming to the following:
   A. Use a camera, television monitor, and other components of the video system capable of producing a quality color picture. Use a television camera for the inspection specifically

designed and constructed for such inspection and capable of radial view for inspection of the entire pipe, including lateral connections.

B. Mount the camera on adjustable skids, or self-propelled, and position in the center of the pipe.
C. Supply lighting of the camera by a lamp on the camera and capable of lighting the entire periphery of the pipe.
D. Use a camera operative in 100% humidity conditions and with a minimum of 650 lines of resolution.
E. Transmit the view seen on the televising camera to a monitor of not less than 17 inches.

5. Use the following televising procedures:
   A. Make a minimum of one pass with a sewer jet prior to televising as specified in 212.3.5. Move the television camera through the sewer at a uniform rate, stopping when necessary to insure proper documentation of the sewer. Do not pull the television camera at a speed greater than 30 feet per minute.
   B. During the inspection operation, if the television camera will not pass through the entire sewer section, reset the equipment in a manner so the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire section, excavate and repair or replace the defective section.
   C. If the camera becomes submerged due to a sag in the pipe, utilize a high velocity jet to pull water away from the camera lens. If the engineer deems the sag is not acceptable, the contractor will excavate and repair or replace the defective section of pipe at the contractor's own expense.
   D. If the camera becomes trapped within the sewer, it is the responsibility of the contractor to remove the camera. All costs for removal, including possible excavation and restoration are the responsibility of the contractor.
6. Furnish computer printed inspection logs and inspection logs in a PDF format to the owner. Supply the following with television inspection logs:
   A. Date, time, city, street, basin, sewer section, reference manhole number, name of operator, inspector, and weather conditions.
   B. Pipe diameter, pipe material, section length, depth of pipe, length between joints, and corresponding video recording identification.
   C. Location of each point of leakage and estimate of flow.
   D. Location of each service connection.
   E. Location of any damaged sections, nature of damage, and location with respect to pipe axis (such as mineral deposits, cracked pipe, sags, etc.).
7. The purpose of video recording is to supply a visual record and audio record of the condition of sewers. Provide recording with playback done at the same speed that it was recorded. Upon final payment of the work, all video recording shall become the property of the owner, and shall be provided in a digital format. Make a complete video and audio recording of each line televised. Label recordings and packages with location information and inspection date. Include the following on television inspection reports:
   A. Visual (On screen in corner)
      a. Report number.
      b. Date of television inspection.
      c. Sewer section and number.
      d. Current distance along reach (tape counter footage).
   B. Audio:
      a. Date and time of television inspection, operator name, name of overlaying or adjacent street, and manhole numbers.

b. Verbal confirmation of sewer section and televising direction in relation to the direction of flow.
c. Verbal description of pipe size, type, and pipe joint length.
d. Verbal description and location of each service connection and pipe defect.
e. Type of weather during inspection.

212.3.7 Hydrostatic Test

1. All force mains are required to pass a hydrostatic test, performed by the contractor, composed of a pressure test and a leakage test on all force mains before acceptance by the owner. Perform pressure testing at 150% of the design operating pressure as specified by the engineer, but not less than 50 psi.
2. Do not add water during the pressure test. No pipe section will be accepted if the test pressure drops more than 5 psi within the 2-hour test duration.
3. The leakage is the amount of water required to bring the pressure back up to the starting pressure once the pressure test passes. The maximum allowable leakage, expressed in gallons per hour, is determined by the following formula:

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

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of main in inches
P = average pressure in pounds per square inch gauge

4. Conduct hydrostatic tests on sections of main recommended as ready by the contractor and approved by the engineer. Do not test sections less than 400 feet unless conditions warrant such testing of smaller sections.
5. Following the testing, drain and dispose test water and remove any temporary fittings, valves, and plugs.

212.4 Basis of Payment

1. Work specified in 212 is incidental to the contract, unless noted otherwise.

213 Abandonments

213.1 Scope

1. This section describes the abandoning of existing sanitary structures, sanitary sewer pipe, storm sewer structures, and storm sewer pipe, either through crushing, filling, or removal of the existing structure or pipe.

213.2 General Requirements

1. Remove abandoned utilities that conflict with new sewer construction from the trench and properly dispose materials.
2. Abandon and seal existing structures and pipes at locations outside excavation or trenching operations as shown on the plans.
3. The engineer will determine at the time of construction if certain manholes, catch basins, or pipes are to be abandoned, filled, or if complete removal is required.

213.3 Construction

213.3.1 Abandon Manholes and Catch Basins

1. Remove all abandoned manholes and catch basins to a depth of 3 feet below the proposed or established grade or existing street grade, whichever is lower.
2. Crack the manhole or structure base to allow drainage.
3. Seal off all pipe entering or leaving such structure. Backfill the manhole, catch basin, or other structure being abandoned as specified in 204.4.2.8.
4. All castings on such abandoned structures are the property of the owner. Salvage and deliver to the owner as directed or dispose as directed by the engineer.

213.3.2 Seal Existing Sewers

1. Construct a bulkhead at each exposed end of abandoned pipes consisting of an 8-inch cement brick and mortar wall.
2. Where trenching or excavating operations for this contract intersect or cut through old sanitary sewer, storm sewer, or water lines which the engineer determines are inactive or are being abandoned, seal such lines off on both sides of the trench or excavation before backfilling operations are commenced.
3. All those locations at which inactive pipe or pipes to be abandoned are likely to be encountered will be noted on the plans, insofar as existing records and field surveys indicate. However, the omission of any note regarding the requirement of such plugs or the existence of some unknown pipe requiring such plugging shall not absolve the contractor of their responsibility to seal all those pipes so encountered when directed by the engineer to do so.

213.3.3 Abandoned Sewer Fill

1. Fill all sewers, 15 inches in diameter or greater, which are to be abandoned and have not been removed with sand or cellular concrete. Maintain service in such sewers and drains until the engineer orders manholes, catch basins, and catch basin leads that are no longer in use to be bulkheaded and abandoned.
2. Provide adequate access points to completely fill the pipe.
3. Backfill and compact any resulting trenches with granular backfill as specified in 204.4.2.8.
4. For all abandonment, the contractor shall have the option to completely remove the existing sewer and backfill trench with appropriate backfill material as specified in 204.4.2.8. The owner will pay for this work at the same amount as abandoned sewer fill except where the plans specifically indicate that the sewer shall be removed.

213.3.4 Remove Sewer

1. Excavate all abandoned sewer pipes and remove from the roadway as shown on the plans or ordered by the engineer.
2. Backfill and compact any resulting trenches with granular backfill as specified in 204.4.2.8.
3. Any sealing of pipe at locations within excavation or trenching operations, such as main or lateral installation, is incidental to the work.

213.3.5 Basis of Payment

1. The owner will measure the abandon manhole and catch basin bid items as each individual unit acceptably completed. Payment for the abandon manhole and catch basin bid items is full compensation for excavating; for breaking down or removing existing manhole or catch basin; for the sealing of all open ends of sewer pipes entering or leaving the manholes or catch basins being

abandoned; for providing granular backfill material; for backfilling; and for cleaning out and restoring the site.

2. The owner will measure the seal existing sewer bid items as each individual location acceptably completed. Payment for the seal existing sewer bid items is full compensation for excavating; for sealing the open ends of sewer pipes; for providing granular backfill material; for backfilling; and for cleaning out and restoring the site.
3. The owner will measure the abandoned sewer bid fill items by the cubic yard acceptably completed. Payment for the abandoned sewer fill bid items is full compensation for excavating, breaking down, removing, sealing ends, and filling existing sewer pipes with sand or slurry. It also includes providing granular backfill material, for backfilling, and for cleaning out and restoring the site.
4. The owner will measure the remove sewer bid items by the linear foot acceptably completed. Payment for the remove sewer bid item is full compensation for removing existing sewer pipes. It also includes providing granular backfill material, for backfilling, for compacting, and for cleaning up and restoring the site. Removing structures is incidental to the work of removing sewer.
5. Abandoning and sealing existing structures and removing and sealing pipes at locations within excavation or trenching operations is incidental to the work for new sewer and manholes.

300 Erosion and Sediment Control

301 Definitions and Acronyms

301.1 Acronyms

1. Interpret erosion and sediment control related acronyms used in sections 301 through 303 as follows:

ECRM	Erosion Control Revegetative Mats
NR	Wisconsin Department of Natural Resources Administrative Code
PAL	Wisconsin Department of Transportation Product Acceptability List

301.2 Definitions

1. Interpret erosion and sediment control related definitions used in sections 301 through 303 as follows:

   Disturbance, Disturbed. Any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover that may result in runoff and lead to an increase in soil erosion and movement of pollutants into the municipal separate storm sewer or waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities, and soil stockpiling.

   Erosion Control Revegetative Mats. A blanket like covering laid on top of a prepared seed bed to protect soil and seed from erosive forces of nature and include erosion mat class I, II, and III Type A on the PAL.

   Stabilization, Stabilized. All land disturbing construction activities at the construction site have been completed and a uniform perennial vegetative cover has been established, with a density of at least 70% of the cover, for the unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures.

   Trackout. The relocation of material from its intended location to offsite surfaces by vehicles.

302 General Erosion and Sediment Control Requirements

302.1 Scope

1. This section describes the general construction site pollutant control requirements to minimize the discharge of sediment and construction materials as shown and specified until site restoration, landscaping, and paving are complete.

302.2 General Requirements

1. Install and maintain erosion and sediment control practices conforming to the requirements outlined in the *WDNR Conservation Practice Standards* (Technical Standards).
2. Strictly comply with the guidelines and requirements set forth in Section 628 of the *Standard Specifications for Highway and Structure Construction*.
3. Comply with all requirements of the State of Wisconsin Construction Site Storm Water Runoff General Permit.
4. Adjust the methods and types of erosion and sediment control, dependent on the location and type of work involved, to meet field conditions at the time of construction. Install sediment control practices prior to any grading or disturbance of existing surface material. Ensure that all temporary sediment control practices are properly installed and maintained to remain in place until stabilization or as the contract specifies. Remove all temporary sediment control practices after final stabilization as determined by the engineer.

5. Commence permanent site restoration and soil stabilization when land disturbing activities cease and final grade has been established. In the event of winter construction, complete restoration work as soon as the weather is conducive to vegetation growth. Commence temporary stabilization activity when land disturbing activities have temporarily ceased and will not resume for a period exceeding 14 calendar days.
6. Inspect erosion and sediment control practices for integrity weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Correct any damaged practices and restore by the end of each working day.

302.3 Materials

302.3.1 Approved Products

1. Furnish manufactured erosion and sediment control products from the PAL. Contact the engineer when there are no products on the PAL. Install products from the PAL conforming to those manufacturer's specifications and as modified in 303 and the plans.

302.4 Construction

302.4.1 Dust Control

1. Take all reasonable measures to protect the owner from complaints regarding dust, as well as complaints pertaining to dirt or debris dropped on streets leading to the waste disposal areas during old pavement removal and excavating operations. If in the engineer's opinion, it becomes necessary to apply a dust palliative along the construction project to relieve abutting property owners from unreasonable dirt and dust conditions, furnish and apply such dust preventives at the expense of the contractor. Apply dust control measures in conformance with *WDNR Conservation Practice Standard 1068*.

302.4.2 Chemicals, Cement, and Other Building Compounds and Materials

1. Prevent the discharge of on-site chemicals, cement, and other building compounds and materials into storm sewers and waters of the state during the construction period.

302.4.3 Spill Prevention and Response

1. Ensure that all hazardous substances are properly labeled and that hazardous substances are stored, dispensed and/or used in a way that prevents release.
2. Provide spill response materials, including, but not limited to, the following:
   A. Containers.
   B. Adsorbents.
   C. Shovels.
   D. Personal protective equipment.
3. Make spill response materials available at all times during the handling or transportation of hazardous materials or wastes. Furnish materials compatible with the type of materials and contaminants being handled.
4. Notify the engineer and notify the WDNR according to Wisconsin Administrative Code NR 706 in the event that a spill or accidental release of any substance results in the discharge of pollutants to the waters of the state. Notify the WDNR via the 24-hour spill hotline, 1-800-943-0003. Immediately take containment actions to minimize the effect of any spill or leak. Perform additional sampling and testing to verify spills have been cleaned up, as directed by the engineer. Perform spill cleanup and testing at no additional cost to the owner.

302.4.4 Equipment Decontamination

1. Follow the most recent WDNR approved washing and disinfection protocols and approved best management practices to avoid the spread of invasive species for all equipment and materials used within or adjacent to waterways and waterbodies.

302.5 Basis of Payment

1. The owner will pay for the work required in 302 as specified in 303.6. Work not having a discrete bid item specified in 303.6 is incidental to the contract.

303 Erosion and Sediment Control Practices

303.1 Scope

1. This section describes providing erosion and sediment control practices to minimize erosion and the discharge of sediment until site restoration, landscaping, and paving are complete.

303.2 General Requirements

1. Install and maintain erosion and sediment control practices where the plans show or the engineer directs.
2. Install or utilize trackout control practices to prevent, reduce, or mitigate trackout of sediment. Implement the following in series where conditions warrant:
   A. Prevent trackout with stabilized work surfaces and reduced vehicle contact with soil.
   B. Reduce trackout with stone tracking pad.
   C. Mitigate trackout with street cleaning.
3. Install storm drain inlet protection at all storm water inlets where the contributing drainage area is temporarily disturbed.
4. Install perimeter control practices to prevent the discharge of sediment offsite and into adjacent waters of the state.
5. Install turbidity barrier or silt curtain whenever construction activities are occurring in or directly adjacent to a waterway or waterbody.
6. Install erosion control practices and ditch checks to prevent the discharge of sediment from drainage ways that flow off the site.
7. Discharge all sediment-laden water to dewatering practices before release into the storm sewer or drainage ways.
8. The contractor is responsible for submitting and obtaining any required WNDR permits for dewatering or pumping of groundwater, including Dewatering Operations WPDES General Permit.
9. Do not install or operate dewatering wells, for which the single or aggregate capacity exceeds 70 gallons per minute, unless the contractor obtains a high capacity dewatering well permit from WDNR.
10. Apply temporary seeding, install perimeter control practices, or apply soil stabilizer, type A or type B to prevent the discharge of sediment from all soil stockpiles existing more than 7 days.
11. Prevent the discharge of untreated wash water from vehicle and wheel washing into waters of the state or storm sewers.

303.3 Materials

303.3.1 Riprap

1. Furnish geotextile fabric as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*. Furnish type R fabric for light riprap and type HR fabric for medium and heavy riprap.

2. Furnish riprap as specified in Section 606 of the *Standard Specifications for Highway and Structure Construction*. Waste concrete slabs may only be used with permission of the engineer.
3. Furnish riprap grout as specified in Section 606 of the *Standard Specifications for Highway and Structure Construction*.

303.3.2 Erosion Mat

1. Furnish erosion mat products of the type and class shown on the plans or directed by the engineer.
2. Furnish urban erosion mat anchoring devices from the PAL or other natural or biodegradable anchoring devices approved by engineer for class I and class II erosion mats. Metal pins or staples are not allowable.

303.3.3 Temporary Seeding

1. Use annual oats for spring and summer plantings and winter wheat or agricultural rye for fall plantings after September 1.
2. Use annual oats with a minimum purity of 98% and minimum germination of 90%. Use winter wheat with a minimum purity of 95% and minimum germination of 90%. Use agricultural rye with a minimum purity of 97% and minimum germination of 85%.

303.3.4 Soil Stabilizers

1. Furnish soil stabilizer products from the PAL.

303.3.5 Polyethylene Sheeting

1. Furnish 6 mil or thicker polyethylene sheeting conforming to **ASTM D4397**.

303.3.6 Silt Fence

1. Furnish silt fence materials, including supports and geotextile fabric, as specified in *WDNR Conservation Practice Standard 1056*.

303.3.7 Log-type Perimeter Control

1. Furnish temporary ditch check products from the PAL.
2. Furnish a product within a minimum height of 12 inches unless indicated otherwise on the plans or directed otherwise by the engineer.

303.3.8 Rock Bags

1. Furnish rock bags made of high-density polyethylene or geotextile as specified in Section 628 of the *Standard Specifications for Highway and Structure Construction*.
2. Furnish bags with minimum dimensions of 18 inches in length, 12 inches in width, and 6 inches in height unless indicated otherwise on the plans or directed otherwise by the engineer.
3. Fill bags with coarse aggregate No. 1 (**AASHTO M43, No. 67**) as specified in Section 501 of the *Standard Specifications for Highway and Structure Construction*.
4. Use rock bags for silt fence relief, ditch checks, culvert pipe checks, and inlet protection.

303.3.9 Ditch Checks

1. Furnish ditch check products of the type shown on the plans or directed by the engineer.
2. For log-type and manufactured product ditch checks, furnish temporary ditch checks from the PAL. Furnish products with a minimum height of 16 inches unless indicated otherwise on the plans or directed otherwise by the engineer.

3. For temporary and permanent stone ditch checks, furnish stone as specified in *WDNR Conservation Practice Standard 1062* unless indicated otherwise on the plans or directed otherwise by the engineer.
4. For bale ditch checks, furnish straw, hay, or other engineer-approved materials, in good condition.

303.3.10 Inlet Protection

1. Furnish type FF fabric, as specified in the PAL, for type A, B, C, or D inlet protection.
2. Furnish type R, DF, and HR fabrics as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction* for type D-M, D-HR, or D-RF inlet protection.

303.3.11 Stone Tracking Pad

1. Furnish stone meeting the material and gradation requirements in *WDNR Conservation Practice Standard 1057* or select crushed material as specified in Section 312 of the *Standard Specifications for Highway and Structure Construction*.
2. Furnish type R fabric as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*.

303.3.12 Dewatering Practices

1. Furnish geotextile filter bags and geotextile filter basins fabricated using type R fabric as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*. Use geotextile filter bags with a minimum footprint of 100 square feet.
2. Furnish settling basins/tanks or manufactured filtering practices such as sand, wound cartridge or membrane filters in conformance with manufacturer's specifications meeting the requirements in *WDNR Conservation Practice Standard 1061*.
3. Furnish polymer approved by the WDNR and meeting the criteria in *WDNR Conservation Practice Standard 1051* unless directed otherwise by the engineer.

303.3.13 Sediment Basins

1. Provide temporary outlet structure according to the plans when required.

303.3.14 Waterway Sediment Control

1. Furnish turbidity barrier as specified in Section 628 of the *Standard Specifications for Highway and Structure Construction*.
2. Furnish silt curtain meeting the requirements in *WDNR Conservation Practice Standard 1070*.

303.4 Construction

303.4.1 Riprap

1. Prepare subgrade in conformance with Section 606 of the *Standard Specifications for Highway and Structure Construction*.
2. Install geotextile fabric in conformance with Section 645 of the *Standard Specifications for Highway and Structure Construction*.
3. Place riprap in conformance with Section 606 of the *Standard Specifications for Highway and Structure Construction*.
4. When the plans specify grouted riprap, place riprap grout in conformance with Section 606 of the *Standard Specifications for Highway and Structure Construction*.

303.4.2 Erosion Mat

1. Install and anchor erosion mat according to manufacturer's instructions and meeting the minimum anchor frequency from the PAL.
2. Install degradable netting where the plans show or the engineer directs. Use degradable netting for all erosion mat installed in terrace areas between the sidewalk and curb and gutter.

303.4.3 Temporary Seeding

1. Apply temporary seeding to disturbed areas as shown on the plans or as directed by the engineer.
2. Prepare a seedbed of loose soil to a minimum depth of 2 inches.
3. Sow at a rate of 3 pounds per 1,000 square feet on areas directed by the engineer.
4. Apply to disturbed areas when land disturbing activities have temporarily ceased and will not resume for a period exceeding 14 calendar days or more frequently as directed by the engineer.
5. Fertilize, mulch, and water temporary seeding areas as necessary to establish adequate vegetation.

303.4.4 Soil Stabilizers

1. Apply soil stabilizer with conventional hydraulic seeding equipment or by dry spreading. Apply the material at the manufacturer's recommended rate. Do not exceed the maximum application rate specified in the PAL.
2. Apply visible tracer or colorant to visually track application.

303.4.5 Polyethylene Sheeting

1. Secure the sheeting from wind and water dislocation.
2. Before placing, remove stones, roots, sticks, and other materials that interfere with the sheeting bearing completely on the soil.
3. Overlap adjacent sheets a minimum of 3 feet in the direction of flow; and seal the edges with waterproof tape or other engineer approved method.

303.4.6 Construction Site Diversions

1. Construct berms or channels to intercept, divert, and safely convey runoff as shown on the plans. Stabilize berms, channels, and outfall before initiating down slope land-disturbing activities.
2. Install temporary slope drains to limit runoff onto disturbed areas. Discharge non-erosive flows to a stabilized area or storm sewer. Install energy dissipation devices as needed.

303.4.7 Silt Fence

1. Install silt fence with a minimum of 8 inches of fabric trenched in the ground.
2. Backfill and compact soil over the trenched-in portion of the silt fence.
3. Do not exceed a post spacing of 3 feet for non-woven silt fence and 8 feet for woven fabric.
4. Extend the ends of the fence upslope to prevent water from flowing around the ends of the fence.

303.4.8 Log-type Perimeter Control

1. Entrench products on disturbed ground a minimum of 2 inches and ensure continuous ground contact.
2. Products installed on vegetated ground do not require entrenchment. Fill all gaps and ruts.
3. Overlap product a minimum of 24 inches or as required by manufacturer if more restrictive.
4. Stake or anchor as needed to maintain constant ground contact along the entire length of the product at all times and to prevent lateral movement and/or flotation. Stake in conformance

with manufacturer's instructions. At a minimum, provide 1-inch by 1-inch stakes placed at the end of each log and every 10 feet and staked to a depth of 12 inches.

5. Extend the ends of product installations upslope to prevent water from flowing around the ends of the product.

303.4.9 Rock Bag Silt Fence Relief

1. Install a base of 2 horizontal rows of bags with 1 bag on each side of the silt fence. Install 1 row of bags on top of the base. The top of the bags should be a minimum of 6 inches below top of silt fence.
2. Make silt fence opening a minimum of 3 feet unless indicated otherwise on the plans or directed otherwise by the engineer.
3. Use metal t-posts at silt fence opening.
4. Overlap silt fence a minimum of 18 inches.

303.4.10 Ditch Checks

1. Place ditch checks immediately after shaping the ditches or slopes.
2. Construct ditch checks such that a minimum height of 10 inches is provided after installation.
3. Place ditch checks such that the resultant ponding will not adversely impact or damage adjacent areas.
4. Extend ditch checks up the slope such that the bottoms of the ends are at least 6 inches higher in elevation than the top of the lowest middle section.
5. Install ditch checks such that 1 ditch check is installed for each 18 inches of elevation drop in the channel.
6. Excavate temporary upstream sumps as directed by the engineer.
7. Install log-type and manufactured product ditch checks as specified below:
   A. Entrench products on disturbed ground a minimum of 2 inches and ensure continuous ground contact.
   B. Products installed on vegetated ground and channels with an ECRM installed do not require entrenchment. Fill all gaps and ruts.
   C. Overlap product a minimum of 24 inches or as required by manufacturer if more restrictive.
   D. Stake or anchor as needed to maintain constant ground contact along the entire length of the product at all times and to prevent lateral movement and/or flotation. Stake in conformance with manufacturer's instructions. At a minimum, provide 1-inch by 1-inch stakes placed at the end of each log and every 10 feet and staked to a depth of 12 inches.
8. Install rock bag ditch checks as specified below:
   A. Entrench rock bags on disturbed ground a minimum of 2 inches and ensure continuous ground contact.
   B. Ditch checks installed on vegetated ground and channels with an ECRM installed do not require entrenchment. Fill all gaps and ruts.
   C. Stagger the joints between adjacent rows of rock bags.
   D. Place rock bags tightly against each other to prevent voids.
9. Install stone ditch checks as specified below:
   A. Provide a minimum top width of 24 inches and a maximum slope of 2:1 (2 horizontal to 1 vertical) on the upslope and downslope sides.
   B. Key base into the soil to a depth of 6 inches.
10. Install bale ditch checks as specified below:
    A. Use 2 rows of bales per check with bales on their sides so the twine wrapped around the bale is off the ground. Stagger the joints between adjacent rows of bales.

B. Anchor bales tightly against one another using 2 wooden stakes driven flush with the top of the bale.
C. Embed or entrench each bale 4 inches deep.
D. When installed on bare soils, place channel erosion mat on the downstream side and extend a minimum of 6 feet.

303.4.11 Culvert Pipe Checks

1. Place culvert pipe checks immediately after installing new pipes or culverts and before beginning land disturbing construction activities in areas with existing pipe and culverts.
2. Place rock bag culvert pipe checks on the inlet end of the pipe or culvert only.

303.4.12 Inlet Protection

1. Install type D-M or type D-RF for all inlet protection installations, unless indicated otherwise on the plans or directed otherwise by the engineer.
2. Use type B or type C inlet protection where there is insufficient depth to install type D series inlet protection with the permission of the engineer.
3. Use a type R filtering fabric with type D-M and type D-RF inlet protection.
4. Use rock bags placed around the inlet or an inlet protection product designed for curb inlets and approved by the engineer for inlet protection installations on “Pod” type inlets.

303.4.13 Trackout Control Practices

1. Construct stone tracking pads at all vehicle egress points from the construction area. Ensure that the stone tracking pad is at least 50 feet long and the full width of the access point.
2. Design the installation to divert surface water flow away from stone tracking pads and, if field conditions dictate, provide a culvert to channel flow under the tracking pad.
3. Underlay stone tracking pads with a type R geotextile fabric.

303.4.14 Dewatering Practices

1. Utilize a floating suction hose or equivalent method to minimize the potential for pumping sediment directly from the bottom of a pond, pit, or trench.
2. Be prepared at all times to discharge into geotextile filter bags, geotextile filter basins, or to use other acceptable dewatering methods in conformance with *WDNR Conservation Practice Standard 1061* for all projects requiring utility construction or where groundwater may be encountered. Additional practices, such as secondary containment, will be required if adequate sediment control is not provided.
3. Place geotextile filter bags on a pallet, aggregate bedding, or some other means of raising the bag above the surface of the ground. Securely connect inflow hoses to filter bags to minimize leakage. Slowly increase the pumping rate to allow a filter cake to develop on the fabric and improve the ability of the fabric to remove soil particles that are smaller than the fabric openings.
4. The contractor may use settling basins/tanks or manufactured filtering practices with the approval of the engineer. Provide required documentation on system prior to use.
5. Use polymer with geotextile filter bags, geotextile filter basins, sediment basins, settling basins/tanks, and manufactured filtering practices unless permitted otherwise by the engineer. Apply in conformance with manufacturer’s instructions. Verify proper dosing with the manufacturer and limit to WDNR allowable usage rate. Provide appropriate contact/mixing time prior to the filtering or settling practice.
6. Provide calculations as appropriate demonstrating that the proposed method will be adequate for the site soils and pumping rate.

303.4.15 Sediment Basins

1. Install sediment basins and detention ponds prior to general grading activities.
2. Use proposed detention ponds as a sediment basin until the contributory drainage area has been stabilized. Do not use existing detention ponds as a sediment basin.
3. Install temporary outlet structure or temporary flow restriction plates when required according to the plans and 209.

303.4.16 Waterway Sediment Control

1. Install turbidity barriers in conformance with *WDNR Conservation Practice Standard 1069*.
2. Install turbidity barrier parallel to the direction of flow.
3. Install silt curtains in conformance with *WDNR Conservation Practice Standard 1070*.

303.4.17 Vegetative Buffers

1. Keep all construction equipment and materials out of areas shown on the plans or marked in the field as vegetative buffers.

303.4.18 Mulching

1. Mulching may be used as a temporary control where soil grading or landscaping has taken place or in conjunction with temporary seeding with the permission of the engineer. Use a soil stabilizer, type A.

303.5 Maintenance

303.5.1 General

1. Maintain all erosion and sediment control measures until the site is stabilized.
2. Remove sediment control measures and restore site when the site is stabilized or, in the case of inlet protection and culvert pipe checks used to protect existing structures, when the existing structure has been removed from service.
3. Begin erosion control corrective action within 24 hours of the engineer's written or verbal order and promptly complete items on the written or verbal order.

303.5.2 Erosion Mat

1. If there are signs of erosion under the mat, install more staples or more trench anchors. If erosion becomes severe enough to prevent vegetation, remove the section of mat where the damage has occurred. Fill eroded area with topsoil, compact, reseed and replace section of mat, trenching and overlapping ends per manufacturer's recommendations. Provide additional staking at points of repaired erosion.
2. If the reinforcing plastic netting has separated from the mat, remove the plastic and if necessary replace the mat.

303.5.3 Temporary Seeding

1. Limit vehicle traffic and other forms of compaction in areas that are seeded.

303.5.4 Polyethylene Sheeting

1. Patch damaged areas with sheeting overlapped a minimum of 3 feet and seal the joints with waterproof tape or other engineer-approved method.

303.5.5 Construction Site Diversions

1. Remove and properly dispose accumulated sediment once deposits reach approximately ⅓ to ½ the height of the diversion berm.
2. Fill eroded areas with topsoil, compact, and reseed.

303.5.6 Silt Fence

1. Replace silt fences when sections of the fence become damaged, decomposed, undercut, or flow channels form around the end of barriers.
2. Remove and properly dispose accumulated sediment once deposits reach approximately ⅓ to ½ the height of the fence.

303.5.7 Log-type Perimeter Control

1. Backfill voids with soil and compact to establish continuous contact between the ground and product when undermined.
2. Reposition and secure with additional stakes any products that move out of installed position.
3. Repair holes, rips, or tears less than 12 inches in any direction and located with the top ⅓ of the product by stitching or wrapping a new piece of fabric around the product and securing. Remove and replace sections of product with ripe, holes, or tears greater than 12 inches in any direction or located within the bottom ⅔ of the product.
4. Repair or replace pinched, settled, or deformed products.
5. Replace products when sections become damaged, decomposed, or flow channels form around the end of barriers.
6. Remove and properly dispose accumulated sediment once deposits reach approximately ⅓ to ½ the height of the product.
7. A second product may be installed immediately upslope and in contact with the original product whenever the product is required to be repaired, replaced, or sediment removed.

303.5.8 Rock Bags

1. Replace bags that have degraded to a point that the bag is no longer sound.
2. Remove and properly dispose accumulated sediment once deposits reach approximately ⅓ to ½ the height of the installed bags.

303.5.9 Ditch Checks

1. Backfill voids with soil, compact, and install an ECRM when undermined or if flow channels form around the ends of barriers.
2. Replace products when sections become damaged, decomposed, or flow channels form around the end of barriers.
3. Remove and properly dispose accumulated sediment once deposits reach approximately ⅓ to ½ the height of the ditch check. Removal of sediment may require replacement of stone.
4. Remove stone ditch checks unless shown on the plans or directed by engineer to remain in place as part of permanent stormwater management system.
5. Do not remove ditch checks until engineer determines slopes and ditches are stable and the turf develops enough to make future erosion unlikely.
6. Reshape the ditch, fill sump and trenches, dispose of excess eroded material, and topsoil, fertilize, and seed the affected area when removing ditch checks.

303.5.10 Culvert Pipe Checks

1. Do not remove culvert pipe checks until engineer determines slopes and ditches are stable and the turf develops enough to make future erosion unlikely.

303.5.11 Inlet Protection

1. When maintaining and removing inlet protection devices, exercise care to minimize sediment falling into the inlet. Immediately remove all material that has fallen into inlets. Deposit sediment removed from the device in a suitable area and stabilize.
2. Replace damaged inlet protection.
3. Remove sediment deposits when sediment has accumulated between ⅓ to ½ of the design height of type A, B, C, and D-RF inlet protection or when the device is no longer functioning as designed.
4. Remove sediment when it accumulates to within 6 inches of the bottom of the overflow holes of type D, D-M, and D-HR inlet protection.
5. Remove inlet protection devices prior to winter season. Replace inlet protection devices in spring until final stabilization. Use type D-RF inlet protection when inlet protection is required during winter season.

303.5.12 Trackout Control Practices

1. Clean and collect trackout from paved roads located near the construction site daily or as directed by the engineer.
2. Replace or rework material in the surface of stone tracking pads to minimize material tracked onto public roads.
3. Remove stone tracking pads when the site is stabilized, the vehicle egress point is no longer needed, or when pavement base course has been installed.

303.5.13 Dewatering Practices

1. Remove accumulated sediment from devices to maintain effectiveness. Properly dispose material and prevent discharge to waterways and waterbodies.
2. Replace clogged, torn, or damaged geotextile filters.
3. Operate and maintain manufactured filters per manufacturer's instructions. Properly dispose any backwash water.

303.5.14 Sediment Basins

1. Clean clogged outlets to restore flow capacity.
2. Remove temporary outlet structure and temporary flow restriction plates when all contributing drainage areas are stabilized and with approval of the engineer.
3. Clean sediment basins when the engineer determines the sediment has accumulated to an extent that impairs the effectiveness of the sediment basin and when all contributing drainage areas are stabilized. Properly dispose surplus material.

303.5.15 Waterway Sediment Control

1. Maintain the integrity of the barrier as necessary to contain sediment from adjacent construction operations. Promptly correct deficiencies. Remove and dispose accumulations of soil and other detrimental material.
2. Do not remove turbidity barriers and silt curtains until the water behind the barrier has equal or greater clarity than the waterway or waterbody.
3. Take care when removing the barrier to minimize the release or re-suspension of accumulated sediment.

303.5.16 Vegetative Buffers

1. Repair and stabilize areas with erosion, ruts, compaction, and damage to vegetation.
2. Maintain a stand of dense vegetation to a height of 3 to 12 inches.

303.5.17 Mulching

1. Reapply and properly anchor mulch that has been displaced.

303.6 Basis of Payment

1. Erosion and sediment control measures not having a discrete bid item specified in this section are incidental to the contract.
2. The replacement of any erosion or sediment control device due to damage, decomposition, or the device otherwise reaching the end of its useful life is considered maintenance, and will not be paid as an additional installation.
3. If the contractor fails to begin corrective action within 24 hours of the engineer's written or verbal order, or fails to promptly install the required corrective action, the owner will deduct $500 per calendar day of delay. The engineer may extend the 24-hour period for delays not the contractor's fault.
4. The owner will measure the riprap bid items by the square yard acceptably completed. Payment for the riprap bid items is full compensation for excavating; for preparing the bed; for providing and installing geotextile; for providing and placing riprap; for restoring adjacent work; and for disposing of surplus material. Payment for the grouted riprap bid items also includes placing and curing mortar.
5. The owner will measure the erosion mat bid items by the square yard acceptably completed. No allowance will be made for portions of the mat that must be entrenched in the soil for any end or junction slot, or for required overlaps. Payment for the erosion mat bid items is full compensation for providing, protecting, and storing erosion mat materials on the project; for placing and anchoring the mat, including anchoring devices; for preparing seeded areas; for installing end and junction slots; for repairing and reseeding damaged areas; and for disposing of surplus material. The owner will pay separately for covering class III types B, C, and D mats with an ECRM under the applicable erosion mat bid item.
6. The owner will measure the temporary seeding bid item by the square yard acceptably completed. Payment for temporary seeding is full compensation for providing, handling, and storing seed; and for preparing the seed bed, sowing, covering, and firming the seed. Temporary seeding will only be paid at areas indicated on the plans and is incidental to the work when temporary seeding is required due to the contractor's scheduling of work.
7. The owner will measure the soil stabilizer, type B bid item by the square yard acceptably completed. Payment for soil stabilizer, type B is full compensation for furnishing, mixing, and applying soil stabilizer. Soil stabilizer, type B will only be paid at areas indicated on the plans.
8. The owner will measure the polyethylene sheeting bid item by the square yard acceptably completed. Payment for polyethylene sheeting is full compensation for furnishing and delivering the polyethylene sheeting to the project site; for storing on the project; for installing the sheeting; for all excavating and backfilling; for securing the sheeting and sealing the edges of the sheeting; for removing the sheeting; and for disposing of eroded material.
9. The owner will measure the diversion berm/swale bid item as each individual location acceptably completed. Payment for the diversions berm/swale bid item is full compensation for excavating, stabilizing, maintaining, and removing diversions; for disposing of eroded material; and for restoring the site. Diversion berm/swale will only be paid for temporary diversions. Permanent diversions will be paid separately under the applicable bid items.
10. The owner will measure the slope drains bid item as each individual location acceptably completed. Payment for slope drains is full compensation for furnishing, installing, maintaining, and removing slope drains; for disposing of eroded material; and for restoring the site.

11. The owner will measure the silt fence bid item by the linear foot acceptably completed. This measurement will be along the base of the fence, center-to-center of end post, for each section of fence. Payment for silt fence is full compensation for providing, protecting, and storing silt fence on the project; for erecting fence, including excavating, placing posts, backfilling, and attaching geotextile; and for removing the fence at project completion.
12. The owner will measure the log-type perimeter control bid item by the linear foot acceptably completed. This measurement will be along the base of the installed product, excluding required overlaps, for each section of product. Payment for log-type perimeter control is full compensation for providing, protecting, and storing perimeter control materials on the project; for installing and removing perimeter control measures at project completion or as the engineer directs; for repairing and reseeding damaged areas; and for disposing of eroded material.
13. The owner will measure the rock bag silt fence relief bid item as each individual location acceptably completed. Payment for rock bag silt fence relief is full compensation for providing rock bags; for periodic sediment removal; for removing rock bags and rock filler; for disposing of eroded material; and for restoring the site.
14. The owner will measure the ditch check bid items as each individual location and type or by linear foot of each type acceptably completed as the contract indicates. Payment for the ditch check bid items is full compensation for providing, protecting, and storing ditch check materials on the project; for installing and removing ditch checks at project completion or as the engineer directs; for repairing and reseeding damaged areas; and for disposing of eroded material.
15. The owner will measure the culvert pipe checks bid item as each individual location or by linear foot acceptably completed. Payment for culvert pipe checks is full compensation for providing rock bags; for periodic sediment removal; for removing rock bags and rock filler; for disposing of eroded material; and for restoring the site.
16. The owner will measure the inlet protection bid items as each individual location and type acceptably completed. Payment for the inlet protection bid items is full compensation for furnishing, transporting, and installing materials; and for maintaining and removing the inlet protection devices. The bid item “Inlet Protection – Type A” includes removal of the type A inlet protection and installation of a type B or type D series inlet protection immediately prior to the start of landscaping work.
17. The owner will measure the stone tracking pads with Type R fabric bid item as each individual location acceptably completed at locations approved by the engineer. Payment for stone tracking pads is full compensation for providing tracking pads including aggregate and geotextile; for replacing or reworking material as required to maintain performance; and for removing the pad and restoring the site.
18. Dewatering is incidental to the work unless specifically indicated otherwise on the plans.
19. The owner will measure the sediment basin temporary outlet bid item as each individual location acceptably completed. Payment for sediment basin temporary outlet is full compensation for furnishing, assembling, installing, maintaining, and removing temporary outlets on sediment basins.
20. Cleaning sediment basins during construction and at the completion of construction is incidental to the contract.
21. The owner will measure the turbidity barrier and silt curtain bid items by the linear foot acceptably completed. This measurement will be along the water surface, excluding required overlaps, for each section of turbidity barrier or silt curtain. Payment for the turbidity barrier and silt curtain bid items is full compensation for furnishing, assembling, installing, maintaining, and removing the turbidity barrier or silt curtain; and for sandbags, buoys, navigational markers, anchors, and anchor ropes.
22. Mulching applied as a temporary erosion control is incidental to the contract. The owner will measure and pay for mulching applied with permanent seeding as specified in 627.6.

400 Water Main Construction

401 Definitions and Acronyms

401.1 Acronyms

1. Interpret the acronyms used in sections 401 through 420 as follows:

DWV	Drainage-waste-vent
MJ	Mechanical joint
NPT	National pipe taper

401.2 Definitions

1. Interpret definitions used in sections 401 through 420 as follows:
   Engineer. The City Engineer or the Water Utility General Manager of the City of Fond du Lac, Wisconsin or any person designated by the City Engineer or Water Utility General Manager to perform a particular task. The engineer has decision-making authority with respect to construction items.

402 General Requirements for Pressure Pipeline Construction

402.1 Scope

1. This section describes general requirements for pressure pipeline construction.

402.2 General Requirements

402.2.1 Erosion and Sediment Control

1. Furnish, install, and maintain construction site pollutant control practices and follow all requirements specified in 302 and 303.

402.2.2 Existing Valve Operation

1. Do not operate existing water main valves. City of Fond du Lac Water Utility personnel will operate all existing water main valves.

402.2.3 Water Shutoffs

1. Do not interrupt water service without prior notification to all affected residents and property owners. The City of Fond du Lac Water Utility will provide notices and a list of customers to be notified by contractor. Ensure that all street-facing and/or visible entrances and all addresses of multi-unit properties are included separately in the notification distribution.
2. Provide the City of Fond du Lac Water Utility and all affected residents and property owners with at least 2 full working days' notice for all planned shut offs. Planned shutoffs may not begin earlier than 8:00 a.m. and may not exceed 8 hours unless approved otherwise by the engineer.
3. Provide a minimum of 1-hour notice to residential customers before turning the water off to install new water services. Provide a minimum of 24 hours' notice and come to a mutually agreed upon time, to commercial customers, before turning the water off to install new water services.
4. For emergency or unplanned shutoffs, notify the City of Fond du Lac Water Utility and all affected residents and property owners before or immediately after water services are shut off.

402.2.4 Existing Cast Iron Water Mains

1. Existing cast iron water mains may be sand cast iron pipe. Check the outside diameter of existing cast iron pipelines prior to cutting pipe to make sure the proper fittings are available to make the connection to the existing pipe.

402.3 Materials

402.3.1 Rejection

1. The owner may reject pipe for failure to conform to any of the specification requirements or for any of the following reasons:
   A. Any of the following which are sufficient to impair the strength, durability, or serviceability of the pipe in the opinion of the engineer:
      a. Any visible damage.
      b. Fractures.
      c. Cracks.
      d. Chips.
      e. Defects that indicate imperfect proportioning, mixing, or molding.
      f. Variations in alignment.
      g. Damaged ends or gaskets.
   B. Extensive patching or painting of any surface of pipe.

402.3.2 Thrust Blocking

1. Construct thrust blocks using solid 16 x 8 x 4-inch cement blocks (half course solids) or poured in place concrete having a minimum 28-day compressive strength of 2,000 psi. Use concrete mixes with a minimum cement content of 4.5 bags of cement per cubic yard of concrete. Use concrete with a 4-inch to 5-inch slump. Provide a bearing area for the thrust blocking as shown on the standard detail drawings or as required by the engineer.

402.3.3 Joint Restraint System

402.3.3.1 Mechanical Joint Restraint

1. Furnish mechanical joint restraint consisting of multiple gripping wedges incorporated into a single restraint/gland ring for use in place of the standard mechanical joint retainer gland and listed below:
   a. Megalug Series 1100 by EBAA Iron Sales, Inc. for ductile iron pipe.
   b. Megalug Series 2000PV by EBAA Iron Sales, Inc. for PVC pipe.
   c. Megalug Series 2000 by EBAA Iron Sales, Inc. for HDPE pipe.

402.3.3.2 Push-On Joint Restraint

1. Furnish push-on joint restraint listed below consisting of 2 **ASTM A536** ductile iron restraint rings and high strength, low alloy steel connection rods. Mount 1 ring to the spigot pipe end with second ring mounted just behind the bell end of the pipe. Fasten the 2 restraint rings together using the low alloy steel connection rods.
   a. Megalug Series 1700 by EBAA Iron Sales, Inc. for ductile iron pipe.
   b. Megalug Series 1600 by EBAA Iron Sales, Inc. for PVC pipe.
   c. Uni-Flange Series 1390 by The Ford Meter Box Company, Inc. for PVC pipe.

402.3.3.3 Restrained Joint Systems

1. Furnish a restrained joint system that, as a minimum, be designed to restrain the pipe or fitting when subjected to the full pressure rating of the pipe or fitting. Submit complete details for all restrained joint systems as specified in 106.2.2.

402.3.4 Mechanical Pipe Couplings

1. Furnish epoxy coated mechanical pipe couplings, with high strength low alloy steel bolts, per **AWWA C111** for joining pipe of different material or outside diameter and listed below:
   A. FC2A style cast coupling by The Ford Meter Box Company, Inc.
   B. FC2A-L12 style cast coupling by The Ford Meter Box Company, Inc.
   C. FC2W style cast coupling by The Ford Meter Box Company, Inc.
   D. Style 501 cast coupling by Romac Industries, Inc.

402.3.5 T-Head Bolts

1. Furnish high-strength, low-alloy steel t-head bolts and nuts conforming to the requirements of **AWWA C111**.

402.3.6 Existing Cast Iron Water Mains

1. Furnish a pipe coupling for joining to sand cast iron pipe listed below:
   A. Macro HP by Romac Industries, Inc. Use XL size gasket when required.
   B. Mechanical Joint Duo-Sleeves by U.S. Pipe
   C. Dual Purpose Sleeves by Tyler Union.
   D. Dual Purpose Sleeves by Sigma Corporation.
2. Furnish MJ caps machined to fit sand cast iron pipe when abandoning an existing pipeline.

402.3.7 Insulation

1. Furnish expanded or extruded polystyrene foam insulation for frost prevention with a minimum thickness of 2 inches, a minimum “R” value of 8.7 (at 75 degrees Fahrenheit mean temperature), and a minimum compressive strength of 40 psi.

402.3.8 Polyethylene Wrap and Tape

1. Furnish polyethylene wrap consisting of linear low-density polyethylene film with a minimum tensile strength of 3,600 psi and a nominal thickness of 8 mils and meeting the requirements of **AWWA C105 (ANSI A21.5)**.
2. Furnish tape for securing the wrap with a minimum thickness of 8 mils, a minimum width of 1 inch, and consisting of a thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, asphaltic coating, and polyethylene.

402.3.9 Tracer Wire Systems

402.3.9.1 Tracer Wire

1. For direct burial installations, furnish blue colored 12 AWG, solid copper tracer wire with a minimum 197 lb. break load, a minimum 30 mil insulation thickness, and complying with **ASTM B3, ASTM B170,** and **ASTM D1248**.
2. For directional drilling or boring installations less than or equal to 2 inches diameter, furnish blue colored 10 AWG, copper-clad steel tracer wire with a minimum 1,150 lb. break load, a minimum 45 mil insulation thickness, and complying with **ASTM B1010 / B1010M, ASTM B170,** and **ASTM D1248**.
3. For directional drilling or boring installations greater than 2 inches in diameter and for pipe bursting installations, furnish blue colored 7x7 stranded, copper-clad steel tracer wire with a

minimum 4,700 lb. break load, a minimum 50 mil insulation thickness, and complying with **ASTM B1010 / B1010M, ASTM B170,** and **ASTM D1248**.

402.3.9.2 Tracer Wire Connectors

1. Furnish 3-way or 4-way lockable connectors designed for direct bury installations at intersections. Use dielectric silicone filled connectors to seal out moisture and corrosion, designed to prevent any exposure of uninsulated wire, and listed below:
   a. SnakeBite Locking Connectors by Copperhead Industries.
2. Furnish inline splice tracer wire connectors consisting of a solid brass lug with set screws, heat shrink weather resistant tubing, and listed below:
   a. Pipe Burst In-line Splice SC-PB-01 by Copperhead Industries.
3. Furnish main to service tracer wire connectors consisting of a mechanical dual lug connector with a high impact polypropylene housing and a non-hardening viscous dielectric silicone sealant, able to connect the service tracer wire to the main tracer wire without having to cut the main tracer wire, designed for 14 to 10 AWG solid copper wire and listed below:
   a. DryConn Direct Bury Lug Aqua connectors by King Innovation.
   b. Mainline-to-Service connector 3WB-01 by Copperhead Industries.

402.3.9.3 Tracer Wire Ground Rods

1. Furnish drive-in magnesium grounding anode rods with a minimum of 20 feet of 12 AWG red colored insulated copper-clad steel wire connected to anode (minimum 1.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the pressure pipeline.

402.3.9.4 Tracer Wire Access Points

1. Furnish flange mounted, single terminal access boxes listed below located at hydrants and 2 feet of flexible 1-inch diameter PVC conduit to protect the tracer wire from the access point to below grade:
   a. T1-B-FLPKG by Copperhead Industries.
2. Furnish schedule 40 DWV PVC pipe conforming to the requirements of **ASTM D2949 / D2665**.

402.4 Construction

402.4.1 Line and Grade for Open-Cut Construction

1. Use a laser beam to facilitate the installation of the water mains unless the engineer approves an alternate method.
2. The owner will provide line and grade stakes for construction.
3. Make staking requests a minimum of 3 working days prior to the time the stakes are needed.
4. Preserve all stakes and markings as specified in 105.5 item 2.

402.4.2 Connecting to Existing Pipe

1. Uncover the existing pipeline to which the new pipeline is to be connected to verify or determine the type of material, type of joint, and elevation of existing pipeline to permit adjustments in line and grade and avoid the use of extra fittings. Protect and block the exposed section of an existing main to prevent the blowing out of the plug or cap at the end of the main.
2. Encase connections to existing cast iron water mains with aggregate slurry backfill as specified in 404.3.5. Use a minimum of 4 cubic yards of slurry at each connection. Install slurry a minimum of 2 feet in length on each side of the connection point, the width of the trench, and to 1 foot

below the proposed subgrade elevation. Provide the engineer with a delivery ticket for each load of material delivered to the project.

402.4.3 Shipment and Storage of Pipe and Fittings

1. Package, handle, and ship pipes and fittings according to manufacturer's instructions and specifications. Replace any pipe or fitting damaged in shipment as directed by the engineer.
2. Store pipes and fittings in the supplier's yard or on the project site according to manufacturer's recommendations.

402.4.4 Handling of Pipe and Fittings

1. Provide sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Exercise extreme care in handling all pipe, fittings, and special castings so as to prevent breakage and coating damage. Repair any significant damage to the coating before installation. Do not, under any circumstances, drop pipe or fittings into the trench or so handle as to receive hard blows or jolts.
2. Remove all mud or concentration of dirt prior to installation. Take every precaution to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe cannot be placed in the trench without earth entering, the engineer may require a heavy, tightly woven canvas bag of suitable size be placed over each end and left until the connection is to be made to the adjacent pipe.
3. Do not place any debris, tools, clothing, or other materials in the pipe during the laying operations.

402.4.5 Direction of Laying

1. Unless otherwise ordered, lay pipe with the bell ends facing the direction of laying. When the grade exceeds 2 feet of rise per 100 feet of trench, face the bells upgrade.
2. Install pipe according to the line and grade as shown on the plans.

402.4.6 Laying Pipe in Cold Weather

1. The engineer reserves the right to order pipe-laying discontinued whenever, in the opinion of the engineer, there is a danger of the quality of work being impaired because of cold weather.
2. Heat the pipe and jointing material so as to prevent freezing of joints.
3. Do not lay pipe on or in frozen ground.

402.4.7 Cleaning of Pipe

1. Ensure the interior and exterior of all pipe is clean and free from all foreign material before installation. Provide the necessary means to wipe, brush, swab, or air blast to remove any foreign material from the interior of the pipe as required by the engineer.

402.4.8 Protection of Open Pipe

1. At all times when pipe laying is not in progress, including during the noon hour as well as overnight, close the open ends of pipe using a watertight plug, cap, or other means accepted by the engineer.
2. If water is in the trench, keep seals in place until the trench is pumped completely dry. Do not lay pipe in water or when trench conditions are unsuitable.

402.4.9 Thrust Restraint Systems

1. Provide a thrust restraint system for all pressure piping to prevent movement caused by hydraulic thrust and pressure.

A. Provide restrained joints for exposed pressure piping.
B. Restrain horizontal buried pressure piping, unless noted otherwise, by thrust blocking. Cast thrust blocks against solid undisturbed ground and install so as to prevent contact or interference with pipe or fitting joints. Wrap fittings in plastic to prevent the concrete from bonding to the surface of the fitting. If adequate support against undisturbed soil cannot be obtained, use restrained joints.
C. Provide an acceptable type of restrained joint for vertical buried pressure piping.

402.4.10 Protection of Buried Metal Surfaces

1. Protect all steel clamps, rods, bolts, and other metal accessories using reaction anchorages or joint harness and all mechanical pipe couplings, flanges, and sleeves installed underground from corrosion by use of 2 layers of polyethylene wrap installed in conformance with **AWWA C105 (ANSI A21.5)**.
2. Keep metal surfaces clean of mortar, cement, clay, sand or other foreign material.

402.4.11 Joining Pipe of Different Material or Outside Diameter

1. Where specified or required, join pipes of different material or outside diameter with mechanical pipe couplings. Use couplings suitable for the intended service and install according to manufacturer's instructions.

402.4.12 Existing Cast Iron Water Mains

1. Check the outside diameter of the existing pipe prior to cutting pipe and have proper fittings available to make the connection to the existing pipe.
2. Replace the original coating on the machined surface of the fitting.

402.4.13 Lead Water Services

1. If discovered, replace any active lead water service pipes with new polyethylene water service pipes. Notify the engineer immediately upon discovery of any active lead water service pipes. Do not proceed with the water service replacement work until authorized by the engineer.

402.4.14 Separation Distances

1. Lay proposed water mains at least 8 feet horizontally from any existing or proposed sanitary and storm sewer mains and manholes. Measure the distance center to center. Should specific conditions prevent this separation, notify the engineer for specific instructions regarding the treatment of the separation. It may be necessary to install **AWWA C900** PVC pressure pipe, joints, and fittings or **AWWA C151** ductile iron pipe, joints, and fittings with a minimum pressure class of 150 psi for sanitary and storm sewers in the congested areas and perform the low pressure air test as specified in 212.3.1.
2. Whenever a water main crosses a sanitary or storm sewer main, lay the water main at least 6 inches above the sewer main, 18 inches below the sewer main, or re-lay the water main with fittings to cross over the sewer. Measure the distance from the top of the bottom pipe to the bottom of the top pipe.

402.4.15 Disinfection and Flushing

1. Perform disinfection and flushing as specified in 418.

402.4.16 Testing

1. Perform testing of ductile iron and PVC pipelines as specified in 419.
2. Perform testing of HDPE pipelines as specified in 409.5.

402.4.17 Insulation

1. Protect all pipeline constructed within 6 feet of the ground surface, within 2 vertical foot of a storm sewer, or within 2 feet of a catch basin, manhole, or inlet with insulation. The minimum width of insulation required varies with the depth of ground cover as shown in ***Table 402-1***. The width of insulation is not required to exceed the trench width when the width in ***Table 402-1*** exceeds the constructed trench width.

Table 402-1
Minimum Width of Insulation

Depth of Pipeline (Feet)	Minimum Width of Insulation (Feet)
2.0	9
2.5	8
3.0	7
3.5	6
4.0	5
4.5	4
5.0	3
5.5	2

2. Prior to placement of the insulation, place bedding material to a height 6 inches over the top of the pipe, level and compact. Place the insulation on the cover material with the long side parallel to the centerline of the pipe. Place the insulation in a staggered arrangement so as to eliminate continuous transverse joints. Install the first lift of backfill material consisting of 6 inches of bedding material end or side dumped onto the insulation and spread in such a manner that the construction equipment does not operate directly on the insulation. Compact this layer with equipment that exerts a compact stress of 70 to 80 psi. Once this layer has been compacted to the specified density, the remaining layers of backfill may be constructed utilizing conventional procedures.

402.4.18 Tracer Wire

1. Provide tracer wire for all components of public water mains, including mains, hydrant leads, and water services to be constructed using PVC, high density polyethylene, polyethylene, or other nonconductive materials.
2. Secure tracer wire to the pipeline every 5 feet using a minimum of 2 wraps of tape around the pipeline. Place the tracer wire in the same orientation to all installed pipeline.
3. Run tracer wire from hydrant to hydrant. Extend tracer wire up the barrel section of the hydrant and terminate with 4 feet of wire above finished grade. Insert tracer wire through a 2-foot section of 1-inch diameter PVC access pipe taped to the hydrant at ground level and on the street side of hydrant barrel. Terminate the top of the 2-foot section of PVC access pipe approximately 2 inches above finish grade and neatly fold the 4 feet of wire into this section of pipe. Seal off the top of the access pipe with tape so the pipe does not fill up during backfilling and leave the end of the tracer wire exposed for locating purposes.
4. Place tracer wire so as to accurately follow the pipeline at water services and tape tracer wire to the polyethylene service pipe at a maximum of 10 foot intervals. Connect tracer wire to the main line tracer wire and run from water main to curb stop box without any splices in this run. Run tracer wire up the outside of the service box without taping the wire or wrapping the wire

to the top section of service box to allow for an adjustment in grade of the box. Terminate tracer wire with approximately 1 foot of wire above finish ground grade and for grounding purposes strip 2 inches of insulation off the end of the tracer wire run. Wrap tracer wire back into the service box and place cover on top.

5. Install tracer wire systems as a continuous wire, except where using approved connectors. Do not loop or coil wire.
6. Properly ground tracer wire at all dead ends and stubs.
7. Locate all new tracer wire installations using typical utility locating equipment in the presence of the engineer prior to acceptance.

402.4.19 Contaminated Soils

1. The owner may require ductile iron water main pipe, wrapped in polyethylene, and copper water services for areas where contaminated soils are present. The locations where ductile iron pipe or copper water services are required, if any, will be determined based on field conditions, as directed by the engineer.
2. Nitrile gaskets or fluorocarbon gaskets may be required in areas of contaminated soils based on field conditions, as directed by the engineer.
3. Permanently plug all hydrant drain ports located in contaminated soils.

402.4.20 Crack and Damage Survey

1. When required, perform a crack and damage survey as specified in 607.

402.4.21 Damaged Water Services

1. Replace all damaged water service lines from the corporation stop to the curb stop. Do not use unions.

402.5 Basis of Payment

1. Work specified in 402 is incidental to the contract, unless noted otherwise.
2. The owner will measure the connect to existing water main bid items as each individual connection acceptably completed. Payment for the connect to existing water main bid items is full compensation for excavating; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for removing existing fittings; for installing sleeves and couplings; for polyethylene wrap; for backfilling; for cleaning out; and for restoring the work site.
3. The owner will measure the polystyrene insulation bid items by the square foot or by linear foot of a specified width acceptably completed. Payment for the polystyrene insulation bid items is full compensation for providing required materials and for installing and backfilling.
4. The owner will measure the nitrile and fluorocarbon gasket bid items as each individual gasket acceptably completed. Payment for the nitrile and fluorocarbon gasket bid items is full compensation for removing existing gaskets and for installing new gaskets.
5. Apply contract unit prices, without adjustment, to the quantities of pressure pipes, fittings, valves, hydrants, manholes, water services, and appurtenances constructed to elevations not greater than 2 foot below what the plans show. If the engineer orders the construction of the pressure pipes, fittings, valves, hydrants, manholes, water services, and appurtenances at elevations greater than 2 foot below what the plans show, then the owner will pay for this work as specified extra work.
6. The owner will measure and pay for aggregate slurry backfill as specified in 404.5.

403 Site Preparation

403.1 Scope

1. This section includes all plant, labor, equipment, and appliances as required or necessary to clear and prepare the work site for further construction as shown and specified.

403.2 General Requirements

1. Perform site preparation in such a manner as not to harm lawns; trees; shrubs; landscape work; fences; sanitary and storm sewer pipes and structures; hydrants; water mains; electrical and communication conduits, wires, and structures; pavement; sidewalks; and curb and gutter that are to remain in place. Provide adequate protection for vehicle and pedestrian traffic in the vicinity of any open excavation. Maintain such protection as long as necessary to prevent damage from the contractor's operations. Repair any damage that may occur at no cost to the owner.
2. When damage is done to water laterals (services), sanitary sewer laterals (house connections), or any other underground facilities belonging to the owner, which facilities are not being removed or abandoned, repair damage to the satisfaction of the engineer. If the contractor cannot, or does not wish to, make such repairs, the owner will make the repairs and charge the contractor for the actual cost of such repairs on a time and material basis. The owner will deduct the cost of repairs of said damages from payments due the contractor.

403.3 Construction

403.3.1 General

1. Perform all clearing and grubbing and perform all demolition and removal work as required and shown for the proper construction and completion of the work.

403.3.1.1 Clearing and Grubbing

1. Clear the site of all trees, stumps, logs, tree trimmings, roots, brush, heavy sod, vegetation, rocks in excess of 6 inches, debris, and other obstruction of whatever kind or character as required to perform the work.
2. Perform clearing and grubbing as specified in 606. Do not remove or damage trees that do not interfere with the work, and properly treat any damaged trees that can be saved.
3. After clearing and grubbing, strip the topsoil. The topsoil may be stockpiled as required for reuse, or it may be removed from the site of the work and replaced with acceptable imported topsoil. If the topsoil is stockpiled, take care to prevent mixing with the subsoil. Temporarily seed or otherwise stabilize, to the satisfaction of the engineer, all soil stockpiles existing for more than 7 days. Remove and dispose excess topsoil from the site of the work.

403.3.1.2 Demolition and Removal

1. Demolish and remove all structures including superstructures, foundation walls, footing, slabs, and other on-grade or below-grade construction. Clean excavations caused by removal of existing structures of all waste and debris.
2. Perform sawing as specified in 605.
3. A drop weight or other type of machinery for breaking pavement may be used when such usage does not become a nuisance or a source of damage to underground or adjacent utilities or structures. Before employing a drop weight, verify that there are no nearby underground or adjacent utilities or structures that could be damaged by its use. The owner reserves the right to order the discontinuance of the use of a drop weight at any time.

403.4 Basis of Payment

1. Work specified in 403 is incidental to the contract, unless noted otherwise.
2. The owner will pay separately for clearing and grubbing as specified in 606.4.
3. The owner will pay separately for sawing as specified in 605.3.

404 Trenching

404.1 Scope

1. This section describes excavating, bedding, covering, and backfilling, for the construction of pressure pipelines and appurtenances.

404.2 General Requirements

1. Submit test reports which include moisture density relationship and gradation results prepared by a certified testing laboratory acceptable to the engineer for bedding, cover, and backfill materials as specified in 106.2.2. Submit a labeled jar containing a sample of each material with the results. Do not use any material unless it has been accepted by the engineer.
2. The standard test to define maximum densities of all compaction work shall be **ASTM D1557**. Express all densities as a percentage of the maximum density obtained in the laboratory by the foregoing standard procedure. The engineer may perform density tests on fills and backfills as placed by the contractor. The contractor shall permit the engineer to sample, test, and inspect in-place materials at times selected by the engineer and without additional compensation or additional time.

404.3 Materials

404.3.1 Bedding and Cover Materials

1. Furnish crushed stone chips made from crushing limestone, dolomite ledge rock, or other rock materials of regional significance. Provide material that is hard, tough, and durable. Ensure that the crushing process produces material of which 85% to 100% of the particles have at least one machine fractured face. Conform to the gradation requirements in ***Table 404-1*** or ***Table 404-2***.

Table 404-1
⅜-Inch Crushed Stone Chips

U.S. Standard Sieve Size	Percent Passing by Weight
½-inch	100
⅜-inch	90-100
No. 8	0-15
No. 30	0-3

Table 404-2
¾-Inch Crushed Stone Chips (ASTM C33 – Size No. 67)

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	90-100
⅜-inch	20-55
No. 4	0-10

No. 8	0-5

404.3.2 Bedding Concrete

1. Provide bedding concrete having a minimum 28-day compressive strength of 3000 psi. Use concrete mixes with a minimum cement content of 5.5 bags of cement per cubic yard. Use concrete mixes with a slump less than 4 inches.
2. Use cement of one brand unless otherwise permitted and conforming to **ASTM C150 Type I** or **IA**.
3. Ensure aggregate used in the manufacture of concrete conforms to the quality and grading requirements of **ASTM C33**. For bedding concrete, use aggregate with a maximum size of 1 inch.
4. Furnish water for bedding concrete that is not brackish and is clean and free from injurious quantities of sugar, oil, or other deleterious substances.
5. Furnish reinforcing steel, when required, consisting of grade 60 deformed bars conforming to the requirements of **ASTM A615**.

404.3.3 Backfill Materials

1. Furnish granular material for backfilling consisting of durable particles ranging from fine to coarse in a substantially uniform combination. Ensure that sufficient fine material is present to fill all the voids of the coarse material. Ensure that no stones over 3-inch sieve size are present. Some fine clay or loam particles are desirable, but may not be present in the form of lumps. Conform to the gradation requirements in ***Table 404-3, Table 404-4***, or ***Table 404-5***.

Table 404-3
Crushed Stone Screenings

U.S. Standard Sieve Size	Percent Passing by Weight
½-inch	100
No. 4	75-100
No. 100	10-25

Table 404-4
1¼-Inch Dense Base

U.S. Standard Sieve Size	Percent Passing by Weight
1¼-inch	95-100
¾-inch	70-93
⅜-inch	42-80
No. 4	25-63
No. 10	16-48
No. 40	8-28
No. 200	2-12

Table 404-5
¾-Inch Dense Base

U.S. Standard Sieve Size	Percent Passing by Weight
1-inch	100

¾-inch	95-100
⅜-inch	50-90
No. 4	35-70
No. 10	15-55
No. 40	10-35
No. 200	5-15

404.3.4 Excavated Material Used As Backfill

1. Furnish excavated material to be used as backfill consisting of loam, clay, or other materials which, in the judgement of the engineer, are suitable for backfilling. Unsuitable backfill materials include vegetable or other organic material, all types of refuse, large pieces or fragments of concrete, and such other material that in the judgement of the engineer are unsuitable for backfilling. Do not use frozen backfill material.

404.3.5 Aggregate Slurry Backfill

1. Aggregate slurry backfill consists of a concrete mix with the cement deleted. Furnish aggregate slurry backfill material mixed in the following quantities:
   A. 1360 lbs. sand **(ASTM C33 fine aggregate)**
   B. 750 lbs. No. 1 stone **(ASTM C33 size number 67)**
   C. 1150 lbs. No. 2 stone **(ASTM C33 size number 4)**
   D. 25 gals. (+0 to -0.5 gal.) water per cubic yard
2. Mix the material with water to inundate the aggregate sufficient to provide an approximate 3-inch slump. Deposit the mix in the trench directly from a concrete transit mix truck. Just prior to placing the slurry, run the mixture at mixing speed to insure a uniform mixture.

404.3.6 Lean Concrete Mix Backfill

1. Furnish lean concrete mix backfill conforming to the requirements of aggregate slurry backfill with the addition of a minimum of 1 bag of cement per cubic yard.

404.3.7 Geotextile Bags and Filter Basins

1. Furnish geotextile filter bags and geotextile filter basins fabricated using type R fabric as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*.
2. Furnish polymer approved by the WDNR and meeting the criteria in *WDNR Conservation Practice Standard 1051* unless directed otherwise by the engineer.

404.4 Construction

404.4.1 General Requirements

404.4.1.1 Work Limits

1. Keep the length of trench excavated in advance of the pipe laying to a minimum, and in no case allow it to exceed 50 feet unless otherwise authorized. Do not exceed a total length of open trench of 100 feet for each main pipe laying operation unless otherwise authorized. Do not obstruct more than one street crossing by the same trench at any one time unless otherwise authorized.
2. Do not exceed a length of unrestored work area and total unfinished trench construction of 800 feet for each main pipe laying operation unless otherwise authorized. Trench construction will not be considered completed until all restoration is completed. A section of

trench will not be considered as finished until excavation, construction, backfilling, compaction, surface restoration and replacement, and cleanup operations have been completed.

404.4.1.2 Control of Water

1. Provide all necessary machinery, appliances, and equipment to keep excavation free from water during construction, and dewater and dispose of the water so as to minimize discharge of turbid water to surface water and not to cause injury to public or private property, or to cause a nuisance or a menace to the public.
2. Before dewatering is started, obtain acceptance from the engineer for the method, installation, and details of the dewatering system proposed to use.
3. Have on hand at all times sufficient pumping equipment and machinery in good working condition for all ordinary emergencies, including power outage, and have available at all times competent workmen for the operation of the pumping equipment. Do not shut down the dewatering system between shifts, on holidays or weekends, or during work stoppages without written permission from the engineer.
4. Control groundwater such that softening of the bottom of excavations or formation of "quick" conditions or "boils" is prevented. Design and operate dewatering systems so as to prevent the removal of the natural soils.
5. During excavating, construction of pipelines and appurtenances, and backfilling, keep excavations free of water. Draw the static water level down a minimum of 1 foot below the bottom of the excavation so as to maintain the undisturbed state of the natural soils and allow the placement of any fill or backfill to the required density. Install and operate the dewatering system so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. Perform the release of groundwater to its static level in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted fill or backfill, and prevent flotation or movement of all pipelines and appurtenances.

404.4.1.3 Trench Dewatering

1. Use a sediment control/capture mechanism at the discharge of the pump hose on all trench dewatering pumps. Discharging into an inlet that has inlet protection installed does not count as having sediment control/capture mechanism installed.
2. Perform all trench dewatering in conformance with *WDNR Technical Standard 1061*. Geotextile bags and geotextile filter basins require a polymer additive for effective treatment with clay loam, silty clay, and clay soils.

404.4.1.4 Dewatering Permits

1. Submit and obtain any required WNDR permits for dewatering or pumping of groundwater, including *Dewatering Operations WPDES General Permit*.
2. Do not install or operate dewatering wells, for which the single or aggregate capacity exceeds 70 gallons per minute, unless the contractor obtains a high capacity dewatering well permit from WDNR.

404.4.1.5 Contaminated Soils and Groundwater

1. Immediately notify the engineer if any contaminated soils or groundwater are exposed or suspected during excavation.

2. If historic contaminated soils or groundwater are expected notify the engineer a minimum of 3 days prior to excavating in or adjacent to the potential impacted areas so a representative can be on-site during the excavation.
3. If prior approval was obtained for the disposal of the contaminated soil, contaminated excavated soil may be placed directly onto trucks for hauling to a landfill designated by the owner. If no prior approval has been obtained, then place the soils on a 6-mil polyethylene sheet and, upon completion of work for the day, cover with a 6-mil polyethylene sheet. Ensure that the cover prevents exposure to storm water runoff and reduces public exposure. If the soils cannot be stockpiled on-site, work with the owner to find a suitable temporary storage location until appropriate testing and analysis can be completed and until approval for disposal at a landfill is obtained. Use a licensed operator, driver, and truck for handling the contaminated soil to deliver the material to an approved facility. The contractor may be required to use liners in the trucks used to transport the material. Adequately dewater all soil prior to hauling to a landfill. The owner will not be responsible for additional charges from the landfill due to the contractor hauling improperly dewatered materials. Excavating, placing material on polyethylene sheeting, covering materials, and maintaining stockpiles are considered incidental to the contract, unless specified otherwise. Landfill tipping fees will be paid for by the owner, unless specified otherwise.
4. Temporarily store contaminated liquids collected from excavation and stockpiles until the liquid can be characterized and approved for disposal at a designated facility or discharged to the City of Fond du Lac sanitary sewer system. Ensure that liquid storage containers are watertight and located in an area approved by the engineer. Clearly label and date storage containers.
5. No extra payment will be made to the contractor for delay of work due to encountering contaminated soils or groundwater. Dewatering, pumping, and storing contaminated groundwater are considered incidental to the contract, unless specified otherwise. Disposal fees will be paid for by the owner, unless specified otherwise.
6. The owner will submit and obtain any required WNDR permits for pumping of contaminated groundwater, including *Contaminated Groundwater from Remedial Action Operations WPDES General Permit*.

404.4.1.6 Clay or Bentonite Trench Dams

1. Install clay or bentonite trench dams, as directed by the engineer, at the boundaries of contaminated areas to prevent contaminant migration along the trench, at the end of new water services, and at connections to existing water service piping. Construct the dam 3 feet in length, the width of the trench, and to a point 4 feet below the finish surface elevation and to a minimum of 2 feet above the top of the pipe.
2. Excavating, constructing forms, providing clay or bentonite, compacting, and backfilling clay or bentonite dams is considered incidental to the contract, unless specified otherwise.

404.4.1.7 Removal of Obstructions

1. Remove all rock, stones, debris and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the work for a depth of at least 6 inches below the bottom of the pipe. Remove material from the site of the work and dispose of in a manner acceptable to the engineer.

404.4.1.8 Sheathing, Shoring, and Bracing

1. Provide all necessary sheathing and shoring including all labor, material, equipment, and tools required or as necessary to maintain the excavation in a condition to furnish safe

working conditions, to permit the safe and efficient installation of all items of contract work, and to protect adjacent property. The contractor shall be held liable for any damage, which may result, to neighboring property from excavation or construction operations. Nothing in 404.4 shall be deemed to allow the use of protective systems less effective than those required by the OSHA and the State of Wisconsin.

2. The engineer may order sheeting and bracing to be left in place at the completion of the work. The contractor will be paid for such materials left in place in open cut trenches on order of the engineer as extra work, but the owner will make no payment for the placing of same.

404.4.1.9 Portable Trench Box and Sliding Trench Shield

1. Portable trench boxes and sliding trench shields approved by the State of Wisconsin may be used as long as in the judgment of the contractor, job conditions warrant such use. Use of the shield does not relieve the contractor of any liability for damages to persons or property occurring from or upon the work of constructing the pipeline or appurtenances occasioned by negligence or otherwise including:
    a. A failure on the part of the contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of the ground.
    b. Disturbance of the completed work or any of the surface or subsurface structures.
2. Take care when a trench box or shield is moved ahead so as not to pull the already jointed pipe apart or leave voids around the pipe wall.
3. When required by the engineer, provide an acceptable method of rechecking line, grade, and horizontal location of the pipe after the shield has been moved ahead. If the pipe has moved, reset it to the proper line and grade.
4. Where a concrete cradle or envelope is required, provide a suitable spacer between the concrete and the shield. Use tar paper or other suitable material to prevent a bond between the spacer and the concrete, so as to permit moving of the shield without disturbing the pipe, cradle or envelope.
5. Use trench shields or boxes with a width such that a minimum 6-inch horizontal clearance is maintained between the pipe and shield at all times.
6. Fill any voids between the trench box or shield and the undisturbed trench wall within the bedding section (bottom of trench to top of initial backfill) with bedding material, immediately after the box or shield is positioned.

404.4.1.10 Unstable Foundations

1. When the trench bottom is wet, soft, or spongy so that, in the opinion of the engineer, it will not provide a proper foundation for the pipe, over excavate the trench until a firm foundation is obtained. Backfill the over excavated portion of the trench with such material and in such a manner as may be required by the engineer. All over excavation and associated backfilling will be paid for as extra work, except as specified in 404.4.2.7 item 4 and when the unstable foundation is a result of the contractor's operations in which case it shall be provided for at the contractor's expense.
2. Where the distance to stable ground is excessive the owner reserves the right to order, in writing, as extra work such other types of foundation as the engineer deems necessary.

404.4.1.11 Over Excavation

1. Whenever the excavation is carried beyond the lines and grades shown on the plans or standard detail drawings, or as determined by the engineer, the contractor shall at their own expense, backfill all such excavated space with such material and in such a manner as

may be required by the engineer. Thoroughly compact the over excavated space beneath and around concrete structures when backfilling or, if deemed necessary by the engineer, backfill with concrete at the contractor's expense.

404.4.2 Excavation

404.4.2.1 General

1. Unless otherwise indicated, use open cut excavation with an unrestricted trench for pipelines and appurtenances. When a restricted trench is specified or indicated, provide sheeting, shoring, and bracing to limit the width of the trench to the width of the bedding section. The contractor may use any method of excavation that will not damage or endanger adjacent structures, utilities, or property, or disturb the natural soils at or below the bottom of the excavation.
2. Begin excavation for the trench at the proposed water main outlet and proceed toward the upper end.
3. Excavate the trenches to the required alignment and grades indicated on the plans and as laid out in the field by the engineer.
4. Keep trenches dewatered at all times.
5. If the contract specifies or the engineer allows, the contractor may construct pipelines by tunneling or jacking instead of open trenches. Adhere to the construction details, construction specifications, and engineer’s decision.

404.4.2.2 Trench Width

1. The maximum width of trench measured at the top of the pipe must not exceed the outside diameter of the pipe exclusive of bells and collars, plus 24 inches, and such maximum width is inclusive of all trench timbers unless otherwise indicated. Always provide sufficient space between the pipe and the sides of the trench to allow for preparing the foundation, laying the pipe, and placing and compacting the backfill. Maintain a minimum of 6 inches between the pipe and the trench wall. Keep the trench walls vertical from the bottom of the trench to the top of the pipe, wherever possible.
2. Where the normal trench width below the top of the pipe is exceeded for any reason, the contractor, at their own expense, shall furnish an adequate section for the actual trench width. This may be accomplished by furnishing a stronger pipe, a better bedding section, or providing concrete encasement, whichever is an adequate section as determined by the engineer. When the pipe specified is strong enough for the actual trench width, as determined by the engineer, no further provisions need be made for this greater trench width.
3. Where wide trench construction is specified, the width of the trench at the top of the pipe is not limited. Extend the bedding section width for wide trench construction 2½ diameters on either side of the pipe or to the trench wall, whichever is less.

404.4.2.3 Excavated Materials

1. Stockpile all excavated material to be used as backfill in a manner that will not endanger the work, cause an obstruction, or block drainage.
2. Remove excavated material not to be used for backfill from the site of the work as soon as excavated. The owner has prior claim to all surplus excavated material. If the owner exercises such claim, the material shall be deposited by the contractor, at such points as designated by the engineer up to 3 miles from the site of the work. If the owner wishes to use a site greater than 3 miles from the site of the work an adjustment to the contract price

will be made with a change order. After delivery to such designated location spread and level the material. If the owner does not wish to claim any or all excavated material, obtain a site for disposal of the material.

404.4.2.4 Materials Type

1. The engineer will classify the materials of excavation either as earth excavation or as rock excavation.
2. Earth excavation includes all clay, silt, loam, sand, gravel, slate, hard pan, pavements of all kinds, soft sandstone or limestone, loose stone, all boulders measuring less than one cubic yard in volume, all old pipelines and appurtenances being abandoned and lying in the path of new construction, all old sewers and manholes being abandoned and lying in the path of new construction, and all storm sewer laterals and catch basins requiring removal to make way for new pipeline or appurtenance construction.
3. Rock is any hard, solid material in ledges, bedded deposits, and unstratified masses, and conglomerate deposits or any other material so firmly cemented they present the characteristics of solid rock, and the engineer determines it is impracticable to excavate this material without blasting or using rippers. Rock also includes removing rock boulders having a volume of one cubic yard or more.

404.4.2.5 Rock Excavation

1. When rock excavation is required perform the work as specified in 609.

404.4.2.6 Tunnel Excavation

1. Locate tunnel shafts as shown on the plans or as approved by the engineer. Provide excavation of sufficient size to permit the construction of the pipeline to the lines, grades and dimensions called for by the plans.
2. Adequately sheet and brace all tunnel excavations. No payment will be made for bracing or sheeting left in place in tunnels.
3. Should the soil be so unstable as to require extraordinary measures to protect the work such as liner plates and/or air pressure, the measures to be adopted and the costs of the extra work shall be agreed upon in advance.

404.4.2.7 Bedding - Constructing Foundation

1. Construct the foundation in the excavation to prevent subsequent settlement or rupture of the pressure pipe, fitting, appurtenance, or manhole base.
2. Do not lay the pipe, fitting, appurtenance, or manhole base in rock, wet conditions, or on a firm earth subgrade.
3. Lay pipe, fitting, appurtenance, or manhole base on a backfilled granular foundation or bed. When placing the pipe on backfilled granular foundation, excavate the trench to at least 4 inches below the elevation established for the bottom of the pipe and a minimum of 3 inches below the bell. For pressure pipe 6 inches in diameter or less, use ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 404-1***. For pipe larger than 6 inches in diameter, use ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 404-1*** or ¾-inch crushed stone chips meeting the gradation requirements of ***Table 404-2***. When placing manhole bases on backfilled granular foundation, excavate the trench to at least 6 inches below the elevation established for the bottom of the base and backfill with ⅜-inch crushed stone chips or ¾-inch crushed stone chips. If excavation has been carried deeper than 6 inches below the pipe barrel or manhole base, fill the excess depth

with backfill concrete or ¾-inch crushed stone chips. Compact the material before laying the pipe on the backfilled granular material.

4. In wet, but otherwise stable trenches, the contractor may, if acceptable to the engineer, over excavate the bottom of the trench and install not less than 6 inches of ¾-inch crushed stone chips. Compact the ¾-inch crushed stone chips using a power operated tamper.
5. In rock excavation increase the minimum depth of the bedding section below the pipe to 6 inches and fill with ⅜-inch crushed stone chips meeting the gradation requirements of ***Table 404-1.*** Place, tamp, and level bedding material to provide a proper, uniform-bearing cushion under the pipeline.
6. Take care to insure that pipe does not rest directly on the bell but is uniformly supported through the entire length.
7. After laying the pipe, place bedding material around the sides of the pipe up to a level 12 inches above the top of the pipe. Place this material by hand or equally careful means.
8. Provide a small depression, as needed, at each joint to insure the barrel of the pipe is properly supported. Make the depression no larger than necessary to accomplish proper joint assembly.
9. If the contract details types of bedding or required excavation widths others than those described in 404.4.2.2 and 404.4.2.7, conform to the construction details.
10. If the foundation material encountered lacks satisfactory bearing strength, lay the pipeline in a concrete cradle supported on a masonry foundation carried to a soil of satisfactory bearing strength or supported on a structure designed to carry the weight of the pipeline and its load to firm bearing. An arch section may be substituted for the concrete cradle when sheathing and shoring is not below the spring line of the pipe or when it is left in place. Start and stop the concrete cradle or arch, in all cases, at pipe joints.
    a. **CONCRETE CRADLE**: Set the pipeline in bedding concrete placed in a flat bottom trench. Use a minimum bedding concrete thickness under the pipe of 4 inches or one-fourth the pipe diameter, which ever is greater, and extend the concrete up one-fourth the outside diameter of the pipe barrel at the sides. Use a minimum cradle width equal to the outside diameter of the pipe plus 8 inches. Use solid concrete masonry units to support the pipe at the correct grade. After the concrete has set fill the remaining portion of the bedding section to a depth of 12 inches over the pipe with ¾-inch crushed stone chips, meeting the gradation requirements of ***Table 404-2***, compacted to 90% of the maximum dry density.
    b. **CONCRETE ARCH**: Bed the pipeline in ¾-inch crushed stone chips, meeting the gradation requirements of ***Table 404-2***, compacted to 95% of the maximum dry density placed on a flat trench bottom. Use a minimum ¾-inch crushed stone chips thickness under the pipe of 4 inches, and extend the crushed stone chips up one-half the outside diameter of the pipe barrel at the sides. Cover the top half of the pipe with a concrete arch having a minimum thickness at the crown of 4 inches or one-fourth the pipe diameter, which ever is greater. Use a minimum arch width equal to the outside diameter of the pipe plus 8 inches. Fill the remainder of the bedding section with ¾-inch crushed stone chips compacted to 90% of the maximum dry density.
    c. **CONCRETE ENCASEMENT**: Set the pipeline in bedding concrete placed in a flat bottom trench. Use a minimum thickness of bedding concrete of 6 inches. Extend concrete to undisturbed earth at the walls of the trench. Support the pipe on solid concrete masonry units. Use multiple pours of concrete to prevent flotation of the pipeline. Start and stop concrete encasement at pipe joints.

404.4.2.8 Drain Rock

1. Use drain rock consisting of ¾-inch crushed stone chips. Place in horizontal layers not exceeding 6 inches in loose depth. Compact each layer to 85% of the maximum dry density.

404.4.2.9 Backfilling

1. Do not commence trench backfill until pipe has been properly bedded.
2. Carefully deposit backfill material in uniform layers.
3. Debris, frozen material, large clods or stones, organic matter, or other unstable materials may not be used for backfill.
4. When the trench is under or within 2 feet of any future pavement, gravel shoulder, or sidewalk, fill the remainder of the pressure pipeline trench with crushed stone screenings meeting the gradation requirements of ***Table 404-3***, 1¼-inch dense base meeting the gradation requirements of ***Table 404-4***, or ¾-inch dense base meeting the gradation requirements of ***Table 404-5*** up to the subgrade elevation. Install backfill at a 1:1 slope to the bottom. Install a 3-foot lift for the first lift and 10-inch lifts for subsequent lifts. Compact using a vibratory compactor to 95% modified proctor.
5. The contractor may use material from the trench excavation that meets the granular backfill requirements with the approval of the engineer. If the contractor decides to use the excavated material, they must supply a gradation analysis showing that it meets the minimum requirements of granular backfill.
6. Suitable excavated material may be used as backfill when the trench is greater than 2 feet from any future pavement, gravel shoulder or sidewalk. Install a 3-foot lift for the first lift and 12-inch lifts for subsequent lifts. Compact using a vibratory compactor to a minimum 80% and maximum 90% modified proctor. Top the backfill material with a minimum of 4 inches of topsoil suitable for seeding. Finish-grade topsoil.
7. Use aggregate slurry backfill or lean concrete mix backfill when required on the plans and/or specifications.
8. Utilize special compaction methods around hydrants, valves, curb boxes, or manholes to insure proper compaction. Simultaneously backfill around all sides so that appurtenances do not suffer damage and remain plumb.
9. Use concrete backfill to support water mains, services, and other utilities crossing trenches or when directed by the engineer.
10. Normally, jetting or flooding of trenches for compaction will not be permitted. However, if jetting or water flooding for consolidating the backfilling is directed or ordered by the engineer, do not apply the first flooding until after the backfill, to a height at least 3 feet above the top of the pipe, has been thoroughly compacted by tamping, and apply the second flooding during or after the subsequent filling of the trench. Avoid an excess of water in order to prevent undue pressure upon the pipe. When jetting or flooding is authorized remove such water from the trench by well-pointing or a sump pump located downstream from the section being jetted or flooded, in order to get excess water out of the trenches and to facilitate better settling of the granular backfill.
11. Carefully draw and remove all sheeting and braces in a manner that will not disturb the completed work. Carefully refill all openings left from the pulled sheeting with an engineer-approved backfill material and compact.
12. Do not walk or work on completed pipes, except as necessary to tamp or backfill, until the trench has been backfilled to at least 3 feet above the top of the pipe.
13. Backfill the trenches to the surface within 24 hours after installation and haul away all surplus materials.
14. Conduct backfilling in every case in a manner which will insure that the pipes and appurtenances are not damaged in any way. To this end, place backfilling materials with a

minimum drop. In case of breakage or disturbance to the pressure pipeline or appurtenances, the contractor will be required at their own expense to re-excavate, repair, and replace in-kind.

15. Do not backfill pressure pipelines and fittings until the locations have been surveyed for position and grade by the engineer. In case the contractor fails to observe this requirement, the contractor shall uncover such pressure pipeline or fitting to permit surveying and refill the trench, at no additional cost to the owner.
16. Leave streets, sidewalks, and other places disturbed or affected by the excavation in, as near practicable, the same condition as they were prior to being disturbed; and keep said streets, sidewalks, and places disturbed in good condition, satisfactory to the engineer throughout the project. Maintain trench disruptions located in the traveled way of public streets or sidewalks that remain open to through pedestrian or vehicular traffic with temporary asphalt, concrete pavement, or suitable hard surface approved by the engineer until permanent pavement is installed.

404.4.3 Finish

1. Uniformly grade all areas covered by the work to the elevations shown on the plans or as required for restoring the surface to its original condition. Finish to the degree that is ordinarily obtainable from a blade grader.

404.5 Basis of Payment

1. Work specified in 404 is incidental to the contract, unless noted otherwise.
2. The owner will pay separately for rock excavation as specified in 609.5.
3. If the contract does not include the rock excavation bid item, the owner will pay for the removal of hard solid rock and boulders larger than one cubic yard as extra work.
4. The owner will pay separately for the removal and disposal of contaminated soils as specified in 612.4.
5. The owner will measure aggregate slurry backfill by the cubic yard acceptably completed. The volume measured equals the in place volume. Payment is full compensation for furnishing and installing aggregate slurry.

405 Boring and Jacking

405.1 Scope

1. This section describes furnishing and installing casing pipes and carrier pipes of various sizes using boring and jacking.

405.2 General Requirements

1. Submit manufacturer's data for the casing, casing spacers, and carrier pipe as specified in 106.2.2. Include information on the name of the pipe manufacturer, the dimensions of the pipe, and details on the materials and method of pipe manufacture or fabrication.
2. Submit a jacking plan for all boring and jacking operations as specified in 106.2.2. Identify the following on the plan:
   A. Installation operations including the method and equipment to be used, the location and size of the jacking pits, and the limits of the proposed jacking.
   B. Methods of maintaining and adjusting line and grade.
   C. Drilled/bored diameter.
   D. Drill hole stabilization procedures.

E. Temporary dewatering measures.
F. Mitigation procedures if sinkholes or settlement occurs above the pipe or excessive movement of settlement monitors is observed.
G. Size and location of the auger head relative to the casing.
H. Estimated jacking thrust required.
I. Method of monitoring casing elevation.
J. Record keeping system to document casing advance and jacking pressures.

405.3 Materials

405.3.1 General

1. Furnish casing pipe consistent with the diameter the bid item indicates and conforming to the following:
   A. Steel casing pipe
   B. Pipe fabricated in conformance with **AWWA C200** using **ASTM A36** steel
2. For steel casing pipe, provide field-welded butt joints or interlocking joints.
   A. For butt-joint casing, furnish pipe conforming to **ASTM A53 Grade B** or **ASTM A139 Grade B**.
   B. For interlocking joint casing, furnish pipe conforming to **AWWA C200** and the following:
      a. Maintain pipe roundness to within 1% of specified diameter.
      b. Maintain outside circumference to within 1% of nominal specified circumference, or ¾ inches, minimum.
      c. Maintain wall thickness to within 5% of specified thickness.
      d. Provide pipes fabricated using the rolled and welded cylinder method and the double submerged arc welding process in sections not less than 8 feet long, except as needed to achieve the final finished length of pipe.
      e. Provide complete penetration butt-welded connectors square to ends of pipe sections.
      f. Perform welding according to **ANSI/AWS D1.1**.
      g. Examine connections at time of shipment. Reject sections with defects.
      h. Ship pipe with protective wax coating over machined surfaces.
3. Unless otherwise tested or approved by the engineer, only use encasement pipe or uncased carrier pipe that is new and has smooth interior and exterior walls.

405.3.2 Carrier Pipe

1. Conform carrier pipe to be installed within casing pipe to the same requirements as pipe to be installed by open cut excavation unless noted otherwise.
2. Use carrier pipe with restrained joints or provide a joint restraint system to prevent any joint from opening or being over inserted during installation in the casing.

405.3.3 Casing Pipe

1. Use casing with a minimum inside diameter not less than 4 inches larger than the maximum diameter of the carrier pipe.
2. Provide casing with a minimum wall thickness as required by permit requirements or the contractor's method of construction, whichever is greater, but in no case less than the values in ***Table 405-1***.

Table 405-1
Casing Pipe Wall Thickness

Nominal Casing Diameter (Inches)	Minimum Wall Thickness, Highway Crossing (Inches)	Minimum Wall Thickness, Railway Crossing (Inches)
18	0.25 (1/4)	0.3125 (5/16)
20	0.25 (1/4)	0.344 (11/32)
22	0.25 (1/4)	0.375 (3/8)
24	0.281 (9/32)	0.375 (3/8)
26	0.281 (9/32)	0.406 (13/32)
28	0.312 (5/16)	0.438 (7/16)
30	0.3125 (5/16)	0.469 (15/32)
34	0.3125 (5/16)	0.531 (17/32)
36	0.344 (11/32)	0.531 (17/32)
40	0.344 (11/32)	0.594 (19/32)
42	0.344 (11/32)	0.625 (5/8)
48	0.344 (11/32)	0.688625 (11/16)

405.3.4 Corrosion Protection

1. Provide corrosion protection for steel casing pipes by installing anode bags or coating the inside and outside of the casing pipe. Furnish corrosion protection listed below as required on the plans or directed by the engineer:
   A. Sacrificial anode bags as specified in 414.3.
   B. Steel pipe coating listed below:
      a. Hot dip galvanizing.
      b. Epoxy conforming to the requirements of **AWWA C210**.

405.3.5 Casing Spacers

1. Furnish casing spacers designed to guide and support the carrier pipe in the casing. Standard casing spacers consist of a 14-gauge **AISI type 304** stainless steel attachment band with a PVC or EPDM liner and not less than 4 10-gauge **AISI Type 304** stainless steel risers. Equip each riser with a removable ultra-high molecular weight polymer or glass reinforced plastic runner. Use **AISI Type 304** stainless steel attachment hardware. Provide a minimum width of spacer of 8 inches. Furnish a standard casing spacer listed below:
   A. Model SSI by Advance Products & Systems, LLC.
   B. Model CCS by Cascade Waterworks Manufacturing.
   C. CSS8 by CCI Piping Systems.
   D. CSS12 by CCI Piping Systems.
2. Furnish restrained joint casing spacers consisting of 2 **ASTM A536** ductile iron clamping rings, **ASTM A242** high strength low alloy restraining rods and nuts, and not less than 4 ductile iron runner supports. Equip each runner support with an ultra-high molecular weight polymer runner. Furnish a restrained casing spacer listed below:
   A. Uni-Flange Series UFRCS 1300 by The Ford Meter Box Company, Inc. for pipe.
   B. Uni-Flange Series UFRCS 1390 by The Ford Meter Box Company, Inc. for pipe joints.

405.3.6 Casing End Seals

1. Furnish pull-on or wrap around EPDM or neoprene casing end seals designed to seal the space between the casing and carrier pipes at the ends of the casing pipe. Furnish an end seal listed below:
   A. Model AC End Seals by Advance Products & Systems, LLC.
   B. Model AW End Seals by Advance Products & Systems, LLC.

C. Model CCES by Cascade Waterworks Manufacturing.
D. Model ESC by CCI Piping Systems.
E. Model ESW by CCI Piping Systems.
F. Model "C" Pull-on End Seals by Garlock.
G. Model "W" End Seals by Garlock.
H. J-Four Pull-On End Seal by Hoff Company.
I. J-Four Rubber Wrap Around End Seal by Hoff Company.

405.3.7 Sand Slurry

1. Use sand slurry composed of fly ash, sand, and water proportioned as specified. Furnish materials conforming to the following:
   A. Class C or F fly ash conforming to the requirements of **ASTM C618**.
   B. Sand conforming to **ASTM C33** and graded so that 100% by weight will pass a standard No. 8 mesh sieve and at least 45% by weight will pass a standard No. 40 mesh sieve.
   C. Air-entraining admixture conforming to **ASTM C260** and listed below:
      a. Darex AEA by GCP Applied Technologies.
2. Use slurry for filling the space between the casing and carrier pipes.
3. **Design Mix**: Use a sand slurry mixture of 5 parts sand, one part fly ash, air entrainment (1 ounce per 430 pounds of sand), and water (1 gallon per 37.5 pounds of sand).

405.4 Construction

405.4.1 General

1. Construct a jacking pit of sufficient size to accommodate the backstop, jacks, pushing frame and pipe to be jacked. Use a pit with guide rails or timbers to keep the pipe in alignment and on grade. Provide a push frame to evenly distribute the jacking pressure to protect the ends of the pipe being jacked. Use a minimum of 2 hydraulic jacks. Fit the casing pipe with a hardened steel cutting edge.
2. Jack the casing upgrade, if possible, to facilitate drainage.
3. Ensure that all pipe is on site before starting jacking.
4. Investigate all sites for the possibility of having to manage groundwater problems that may occur due to seasonal changes or natural conditions.

405.4.2 Casing Installation

1. Push the casing into place as the soil is excavated from the inside of the pipe. Do not allow the excavation to precede the leading edge of the casing unless it is necessary to remove a large obstruction. Accomplish excavation for small diameter casing using a boring auger. Accomplish excavation for large diameter casings by hand or mechanical means. Once the jacking operation is started continue it without interruption until completion.
2. Do not exceed forces recommended by the manufacturer for joining or pushing pipe.
3. Ensure that the casing pipe in its final position is straight and true in alignment and grade.
4. Ensure that there is no space between the earth and the outside of the casing.
5. If it is necessary to over excavate, identify the location and pressure grout after the casing is in place.
6. Ensure that the final alignment of the casing pipe is within 3 inches of the line and grade.
7. Do not allow the bore head to extend more than 1 inch ahead of the casing.

405.4.3 Steel Casing Pipe Joints

405.4.3.1 Field-Welded Butt Joints

1. Joint steel casing pipes with a continuous weld for the full circumference. Provide watertight welded butt joints capable of resisting all jacking stresses. A qualified welder must perform all welding.

405.4.3.2 Interlocking Joints

1. Provide integrated interlocking joints. Apply silicone sealant and ensure joint is watertight.

405.4.4 Corrosion Protection

1. Install sacrificial anode bags as specified in 414.4.
2. Protect coatings from damage during installation.

405.4.5 Boring Without Casing Pipe

1. Install pipeline by boring without a casing pipe when shown on the plans or with written permission of the engineer.
2. Limit bores without a casing pipe to a maximum of 16 feet in length. Ensure that all joints are located outside the bore.
3. Place bedding before pushing in pipeline. Backfill between pipeline and bored hole by pumping or blowing in sand.

405.4.6 Tracer Wire

1. Install tracer wire as specified in 402.4.18.
2. Place tracer wire in the casing pipe and attach to the carrier pipe.
3. If tracer wire is attached externally to bored pipe, attach a minimum of 2 separate and continuous tracer wires. Ensure the conductors are located on opposite sides of pipe.

405.4.7 Augering Fluids

1. Use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a minimum pH of 6.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Do not use other chemicals or polymer surfactant in the drilling fluid without written consent of the engineer.
2. Certify in writing to the engineer that any chemicals to be added are environmentally safe and not harmful or corrosive to the facility. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds, or fire hydrants. Any water source used other than potable water may require a pH test.

405.4.8 Excess Material and Fluids

1. Monitor the pumping rate, pressures, viscosity, and density of the boring fluids to ensure adequate removal of soil cuttings and the stability of the bore hole. Contain excess drilling fluids, slurry, and soil cuttings at entry and exit points in pits until they are recycled or removed from the site. Ensure all boring fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, and federal regulatory agencies.
2. When jacking and boring in suspected contaminated ground, test the boring fluid for contamination and dispose of appropriately. Remove any excess material upon completion of the bore. If it becomes evident the soil is contaminated, contact the engineer immediately. Do not continue boring without the engineer's approval.

405.4.9 Boring Failure

1. If any obstruction is encountered, which prevents completion of the installation in conformance with the design location and specifications, the pipe may be taken out of service and left in place at the discretion of the engineer. Immediately fill the product left in place with excavatable, flowable fill. Submit a new installation procedure and revised plans to the engineer for approval, before resuming work at another location.
2. If damage is observed to any property, cease all work until a plan of action to minimize further damage and restore damaged property is submitted and approved by the engineer.

405.4.10 Carrier Pipe Installation

1. After the casing has been installed and accepted by the engineer, install the carrier pipe. Position spacers to adequately support the carrier pipe throughout the casing. Install a casing spacer within 1 foot of each end of the casing, on each side of each pipe joint, and at a maximum spacing of 10 feet for ductile iron and 6 feet for PVC carrier pipe, at a minimum. Assemble and locate casing spacers in strict conformance with manufacturer's recommendations. Size the casing spacers such that the carrier the carrier pipe will meet the line and grade as indicated on the plans and be centered as close as possible in the casing.
2. Push and pull the carrier pipe into place in such a manner that there is no opportunity for a joint to be opened or over inserted. Adjust the carrier pipe length so that the end extends past the end of the casing 12 to 18 inches.
3. Fill the space between the casing and carrier with a sand slurry when required on the plans or directed by the engineer.
4. After the carrier pipe is installed seal the end of the casing using an end seal.

405.4.11 Sand Slurry Application

1. Pump or pour sand slurry into the void between the casing and carrier pipe by means of a filler pipe. Install the filler pipe at the top of the seal at the low end of the casing and install a vent pipe at the seal on the other end of the casing. Use PVC pipes for filler and vent pipes and extend up to an elevation above the highest part of the casing or to ground level. Install the filler pipe such that the top of the filler pipe is located at an elevation approximately 6 inches higher than the vent. Add sand slurry to the void between the casing pipe and carrier pipes until the slurry flows from the vent pipe. After 24 hours, remove the filler and vent pipes at the end seals.

405.4.12 Pressure Grouting

1. Use qualified mechanics under supervision of experienced foremen to perform pressure grouting, where required.
2. Use an apparatus for mixing and placing cement grout of a type acceptable to the engineer and capable of effectively mixing and stirring the grout and forcing it into the holes or grout connections in a continuous, uninterrupted flow at any specified pressure up to a maximum of 15 pounds per square inch. Provide gauges, with an accurate meter reading in cubic feet to tenths of a cubic foot, for controlling the amount of mixing water used in the grout. In addition to the grout mixer, provide holdover mechanical agitator tanks. Pump all grout with a duplex piston–type pump.
3. Prior to grouting, thoroughly wash clean systems and holes to be grouted. No washing will be required for grouting soil voids outside pipe cylinders or casing pipes. Complete grouting without stoppage once started. In case of breakdown of equipment, the contractor, at the engineer's option, shall wash out the grouting system. Maintain grout pressure until grout has set.

405.4.13 Settlement Monitoring at Railroad Tracks

1. For crossings under railroad tracks, monitor rail elevations prior to, during, and immediately after boring and jacking operations. Perform monitoring using a method approved by the engineer and the railroad.
2. Submit a settlement monitoring plan as specified in 106.2.2. Identify the following on the plan:
   A. Type of probes or monitoring.
   B. Location of settlement monitoring probes, plates, or measurements.
   C. Frequency and duration of monitoring.
3. Record elevations with an accuracy of 0.01 feet.
4. Immediately report to railroad any settlement $^{3}/_{16}$ inches or greater. Immediately stop work and report to railroad any settlement ⅜ inches or greater.

405.5 Testing

1. After the carrier pipe is installed, seal and brace the ends and test according to the requirements for the carrier pipe. The carrier pipe may be tested separately or it may be tested with the pipeline segment it is associated with.
2. When there is any indication the installed product has sustained damage and may leak, stop the work, notify the engineer, and investigate damage. The engineer may require a pressure test and reserves the right to be present at the test. Perform pressure test within 24 hours, unless otherwise approved by the engineer. Furnish a copy of the test results to the engineer for review and approval. Allow the engineer up to 72 hours to approve or determine if the product installation is not in compliance with specifications. The engineer may require non-compliant installations to be filled with excavatable, flowable fill.

405.6 Basis of Payment

1. The lump sum price for the mobilization and demobilization of boring and jacking equipment bid items is full compensation for installing and removing the boring and jacking equipment; for providing access to the site; for maintaining site drainage; for providing dust abatement; for providing construction utilities; for excavating the boring pit and receiving pit; for providing and removing sheeting and shoring; for granular backfill material; for backfilling; and for restoring the site. Measure the mobilization and demobilization of boring and jacking equipment bid item as follows:
   A. The first 60% will be measured after the equipment is set up and ready for use.
   B. The remaining 40% will be measured after the equipment has been removed from the site and clean up has been completed.
2. The owner will measure the water main casing pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe. Payment for the water main casing pipe bid items is full compensation for dewatering; for removing and disposing excess material; for laying pipe; for filling the space between casing and carrier pipe; for furnishing and installing stainless steel casing pipe spacers; for end seals; for corrosion protection; for settlement monitoring; for cleaning out; and for restoring the site.
3. The owner will measure the water main carrier pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe. Payment for the water main carrier pipe bid items is full compensation for laying pipe; for installing joint restraint systems; for cleaning out; for testing pipe; and for restoring the site.
4. If conditions warrant removal of any materials installed during a failed bore path, as determined by the engineer, it will be at no cost to the owner.

406 Directional Drilling

406.1 Scope

1. This section describes installing pipelines and appurtenances of various sizes using directional drilling.

406.2 General Requirements

1. Submit a drilling plan for each installation as specified in 106.2.2 and 406.4.1.
2. Record the ground elevation at the point of measurement and the alignment and depth of the pipeline every 10 feet and at all changes in direction and changes in grade. Reference all depth measurements to the center line of the pulling head. Document the alignment and depth information on a set of as-built drawings. Convert depth measurements to elevations using the project vertical datum.
3. Perform directional drilling in conformance with *WDNR Conservation Practice Standard 1072*.

406.3 Materials

406.3.1 Drilling Fluid

1. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds, or fire hydrants. Any water source used other than potable water may require a pH test.
2. Furnish drilling products on the WDNR approved horizontal directional drilling products list.

406.4 Construction

406.4.1 Drilling Plan

1. Include the following information on the drilling plan:
   A. A detailed schedule.
   B. Working plans showing the general arrangement of the contractor's work areas, storage areas, and laydown areas showing locations of drill entry and exit work shafts, slurry work shafts and plants, drilling equipment, and pollution prevention measures among other features. Show the layout profile and supports for any work shafts, trenches, or other excavations required to drill and install the pipe on the working plans.
   C. Composition and plan for safe disposal of drilling fluids and additives.
   D. Methods for maintaining borehole stability and for controlling seepage and lost ground at the borehole junctures with work shaft walls.
   E. Temporary dewatering measures, spill response materials maintained on-site, and spill response procedures
   F. Mitigation measures for inadvertent releases including the following:
      a. Site personnel response training.
      b. List of materials and equipment to be used and staging location.
      c. Description of site-specific plans for access.
      d. Immediate and extended response and control plans.
      e. Description of requirements before drilling resumes after an inadvertent release.
      f. Restoration methods.
      g. Location-specific contact information for agencies and response teams.
   G. A contingency plan detailing the contractor's proposed response to obstructions encountered along the hole alignment, unanticipated conditions, changes, and other problems arising due to the selected construction procedure or other conditions to ensure completion of the project accordingly.

H. Record information of the pilot hole drilling.

406.4.2 Guidance System

1. Use a manufactured guidance system that provides a continuous and accurate determination of the location of the drill head during the drilling operation. Use a guidance system that conforms to the following requirements:
   A. Capable of tracking the drill head at all depths up to 50 feet and in any soil condition.
   B. Provides immediate information on the tool face, azimuth, and inclination.
   C. Calibrated to the manufacturer's specifications.
   D. Accurate at sensing the drill head's position within plus or minus 1 foot horizontally and plus or minus 0.25 foot vertically.
2. Do not proceed with directional drilling unless the guidance system is operating correctly. Calibrate the guidance system in the presence of the engineer. Dig a verification pit 10 feet from the initial point of entry, unless a different location is approved by the engineer. Measure the depth and alignment at the verification pit and ensure that the guidance system accuracy requirements are met.

406.4.3 Site Survey

1. Accurately survey the entire directional drill route. Mark the entry and exit locations as shown on the contractor's directional drilling plan. Field verify the location and elevation of all existing utilities that will be crossed during the directional drilling operation. Survey the directional drill route for any surface geo-magnetic variations or abnormalities if the contractor is using a magnetic guidance system.

406.4.4 Trenchless Installation

406.4.4.1 Pilot Hole

1. Drill a pilot hole at the alignment and grade shown on the construction drawings.
2. Take readings with the guidance system after each successive drill pipe but not more than 10 feet.
3. At no time allow the deflection radius of the drill pipe to exceed the maximum specified deflection of the pressure pipe to be installed.
4. Upon approval of the pilot hole location, ream the pilot hole larger. Ream the pilot hole to the diameter recommended by the pipe manufacturer or a maximum of 1.5 times larger than the largest outside diameter of pipe, whichever is smaller.
5. Select the drilling fluid based on the existing soils. Use a drilling fluid acceptable to the pipe manufacturer. Monitor returns continuously during drilling operations. Inspect the drill path immediately upon noted loss of drilling fluid.

406.4.4.2 Pipeline Installation

1. Pull the pipe through the drilled hole using constant tension throughout the operation. Use a pulling device with a direct reading gauge to indicate the pulling tension.
2. Select wall thickness for the pipe that will withstand the pulling forces exerted on the pipe. Use a minimum wall thickness for the pipe listed in the piping system specifications.
3. Do not allow the actual tension to exceed the safe pulling tension of the pipe.
4. Allow PVC and HDPE pipe to relax for 24 hours prior to making the final connections.

406.4.5 Tracer Wire

1. Install tracer wire as specified in 402.4.18.

2. Attach tracer wire to the pulling eye and the top of the pressure pipe. Ensure the conductors are located on the opposite sides when installed externally.

406.4.6 Borehole Abandonment

406.4.6.1 General

1. Abandon boreholes, installed pipe, and/or partially installed pipe that fails to meet the requirements of 406 and backfill with grout. Rejection criteria includes failure to drill the borehole to within the required tolerances, failure to maintain the borehole open for insertion of the pipe, and failure to install the pipe properly without damage, collapse, or parting the joints.

406.4.6.2 Sand-Grout Mix

1. Completely grout abandoned boreholes and pipe with a sand-cement grout mix conforming to the following requirements and approved by the engineer:
   a. Furnish grout consisting of a mixture of water and portland cement, with mineral fillers or admixtures as necessary to achieve a non-shrink, non-bleed, flowable grout.
   b. Achieve a minimum 28-day compressive strength of 5000 psf.
2. Furnish sand for grout consisting of clean natural silica sand, graded such that 100% of the material passes the No. 20 sieve and not more than 20% passes the No. 200 sieve.

406.4.6.3 Grouting

1. Inject grout into the borehole through drill rods or pipes extending to the end of the borehole or pipe. Inject grout at a pressure sufficient to overcome the hydrostatic pressure of the drilling fluid, but not high enough to cause heave or damage to the overlying or adjacent structures. Inject grout until the borehole or pipe is flushed of all drilling fluid and the return flow at the collar of the boring or pipe shows undiluted grout.
2. Plug the boring or pipe to maintain the grout in the boring or casing until the grout has set. Inject additional grout as necessary to fill voids left as a result of shrinkage or bleeding of the grout.

406.5 Basis of Payment

1. Work specified in 406 is incidental to the contract unless noted otherwise. Include all costs involved with directional drilling work for the pipeline installation in the unit price for the work it is associated with as specified in 408.6 and 409.6.
2. The contractor is responsible for any damage resulting from any drilling fluid-induced blow out or any inadvertent return.

407 Ductile Iron Pipe and Fittings

407.1 Scope

1. This section describes excavating required trenches, laying or constructing 4-inch to 36-inch ductile iron pressure pipe and fittings inside, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

407.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2.

407.3 Materials

407.3.1 Pipe

1. Furnish pipe consistent with the size the bid item indicates and materials conforming to the following:
   A. Pipe with mechanical and push-on joints **AWWA C151 (ANSI A21.51)**
   B. Pipe with flanged joints **AWWA C115 (ANSI A21.15)**
2. Provide pipes conforming to the following thickness classes:
   A. Thickness class 52 for pipe with mechanical and push-on joints, unless specified otherwise.
   B. Not less than thickness class 53 for pipe with flanged or grooved ends.
3. Provide cement-mortar lined pipes in conformance with **AWWA C104 (ANSI A21.4)**. Use standard thickness cement-mortar lining, unless specified otherwise.
4. Use an asphaltic coating on the exterior of pipe for buried service. Use a primer coat of paint compatible with the specified finish coat on the exterior of pipe for exposed service.
5. Provide pipes with the weight, class or nominal thickness, and casting period conspicuously painted on each pipe. Provide pipes with the manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or the word "DUCTILE" cast or stamped on the pipe. Ensure that all cast marks and required markings are on or near the bell. Improper or incomplete markings will because for rejection.
6. The owner will accept fittings based on visual inspection at the job site.
7. Do not stack pipe higher than 4 feet.

407.3.2 Fittings

1. Furnish fittings with flanged, mechanical, and push-on joints conforming to the requirements of **AWWA C110 (ANSI A21.10)** or **AWWA C153 (ANSI A21.53)**. Furnish fittings with grooved end joints conforming to the dimensional requirements of **AWWA C110 (ANSI A21.10)**. Furnish fittings made by a manufacturer listed below:
   A. Tyler Union.
   B. American Flow Control by American Cast Iron Pipe Company.
   C. Sigma Corporation.
2. Provide fittings with the same lining and coating as the pipe.
3. Provide fittings with 350 psi pressure rating for 4-inch to 24-inch diameter fittings and 250 psi pressure rating for 30-inch and 36-inch diameter fittings, unless specified otherwise.

407.3.3 Joints and Couplings

407.3.3.1 Fittings

1. Furnish fittings as specified in 407.3.2.

407.3.3.2 Mechanical and Push-on Joints

1. Furnish mechanical and push-on joints for ductile iron pipe and fittings conforming to the requirements of **AWWA C111 (ANSI A21.11)**.
2. Furnish high strength low-alloy steel bolts for mechanical joints conforming to the requirements of **AWWA C111 (ANSI A21.11)**.

407.3.2.3 Restrained Joints

1. Furnish restrained joints conforming to the applicable requirements of **ANSI A21.11 (AWWA C111)**. Provide joints with a minimum deflection of not less the 5 degrees for pipes 12 inches in diameter and smaller and 3 degrees for pipes 14 inches in diameter through 30

inches in diameter. Provide joints capable of providing full restraint for the thrust generated at the rated working pressure of the pipe.

2. Furnish restrained joint pipe listed below:
   a. TR FLEX Restrained Joint Pipe by McWane Ductile.
   b. Fastite Joint Pipe with Fast-Grip Gasket by American Cast Iron Pipe Company.
   c. Flex-Ring Joint Pipe by American Cast Iron Pipe Company.
   d. Lok-Ring Joint Pipe by American Cast Iron Pipe Company.
   e. TR FLEX Restrained Joint Pipe by U.S. Pipe.
   f. Bolt-Lok Restrained Joint Pipe by U.S. Pipe.
3. Furnish restrained joint gaskets listed below:
   a. MJ Field-Lok Gasket by U.S. Pipe.
   b. Field Lok 350 Gasket by U.S. Pipe.

407.3.2.4 Flexible Joints

1. Furnish flexible joints conforming to the applicable requirements of **ANSI A21.11 (AWWA C111)**. Provide joints with a minimum deflection of not less than 12 degrees. Provide joints capable of providing full restraint for the thrust generated at the working pressure of the pipe without the use of bolts. Furnish flexible joint pipe listed below:
   a. Ball and Socket Joint Pipe by McWane Ductile.
   b. Flex-Lok Ball Joint Pipe by American Cast Iron Pipe Company.
   c. M-Flex by U.S. Pipe.

407.3.2.5 Pipe Threads

1. Unless noted otherwise, conform all pipe threads in dimensions and limits of size to **ANSI B2.1**, taper joint thread.

407.3.2.6 Grooved Joints

1. Furnish grooved pipe couplings and joints conforming to the requirements of **AWWA C606**.

407.3.2.7 Couplings

1. Furnish couplings listed below:
   a. Style 31 AWWA Coupling by Victaulic.
2. Use coupling gaskets recommended by the coupling manufacturer for the intended service.

407.3.2.8 Flange Coupling Adapters

1. Furnish flanged-coupling adapters listed below:
   a. Style 128 by Dresser Utility Solutions.
2. Use coupling gaskets recommended by the coupling manufacturer for the intended service.

407.3.2.9 Mechanical Pipe Couplings (For Pipe 14 Inches in Diameter and Larger)

1. Furnish mechanical pipe couplings for joining pipe of different outside diameters listed below:
   a. FC2A style cast coupling by The Ford Meter Box Company, Inc.
   b. Style 501 cast coupling by Romac Industries, Inc.
2. Use epoxy coated couplings with high strength low alloy steel bolts per **AWWA C111**.

407.3.2.10 Mechanical Flange Connectors

1. Furnish mechanical flange connectors manufactured from **ASTM A536, Grade 65-45-12** or **Grade 60-42-10**, ductile iron. Provide flange including setscrews that provides a safety factor

of 2 without leaking. Provide flange with bolt circles and holes conforming to **ANSI B16.1**. Furnish mechanical flange connectors listed below:
   a. Uni-Flange Series 200 by The Ford Meter Box Company, Inc.
   b. Series 1000 by EBAA Iron Sales, Inc.
2. Use couplings gasket recommended by the coupling manufacturer for the intended service.

407.3.4 Sleeves

407.3.4.1 Tapping Sleeves

1. Furnish tapping sleeves of the MJ branch type designed for attachment of the MJ inlet of a standard MJ gate valve. Use sleeves with an all stainless steel sleeve body and a ¾-inch NPT test plug. Provide sleeves rated for a maximum working pressure of at least 250 psi for outlet sizes 4 inches to 8 inches and at least 200 psi for outlet sizes 10 inches to 24 inches. Furnish tapping sleeves listed below:
   a. Model 3490MJ by PowerSeal Pipeline Products Corporation.
   b. H-304 Series by U.S. Pipe Valve & Hydrant, LLC.

407.3.4.2 Cutting-In Sleeves

1. Furnish cutting-in sleeves listed below:
   a. HYMAX Grip MJ Cut-In Sleeve by Mueller Water Products, Inc.
   b. H-840 Series by U.S. Pipe Valve & Hydrant, LLC.
   c. MJ x PE Dual Purpose Cutting-In Sleeve by Tyler Union.
   d. Dual Cutting-In Sleeves by Sigma Corporation.
2. Provide sleeves with a minimum of 10 inches of adjustment.

407.3.4.3 Solid Sleeves

1. Furnish solid sleeves listed below:
   a. HYMAX 2 by Mueller Water Products, Inc.
   b. Macro HP by Romac Industries, Inc.
   c. Mechanical Joint Sleeves by U.S. Pipe
   d. Sleeves by American Cast Iron Pipe Company.
   e. Sleeves by Tyler Union.
   f. Short Sleeves or Long Sleeves by Sigma Corporation.

407.4 Construction

407.4.1 General

1. Excavate trenches and tunnels for all ductile iron pipes and fittings as specified in 404.4.
2. Unless otherwise indicated, use push-on joints on buried, embedded, and encased pipe and fittings.
3. Set fittings on hardwood blocking 2 x 6 x 18-inch with the long side of the block set perpendicular to the water main.
4. Use mechanical joint pipe and fittings where specified or when accepted by the engineer.
5. Unless otherwise indicated use grooved or flanged joints on exposed pipe and fittings.

407.4.2 Constructing Foundation

1. Construct foundations for all ductile iron pipes and fittings as specified in 404.4.2.7.

407.4.3 Joining Pipe

407.4.3.1 Push-On Joints

1. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.
2. After cleaning dirt or foreign material from the plain end, apply lubricant according to the pipe manufacturer's recommendations. Use non-toxic, tasteless, and odorless joint lubricant that does not support bacterial growth or contain bacterial contaminants.
3. Provide a beveled plain end. A square or sharp edge may damage or dislodge the gasket and cause a leak. Push the plain end into the bell of the pipe. Keep the joint straight while pushing.
4. In cold weather, warm gaskets prior to installing.
5. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot end is inserted to the full depth of the joint.
6. Make deflection after the joint is assembled. Whenever it is desirable to deflect push-on joint pipe, do not allow the amount of deflection to exceed the maximum limits shown in ***Table 407-1***.

Table 407-1
Allowable Deflection for Ductile Iron Pipe Push-On Joints

Nominal Pipe Size (Inches)	Deflection Angle (Degrees)	Maximum Offset (Inches)		Approx. Radius of Curve-R Produced by Succession of Joints (Feet)	
		18 Ft L	20 Ft L	18 Ft L	20 Ft L
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3	11	12	340	380
16	3	11	12	340	380
18	3	11	12	340	380
20	3	11	12	340	380
24	3	11	12	340	380
30	3	11	12	340	380
36	3	11	12	340	380

407.4.3.2 Mechanical Joints

1. Wipe the socket and the plain end clean. Wash the plain end, socket, and gasket with pipe joint lubricant or soapy water to improve gasket seating. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.
2. Make deflection after joint assembly but before tightening bolts. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Tighten the bolts to the normal range of bolt torque while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Maintain the same distance by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and finally the remaining

bolts. Repeat the process until all bolts are within the appropriate range of torque. Tighten all nuts with a suitable (preferably torque-limiting) wrench. Apply torque for various sizes of bolts as shown in ***Table 407-2***.

Table 407-2
Allowable Torque for Ductile Iron Pipe Mechanical Joint Bolts

Size (Inches)	Range of Torque (Ft - Lb)
⅝	45-60
¾	75-90
1	100-120
1¼	120-150

3. Whenever it is desirable to deflect mechanical-joint pipe, do not allow the amount of deflection to exceed the maximum limits shown in ***Table 407-3***.

Table 407-3
Allowable Deflection for Ductile Iron Pipe Mechanical Joints

Nominal Pipe Size (Inches)	Deflection Angle (Degrees-Minutes)	Maximum Offset (Inches)		Approx. Radius of Curve-R Produced by Succession of Joints (Feet)	
		18 Ft L	20 Ft L	18 Ft L	20 Ft L
4	8-18	31	35	125	140
6	7-07	27	30	145	160
8	5-21	20	22	195	220
10	5-21	20	22	195	220
12	5-21	20	22	195	220
14	3-35	13.5	15	285	320
16	3-35	13.5	15	285	320
18	3-00	11	12	340	380
20	3-00	11	12	340	380
24	2-23	9	10	450	500
30	2-23	9	10	450	500
36	2-05	8	9	500	550

407.4.3.3 Flanged Joints

1. Clean all parts thoroughly. Wipe off the gasket. Support the pipe so that no strain is placed on the joint. Align the flanges and check with a level both horizontally along the pipe and vertically across the flange faces. With the flanges secured in position, coat the gasket with a recommended lubricant and insert it between the flanges.
2. Install the bolts and hand turn them as tight as possible. Tighten the bolts with a wrench using a crossover pattern to load the bolts evenly and eliminate concentrated stresses. Continue to tighten the bolts using the crossover pattern until the joint is uniformly tight. Apply torque for various sizes of pipe as recommended by the pipe manufacturer.

407.4.3.4 Restrained and Flexible Joints

1. Assemble restrained and flexible joint pipe in strict conformance with the manufacturer's written instructions. Do not assemble pipe joints underwater.

407.4.4 Polyethylene Wrap

1. Unless specified otherwise, protect all pipe, fittings, valves, and appurtenances from corrosion by use of 2 layers of polyethylene wrap installed in conformance with **AWWA C105 (ANSI A21.5)** with 2 equally spaced circumferential tape wraps per pipe section. Contractor may use either method "A" or "B".
2. Make service taps through the polyethylene adhesive tape as described in the "preferred" method in **AWWA C105 (ANSI A21.5)**. Keep pipe and fittings clean of mortar, cement, clay, sand, or other foreign material.

407.4.5 Field Closure

1. Make field closures by cutting the pipe in a neat workmanlike manner perpendicular to the axis of the pipe without damage to the pipe or lining so as to leave a smooth end. Make all cuts with an acceptable mechanical cutter.
2. When the field cut pipe is to be used with rubber gasket joints, taper it by grinding or filing about ⅛-inch back at an angle of about 30 degrees and remove all sharp edges. Join plain end pipe with a mechanical pipe coupling.

407.4.6 Backfill

1. Backfill all ductile iron pipes and fittings as specified in 404.4.2.9.

407.5 Testing

1. Perform a hydrostatic test composed of a pressure test and a leakage test on all pipelines and appurtenances as specified in 419.

407.6 Basis of Payment

1. The owner will measure the ductile iron water main bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe excluding fittings and valves. Payment for the ductile iron water main bid items is full compensation for providing materials, including harnesses and blocking; for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for joining pipe; for polyethylene wrap; for making connections; for anchoring pipe; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the work site.
2. The owner will measure the ductile iron fitting bid items, including crosses, tees, bends, reducers, caps, and plugs, as each individual fitting acceptably completed. Payment for the ductile iron fitting bid items is full compensation for providing materials, including harnesses and blocking; for excavating; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for installing fitting; for polyethylene wrap; for making connections; for backfilling; for cleaning out; and for restoring the work site.

408 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

408.1 Scope

1. This section describes excavating required trenches, laying or constructing 4-inch to 36-inch polyvinyl chloride pressure pipe and fittings inside, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

408.2 General Requirements

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2.

408.3 Materials

408.3.1 Pipe

1. Furnish pipe consistent with the size the bid item indicates and conforming to the requirements of **AWWA C900** for bell end pipe with elastomeric-gasket joints. Use pipe with the same outside diameter as ductile iron pipe. Provide DR 18 pipe with a pressure class rating of 235 psi, unless noted otherwise.
2. Provide pipes clearly marked with the following:
   A. Manufacturer’s name.
   B. Nominal pipe size.
   C. Type of plastic pipe material.
   D. DR number.
   E. AWWA designation.
   F. Seal or mark of the laboratory making the evaluation of the pipe for the transport of potable water.

408.3.2 Storage of Pipes

1. Store pipes in the supplier’s yard or on the project site according to **AWWA M23** and manufacturer’s recommendations.
2. Do not stack pipe higher than 4 feet or on the bell ends.
3. Cover PVC pipe, which is stored outside for a prolonged period, with an opaque material to protect it from the sun’s ultraviolet radiation. Do not use PVC pipe, identified by color fading or chalking, which has been subjected to excessive ultraviolet radiation. The determination as to the acceptability of the pipe rests solely on the engineer’s decision.
4. Do not use pipe that has been contaminated in any way with petroleum products on the inside or outside of the pipe.

408.3.3 Fittings

1. Furnish fittings conforming to the requirements of **AWWA C110 (ANSI A21.10)** or **AWWA C153 (ANSI A21.53)** and made by a manufacturer listed below:
   A. Tyler Union.
   B. American Flow Control by American Cast Iron Pipe Company.
   C. Sigma Corporation.
2. Provide fittings with cement mortar lining according to **AWWA C104 (ANSI A21.4)**. Use standard thickness cement-mortar lining, unless noted otherwise. Use an asphaltic coating on the exterior of the fitting for buried service.
3. Provide fittings with 350 psi pressure rating for 4-inch to 24-inch diameter fittings and 250 psi pressure rating for 30-inch and 36-inch diameter fittings.

408.3.4 Joints and Couplings

408.3.4.1 Fitting Joints

1. Furnish fittings with mechanical or push-on joints conforming to the requirements of **AWWA C111 (ANSI A21.11)**.
2. Furnish high strength low-alloy steel bolts for mechanical joints conforming to the requirements of **AWWA C111 (ANSI A21.11)**..

408.3.4.2 PVC Pipe Joints

1. Furnish PVC pressure pipe with bell and spigot type joints with the bell being integrally formed with the pipe. Seal the joint using an elastomeric gasket conforming to the requirements of **ASTM D3139**.

408.3.4.3 PVC Pipe Restrained Joints

1. Furnish PVC restrained pipe joints on 4-inch to 16-inch diameter pressure pipe consisting of a PVC coupling with beveled edges, 2 sealing gaskets, and 2 restraining grooves; plain end pipe with a restraining groove at each end; and nylon splines for each groove. Provide joints capable of providing full restraint for the thrust generated at the working pressure of the pipe.
2. Furnish restrained joint pipe listed below:
   a. AquaSpring C900 Certa-Lok RJ PVC Pipe by Westlake Pipe & Fittings.
3. Furnish restrained joint gaskets listed below:
   a. Eagle Loc 900 by JM Eagle.

408.3.5 Sleeves and Transition Couplings

408.3.5.1 Tapping Sleeves

1. Furnish tapping sleeves of the MJ branch type designed for attachment of the MJ inlet of a standard gate valve. Use sleeves with an all stainless steel sleeve body and a ¾-inch NPT test plug. Provide sleeves rated for a maximum working pressure of at least 250 psi for outlet sizes 4 inches to 8 inches and at least 200 psi for outlet sizes 10 inches to 24 inches. Furnish tapping sleeves listed below:
   a. Model 3490MJ by PowerSeal Pipeline Products Corporation.
   b. H-304 Series by U.S. Pipe Valve & Hydrant, LLC.

408.3.5.2 Cutting-In Sleeves

1. Furnish cutting-in sleeves listed below:
   a. HYMAX Grip MJ Cut-In Sleeve by Mueller Water Products, Inc.
   b. H-840 Series by U.S. Pipe Valve & Hydrant, LLC.
   c. MJ x PE Dual Purpose Cutting-In Sleeve by Tyler Union.
   d. Dual Cutting-In Sleeves by Sigma Corporation.
2. Provide sleeves with a minimum of 10 inches of adjustment.

408.3.5.3 Solid Sleeves

1. Furnish solid sleeves listed below:
   a. HYMAX 2 by Mueller Water Products, Inc.
   b. Macro HP by Romac Industries, Inc.
   c. Mechanical Joint Sleeves by U.S. Pipe
   d. Sleeves by American Cast Iron Pipe Company.
   e. Sleeves by Tyler Union.
   f. Short Sleeves or Long Sleeves by Sigma Corporation.

2. Solid sleeves may be cast or ductile iron construction conforming to the requirements of **AWWA C110** and **AWWA C111**.

408.3.5.4 Mechanical Pipe Transition Couplings

1. Furnish mechanical pipe transition couplings for joining pipe of different outside diameters listed below:
   a. FC2A style cast coupling by The Ford Meter Box Company, Inc.
   b. FC2A-L12 style cast coupling by The Ford Meter Box Company, Inc.
   c. FC2W style cast coupling by The Ford Meter Box Company, Inc.
   d. Style 501 cast coupling by Romac Industries, Inc.
2. Use coupling gaskets recommended by the coupling manufacturer for the intended service.
3. Use ductile iron or cast iron couplings with high strength low alloy steel bolts per **AWWA C111** for mechanical pipe couplings for buried PVC.

408.4 Construction

408.4.1 General

1. Excavate trenches and tunnels for all PVC pipes as specified in 404.4.
2. Unless otherwise indicated, use push-on joints on buried, embedded, and encased pipe and fittings. Restrained joint pipe may be used as carrier pipe in casings.
3. Set fittings on hardwood blocking 2 x 6 x 18-inch with the long side of the block set perpendicular to the water main.
4. Use mechanical joint fittings where specified or when accepted by the engineer.

408.4.2 Constructing Foundation

1. Construct foundations for all PVC pipes and fittings as specified in 404.4.2.7.

408.4.3 Joining Pipe to Fittings

408.4.3.1 Push-On Joints

1. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.
2. After cleaning dirt or foreign material from the spigot end, apply lubricant according to the pipe manufacturer's recommendations. Use non-toxic, tasteless, and odorless joint lubricant that does not support bacterial growth or contain bacterial contaminants. Supply lubricant in sterile cans and make every effort to keep it sterile.
3. Confirm that the spigot end is beveled. A square or sharp edge may damage or dislodge the gasket and cause a leak. Push the spigot end into the bell of the fitting. Keep the joint straight while pushing
4. In cold weather, warm gaskets prior to installing.
5. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot end is inserted to the full depth of the joint.
6. Make deflection after the joint is assembled. Whenever it is desirable to deflect push-on joint PVC pipe with ductile iron fittings, do not allow the amount of deflection to exceed the maximum limits shown in ***Table 408-1***.

Table 408-1
Allowable Deflection for Joining PVC Pipe to Fittings

Nominal Pipe Size (Inches)	Deflection Angle (Degrees)	Maximum Offset – 20 Ft L (Inches)
4	5	22
6	5	22
8	5	22
10	5	22
12	5	22
14 and larger	3	12

408.4.3.2 Mechanical Joints

1. Wipe the socket and the plain end clean. Wash the spigot end, socket, and gasket with pipe joint lubricant or soapy water to improve gasket seating. Place the gland on the spigot end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the spigot end. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.
2. Make deflection after joint assembly but before tightening bolts. Push the gland toward the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Tighten the bolts to the normal range of bolt torque while at all times maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Maintain the same distance by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and finally the remaining bolts. Repeat the process until all bolts are within the appropriate range of torque. Tighten all nuts with a suitable (preferably torque-limiting) wrench. Apply torque for various sizes of bolts as shown in ***Table 408-2***.

Table 408-2
Allowable Torque for PVC Pipe Mechanical Joint Bolts

Size (Inches)	Range of Torque (Ft - Lb)
⅝	45-60
¾	75-90
1	100-120
1¼	120-150

3. Whenever it is desirable to deflect mechanical-joint pipe, do not allow the amount of deflection to exceed the maximum limits shown in ***Table 408-3***.

Table 408-3
Allowable Deflection for PVC Pipe Mechanical Joints

Nominal Pipe Size (Inches)	Deflection Angle (Degrees)	Maximum Offset – 20 Ft L (Inches)
4	8	35
6	7	30
8	5	22
10	5	22

12	5	22
14 and larger	3	12

408.4.4 Joining Pipe

408.4.4.1 Push-On Joints

1. Provide a bell hole at each joint for push-on joint pipe. Make the bell hole no larger than necessary to accomplish proper joint assembly. When the joint has been made, fill the void under the bell with bedding material to provide adequate support to the pipe throughout its entire length.
2. Assemble all joints according to the recommendations of the manufacturer. Verify proper jointing by rotation of the spigot by hand or with a strap wrench. If unusual joint resistance is encountered or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, reclean the joint components, and repeat the assembly steps. Note that fitting bells may permit less insertion depth than pipe bells.
3. For shorter than standard pipe lengths, field cuts may be made with either hand or mechanical saws or plastic pipe cutters. Cut ends square and perpendicular to the pipe axis. Remove burrs from spigots and smoothly bevel ends using a mechanical beveller or by hand with a rasp or file. Stop-mark field spigots with felt tip marker or wax crayon for the proper length of assembly insertion. Make the angle and depth of field bevels and lengths to stop-marks comparable to factory pipe spigots.
4. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated. After cleaning dirt or foreign material from the spigot end, apply lubricant according to the pipe manufacturer's recommendations. Use non-toxic, tasteless, odorless joint lubricant that does not support bacterial growth or contain bacterial contaminants. Provide a beveled spigot end. A square or sharp edge may damage or dislodge the gasket and cause a leak. Push the spigot end into the bell of the pipe. Keep the joint straight while pushing. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot end is inserted to the full depth of the joint. Push pipe home by using a cross member and levers or jacks. Do not push pipe home with motor powered excavation equipment. Use pipe manufacturer's recommendations for the type of joint.
5. Make deflected joints by pushing the spigot into the bell about ½-inch short of the reference line then moving the loose bell end of the assembled length not more than the maximum allowable offset. Make pipe offsets with manual effort only.
6. Whenever it is desirable to deflect push-on joint PVC pipe, do not allow the amount of deflection to exceed the pipe manufacturer's written recommendations or the maximum limits in ***Table 408-4***, whichever is more restrictive:

Table 408-4
Allowable Deflection for PVC Pipe Push-On Joints

Nominal Pipe Size (Inches)	Deflection Angle (Degrees)	Maximum Offset – 20 Ft L (Inches)	Approx. Radius of Curve-R Produced by Succession of Joints (Feet)
4	3	12	382
6	3	12	382
8	3	12	382
10	3	12	382

12	2.5	10	458
14 and larger	1.5	6¼	764

408.4.4.2 Restrained Joints

1. Assemble restrained joints according to the recommendations of the manufacturer. Clean surfaces to be joined. Lubricate and align pipe. Insert pipe into coupling and insert spline through insertion hole in coupling. Cut off spline so that it protrudes from the insertion hole approximately ⅜ inch.

408.4.5 Trenchless Installation

1. Utilize a system as approved by the engineer prior to installation for trenchless installation by directional drilling. Perform directional drilling as specified in 406.

408.4.6 Polyethylene Wrap

1. Unless specified otherwise, protect all fittings, valves, service saddles, and appurtenances from corrosion by use of 2 layers of polyethylene wrap installed in conformance with **AWWA C105 (ANSI A21.5)**.

408.4.7 Field Closure

1. Make field closures by cutting the pipe in a neat workmanlike manner perpendicular to the axis of the pipe without damage to the pipe or lining so as to leave a smooth end. Make all cuts with an acceptable mechanical cutter.
2. When the field cut pipe is to be used with rubber gasket joints, taper it by grinding or filing about ⅛ inch back at an angle of about 30 degrees and remove all sharp edges. Join plain end pipe with a solid sleeve.

408.4.8 Backfill

1. Backfill all PVC pipes and fittings as specified in 404.4.2.9.

408.5 Testing

1. Perform a hydrostatic test composed of a pressure test and a leakage test on all pipelines and appurtenances as specified in 419.

408.6 Basis of Payment

1. The owner will measure the PVC water main bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe excluding fittings and valves. Payment for the PVC water main bid items is full compensation for providing all necessary materials, including harnesses and blocking; for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for directional drilling and drilling fluids; for joining pipe; for polyethylene wrap; for making connections; for anchoring pipe; for tracer wire system; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; and for restoring the work site.
2. The owner will measure and pay for ductile iron fittings as specified in 407.6.

409 High Density Polyethylene Pressure Pipes and Fittings

409.1 Scope

1. This section describes excavating required trenches, laying or constructing 6-inch to 36-inch high density polyethylene pressure pipe and fittings inside, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

409.2 General Requirements

409.2.1 Submittals

1. Submit manufacturer's data for the pipe, fittings, gaskets, and appurtenances as specified in 106.2.2.
2. Submit information on the procedure and equipment that will be used to join the pipe and fittings as specified in 106.2.2.
3. Submit shop drawings of concrete thrust collars showing concrete mix designs, reinforcing details, and strap and attachment hardware details as specified in 106.2.2.
4. Submit copies of the manufacturer's proposed joint restraint system for approval by the engineer as specified in 106.2.2.
5. Submit complete details of the procedure and equipment to be used for directional drilling as specified in 106.2.2.

409.2.2 Manufacturer

1. Use Performance Pipe DriscoPlex 4000 Series ductile iron pipe size, WL Plastics WL 104, or JM Eagle HDPE Water Sewer C906 DIPS HDPE pipe and fittings.

409.3 Materials

409.3.1 Pipe

1. Furnish pipe and fittings consistent with the size the bid item indicates and conforming to the requirements of **AWWA C906**. Provide pipe with a SDR of 11 or less. Provide pipe and fittings with the same outside diameter as ductile iron pipe. Use pipe with an internal pressure rating of 160 psi at 73.4 degrees Fahrenheit temperature and a service life of 50 years.
2. Use HDPE PE3408 pipe materials conforming to the requirements of **ASTM D3350**. Use pipe with a minimum cell classification of PE334434C. Use polyethylene pipe material with a minimum tensile yield strength of 3,200 psi; a minimum flexural modulus of 135,000 psi; and a minimum Modulus of Elasticity of 125,000 psi. Use polyethylene pipe with a hydrostatic design basis (HDB) rating of 1,600 psi at 73.4 degrees Fahrenheit and 800 psi at 140 degrees Fahrenheit.
3. Use pipe homogenous throughout and free of cracks, holes, foreign inclusions, or other injurious defects. Use pipe uniform in color, density, and other physical properties.

409.3.2 Pipe Color Coding and Marking

1. Furnish pipe color coded with blue stripes and coded at intervals not greater than 6 feet. Provide pipe with markings that include manufacturer's name and codes, nominal pipe size, type, and SDR or pressure rating.

409.3.3 Fittings and Joints

409.3.3.1 Fittings

1. Furnish polyethylene fittings made from material conforming to the same requirements as the pipe. The pipe manufacturer must certify that they produced the pipe, fabricated the

fitting, and provide the warranty. Provide fittings pressure rated to match the system piping to which they are joined.

2. Furnish molded fittings manufactured in conformance with either **ASTM D2683** (socket fused) or **ASTM D3261** (butt fused) and so marked. Use pipe that, at the point of fusion, the outside diameter and minimum wall thickness meets the outside diameter and minimum wall thickness specifications of **AWWA C906**.

409.3.3.2 Joints

1. Furnish fittings for joining polyethylene pipe to other materials that are molded stub end type with flange back-up ring. Use external mechanical joint restraints when polyethylene pipe is joined with non-polyethylene piping components and use in conjunction with a stiffener as recommended by the pipe manufacturer.
2. Furnish flanges, bolts, and gaskets for joining polyethylene pipe to other pipe suitable for the intended service. Assemble restrained joints according to the recommendations of the pipe and restrained joint manufacturer.

409.3.4 Concrete Thrust Collar

1. Construct concrete thrust collar of reinforced concrete having a minimum 28-day compressive strength of 4,000 psi. Provide concrete with an air content of 6%. Use a minimum cement content of 5½ bags (517 lbs.) of cement per cubic yard of concrete.
2. Furnish reinforcing steel conforming to **ASTM A615, Grade 60**. For the strap, use steel conforming to the requirements of **ASTM A36**. Hot-dip galvanize straps and attachment hardware after fabrication. Coat damaged galvanized surfaces in a manner acceptable to the engineer.

409.4 Construction

409.4.1 Joining the Pipe

1. Join the pipe by butt fusion, utilizing heat and pressure according to manufacturer's recommendations. Perform the butt fusion work using skilled technicians certified to perform the work by the Plastic Pipe Institution. Prior to starting the work, submit to the engineer current certifications of the personnel employed to perform the butt fusion work.

409.4.1.1 Butt Fused Joints

1. Prior to actual fusion, thoroughly cleaned the pipe ends inside and out, removing all foreign material. Square the pipe ends on the fusion machine, and check so that the pipe ends meet uniformly around the entire circumference of the surfaces to be fused. Fuse the pipe ends using heat and pressure sufficient to provide a bead of at least $^{3}/_{16}$-inch wide around the entire circumference of the pipe. The contractor shall guarantee in writing that each joint has been made so that it will not leak, and that it will be of equal or greater strength than the specified pipe.

409.4.2 Trenchless Installation

1. Utilize a system as approved by the engineer prior to installation for trenchless installation by directional drilling. Perform directional drilling as specified in 406.

409.4.3 Trench Installation

1. Provide a trench width below the top of the pipe to the bottom not less than the pipe outside diameter plus 12 inches, nor greater than the pipe outside diameter plus 24 inches. Keep the trench walls vertical to the top of pipe whenever possible.
2. Construct foundations for all HDPE pressure pipelines as specified 404.4.2.7.
3. Provide at least 30 inches of cover over the top of the pipe before the trench is wheel loaded, and at least 48 inches of cover prior to using heavy compactor equipment.

409.5 Testing

1. Perform a hydrostatic test on all HDPE pipelines and appurtenances. Perform the pressure test at the test pressure specified in 419.2.2.
2. Fill the HDPE pipeline and maintain the test pressure for 4 hours before the pressure test begins. The contractor may use either Test Method A or Method B. There is no allowed observable leakage. Do not exceed a total length of time that the pipeline is at the test pressure of 8 hours. Provide at least 8 hours of unpressurized time between any two successive hydrostatic tests.

409.5.1 Test Method 'A'

1. Pressurize the pipeline to the test pressure and hold for a two-hour period. Add water to the pipeline at the end of the test period to return the pipeline to the test pressure. The amount of water added at the end of the test may not exceed the values in ***Table 409-1***.

Table 409-1
Maximum Water Added Using HDPE Pipe Pressure Test Method 'A'

Pipe Size (Inches)	Gallons per 100 Feet of Pipe
4	0.25
6	0.60
8	1.00
10	1.30
12	2.30
14	2.80
16	3.30
18	4.30
20	5.50

409.5.2 Test Method 'B'

1. Reduce the pipeline pressure to 10 psi less than the test pressure and hold for a one-hour period. The pressure may not drop more than 5% of the test pressure in the one-hour period.

409.6 Basis of Payment

1. The owner will measure the HDPE water main bid items by the linear acceptably completed. The length measured equals the distance along the centerline of the pipe including fittings and valves. Payment for the HDPE water main bid items is full compensation for providing all necessary materials, including fittings, harnesses and blocking; for excavating; for removing, abandoning, and sealing existing structures, pipes, and appurtenances within the limits of excavation or trenching operations; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for directional drilling and drilling fluids; for joining pipe; for installing fittings; for polyethylene wrap; for making connections;

for anchoring pipe and fittings; for tracer wire system; for backfilling; for replacing pipe made unusable by contractor operations; for cleaning out; for testing; and for restoring the work site.
2. The owner will measure and pay for ductile iron fittings as specified in 407.6.
3. No additional compensation will be provided for providing and installing polyethylene fittings.

410 Resilient-Seated Gate Valves and Boxes

410.1 Scope

1. This section describes installing 4- to 12-inch resilient-seated gate valves and boxes and testing under actual operating conditions.

410.2 General Requirements

1. Submit manufacturer's data and shop drawings for valves and valve boxes as specified in 106.2.2.
2. Unless otherwise indicated furnish valves as specified herein. Furnish valves with push-on or mechanical joint ends and a 2-inch operating nut for buried valves. Furnish valves with flanged ends for exposed valves. Provide a hand wheel or crank type operator for exposed valves above grade. Provide a 2-inch operating nut operable from the surface for exposed valves below grade (e.g. in a manhole). Provide valves in which the direction of the valve operating wheel, lever, or wrench nut turns to the left (counterclockwise) to open the valve.

410.3 Materials

410.3.1 Resilient-Seated Gate Valves

1. Furnish resilient-seated gate valves that are full opening, non-rising stem, compression seated wedge type valves conforming to the requirements of **AWWA C509**. Use valves with an epoxy coated iron body, bronze stem, and a double sealing permanently bonded fully encased gate. Furnish resilient-seated gate valves by a manufacturer listed below:
   A. Waterous Series 2500 by American Cast Iron Pipe Company.
   B. Clow Valve Company.
   C. Kennedy Valve Company.
   D. Mueller Water Products, Inc.
2. Furnish stainless steel valve bonnet and stuffing box nuts and bolts conforming to **AISI Type 304**.
3. Furnish valve stems with O-ring seals. Ensure that the O-ring stem seal is designed so that the seal above the stem collar can be replaced with the valve under pressure in the full open position.

410.3.2 Valve Boxes

1. Furnish cast iron, three-piece screw type valve boxes with 5¼-inch shaft diameter. Provide cover marked "Water". Furnish valve boxes listed below:
   A. Series 6860 by Tyler Union.

410.3.3 Valve Box Adapters

1. Furnish fabricated steel assembly valve box adapters with a ½-inch thick neoprene gasket and listed below:
   A. Gate Valve Adaptor by Adaptor, Inc.

410.4 Installation

410.4.1 Buried Valves

1. Set the valve on hardwood blocking 2 x 6 x 18-inch with the long side of the block set perpendicular to the water main.
2. Protect the valve from corrosion by use of 2 layers of polyethylene wrap.
3. Tamp pipe bedding material in place from a point above the main to a point 6 inches above the bottom of the valve box base to prevent the valve box or base from shifting. Place a sheet of polyethylene over the operating nut to prevent bedding material from entering around the operating nut.
4. Set a valve box over all gate valves unless vaults or special chambers are specified. Set the valve box on a valve box mounting bracket. Center valve boxes and covers over the valve operating nut and secure the entire box assembly in place before backfilling operations. Entirely uncover and reset valve boxes that become shifted or filled during backfilling.

410.4.2 Exposed Valves

1. Align, connect, and install each valve at the location shown according to the manufacturer's recommendations. Support the valve so it does not induce strain on the pipe. Arrange the valve operator to provide ease of access for operation and maintenance.

410.5 Testing

1. Open and close the valve after installation. After testing for proper operation, close the valve and pressure test at 150% of working pressure, as specified in 419.2.2, in both directions.

410.6 Basis of Payment

1. The owner will measure the valve and box bid items as each individual valve and box acceptably completed. Payment for the valve and box bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for bedding and installing valve with valve box and valve box mounting bracket; for testing; for backfilling; for disposing surplus material; and for restoring the work site.
2. The owner will measure the tapping sleeve and valve bid items as each individual tapping sleeve and valve acceptably completed. Payment for the tapping sleeve and valve bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for live tapping water main and installing tapping sleeve; for bedding and installing valve with valve box and valve box mounting bracket; for testing; for backfilling; for disposing surplus material; and for restoring the work site.

411 Butterfly Valves and Boxes

411.1 Scope

1. This section describes installing 14- to 36-inch butterfly valves and boxes and testing under actual operating conditions.

411.2 General Requirements

1. Submit manufacturer's data and shop drawings for valves and valve boxes as specified in 106.2.2.
2. Unless otherwise indicated furnish valves as specified herein. Furnish valves with push-on or mechanical joint ends and a 2-inch operating nut for buried valves. Furnish valves with flanged ends and a hand wheel or crank type operator for exposed valves. Provide valves in which the direction of the valve operating wheel, lever, or wrench nut turns to the left (counterclockwise) to open the valve.

411.3 Materials

411.3.1 Butterfly Valves

1. Furnish butterfly valves meeting or exceeding the requirements of **AWWA C504** for Class 150B valves. Provide gray iron valve bodies conforming to the requirements of **ASTM A126 Class B**. Provide valve discs conforming to the requirements of **ASTM A48 Class 40** or **ASTM A536** ductile iron with stainless steel shafts conforming to the requirements of **ASTM A276 Type 304** or **316**. Provide shaft sleeves with O-ring seals or V-type packing. Furnish butterfly valves listed below:
   A. CL 150 by M&H valve Company/Clow Valve Company.
   B. CL 250 by M&H valve Company/Clow Valve Company.
   C. Groundhog by Henry Pratt Company, LLC.
   D. Lineseal by Mueller Water Products, Inc.
2. Provide flanged valves with short body laying lengths with 125-pound flanged ends. Provide valve operators with a totally enclosed worm gear or traveling nut, as required, capable of withstanding an overload input torque of 450 ft. lbs. at full open or closed position without damage to the valve or the valve operator.
3. Furnish stainless steel bolts, nuts, washers, and other attachment hardware conforming to **AISI Type 304**.

411.3.2 Valve Boxes

1. Furnish cast iron, two-piece screw type valve boxes with 5¼-inch shaft diameter. Provide cover marked "Water". Furnish valve boxes listed below:
   A. Series 6850 by Tyler Union.

411.3.3 Butterfly Valve Box Adapters

1. Furnish fabricated steel assembly butterfly valve box adapters listed below:
   A. Butterfly Valve Adaptor by Adaptor, Inc.

411.4 Installation

411.4.1 Buried Valves

1. Set the valve body and the valve actuator on hardwood blocking 2 x 6 x 18-inch with the long side of the block set perpendicular to the pipeline.
2. Protect the valve from corrosion by use of 2 layers of polyethylene wrap.
3. Tamp pipe bedding material in place from a point above the main to a point 6 inches above the bottom of the valve box base to prevent the valve box or base from shifting. Place a sheet of polyethylene over the operating nut to prevent bedding material from entering around the operating nut.
4. Set a valve box over all operating housings for butterfly valves unless vaults or special chambers are specified. Set the valve box on a valve box adapter that is supported by hardwood blocking. Center valve boxes and covers over the valve operating nut and secure the entire box assembly in place before backfilling operations. Entirely uncover and reset valve boxes that become shifted or filled during backfilling.

411.4.2 Exposed Valves

1. Align, connect, and install each valve at the location shown according to the manufacturer's recommendations. Support the pipes around the valve so they do not induce strain on the valve.

Arrange the valve operator to provide ease of access for operation and maintenance. Ensure each valve has a position indicator needle.

411.5 Testing

1. Open and close the valve after installation. After testing for proper operation, close the valve and pressure test at 150% of working pressure, as specified in 419.2.2, in both directions.

411.6 Basis of Payment

1. The owner will measure the valve and box bid items as each individual valve and box acceptably completed. Payment for the valve and box bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for bedding and installing valve with valve box and valve box mounting bracket; for testing; for backfilling; for disposing surplus material; and for restoring the work site.
2. The owner will measure the tapping sleeve and valve bid items as each individual tapping sleeve and valve acceptably completed. Payment for the tapping sleeve and valve bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for live tapping water main and installing tapping sleeve; for bedding and installing valve with valve box and valve box mounting bracket; for testing; for backfilling; for disposing surplus material; and for restoring the work site.

412 Fire Hydrants

412.1 Scope

1. This section describes excavating required trenches, installing fire hydrants inside, testing under actual operating conditions, and then backfilling and cleaning out as necessary.
2. This section also describes salvaging and reinstalling existing fire hydrants including excavating required trenches, installing fire hydrants inside, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

412.2 General Requirements

1. Submit manufacturer's data and shop drawings for fire hydrants as specified in 106.2.2.
2. Furnish fire hydrants painted yellow and with National Standard 1½-inch pentagon operating nuts.

412.3 Materials

1. Furnish traffic pattern, dry barrel fire hydrants conforming to the requirements of **AWWA C502**. Use hydrants with a 5¼-inch main valve opening, 6-inch mechanical joint or push-on joint connection, two 2½-inch hose connections, one 4½-inch pumper connection (National Standard Threads), O-ring seals and compression type shutoff. Ensure hydrant length provides a minimum of 6 feet of cover over inlet pipe, and opens by turning clockwise. Furnish hydrants listed below:
   A. Waterous Pacer WB-67 by American Flow Control.
2. Furnish stainless steel bolts, nuts, washers, and other attachment hardware between the hydrant bottom and the hydrant barrel conforming to **AISI Type 304**.

412.4 Construction

1. Set hydrants on hardwood blocking and protect the portion of the hydrant below ground from corrosion by use of 2 layers of polyethylene wrap. Install the polyethylene wrap so as to insure that the drain holes on the hydrant are not sealed.

2. Immediately before installation thoroughly inspect and clean the hydrant on the interior and open and close as many times as necessary to determine if all parts are in proper working order.

412.4.1 Location and Position

1. Locate hydrants as shown or as required so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. Ensure all hydrants stand plumb and have their nozzles parallel with or at right angles to the curb, with the pumper nozzle facing the curb. Set hydrants to the established grade, with nozzles at least 20 inches above the ground as shown or as required by the engineer.

412.4.2 Hydrant Drainage

1. Provide drainage by placing approximately 2 cubic yards of drain rock, as specified in 404.4.2.8, around the hydrant to a minimum of 24 inches above the waste opening in the hydrant, and at least 2 feet around the hydrant. Cover the drain rock with a sheet of 8-mil polyethylene to prevent soil from filling the voids in the drain field.

412.4.3 Salvage Hydrants

1. Do not proceed with hydrant abandonments until the existing water main has been abandoned.
2. Excavate to the bottom of the hydrant and disassemble/disconnect it from the hydrant lead. Remove and salvage the hydrant.

412.5 Basis of Payment

1. The owner will measure the fire hydrant bid item as each individual fire hydrant acceptably completed. Payment for fire hydrant is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for installing hydrant and blocking; for installing tracer wire system; for backfilling; for disposing surplus material; for testing; and for restoring the work site.
2. The owner will measure the remove and reinstall hydrant bid item as each individual hydrant acceptably completed. Payment for remove and reinstall hydrant is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for salvaging, storing, and reinstalling existing hydrant; for blocking; for installing tracer wire system; for backfilling; for disposing surplus material; for testing; and for restoring the work site.

413 Water Valve Manholes

413.1 Scope

1. This section describes constructing water valve manholes made of concrete with necessary reinforcement, metal frames and lids, including required excavation and backfilling.

413.2 General Requirements

1. Submit manufacturer's data and shop drawings for the valve manholes, frames, and covers as specified in 106.2.2. Include a “plan view”, a “section view”, and a list of materials (base section, riser sections, cone section, adjustment, casting, etc.) necessary to construct the structure in the field on all shop drawings. List elevations for the rim and all pipe inverts. Showing only a measurement from either the top or bottom of the structure is insufficient to allow for proper review of the drawings. Shop drawings not conforming to these requirements will be rejected by the engineer without review.

2. Structures delivered to the site that do not comply with approved shop drawings will immediately be rejected by engineer.
3. Construct items not covered in this section as specified in 209.

413.3 Materials

413.3.1 Concrete

1. Furnish materials conforming to the following:
   A. Precast concrete manholes **ASTM C478**
2. Furnish precast valve manholes manufactured at a facility on the WisDOT pre-qualified list for precast concrete fabricators.
3. Provide precast reinforced concrete manhole base, wall, and flat top thicknesses as shown in the standard detail drawings.
4. Provide eccentric cone or flat top type manholes.
5. Provide a minimum 3-inch vertical ring integrally cast with the top of the precast eccentric cone.
6. Clearly mark each precast reinforced concrete manhole riser and top section with the name or trademark of the manufacturer and the date of manufacture. Indent this marking into the manhole section or paint on with waterproof paint.
7. Precast reinforced concrete manhole risers and flat top sections are subject to rejection by the engineer for failure to conform to any of the specification requirements. In addition, individual sections of manhole risers and tops may be rejected because of any of the following reasons:
   A. Fracture cracks passing through the walls, except for a single end crack that does not exceed the depth of the joint.
   B. Defects that indicate imperfect proportioning, mixing, or molding.
   C. Surface defects indicating honey-combed or open texture.
   D. Damaged ends, where such damage would prevent making a satisfactory joint.
   E. Manhole steps out of line or improperly spaced.
   F. The interval diameter of the manhole section varies more than 1% of the nominal diameter.
   G. Any continuous cracking having a surface width of 0.01 inches or more and extending for a length of 12 inches or more, regardless of the position in the section wall.

413.3.2 Joints

1. Furnish joints conforming to the following:
   A. Butyl rubber sealant **ASTM C443**
   B. Butyl rubber gaskets **ASTM C443, ASTM C478,** and **ASTM C497**
2. When an embedded bell gasket manhole is used, provide manholes with bell and spigot style joints with an embedded gasket. Use embedded gaskets with wedge shaped ribbed rubber material that is cast into the inner portion of the bell of the manhole.
3. Provide gasket of a proper volume to fill the annular space of the joint and be placed firmly against the lower third of the vertical slope of the joint.
4. Use preformed butyl rubber sealants 1 inch high by 1½ inches wide or sized according to manufacturer's recommendations for the type of application.

413.3.3 Steps

1. Furnish steps conforming to the following:
   A. Copolymer polypropylene **ASTM D4101 Type II Grade 49108**
   B. Steel bar **ASTM A615 Grade 60**
2. Use manhole steps made with an approved plastic such as copolymer polypropylene reinforced with a deformed ½-inch diameter reinforcing bar.

3. Ensure that all manhole steps are approved by the owner and OSHA.

413.3.4 Water Main Pipe to Manhole Connectors

1. Furnish pipe to manhole connectors consisting of a molded rubber boot of appropriate size conforming to **ASTM C923** and listed below:
   A. Kor-N-Seal by Trelleborg Pipe Seals Milford, Inc.
   B. Quik-Lok by A-Lok Products, Inc.
2. Ensure that connectors come complete with all required stainless steel hardware.

413.3.5 Adjustment Rings

1. Furnish materials conforming to the following:
   A. Polyethylene adjustment rings **ASTM D4976**
   B. Expanded polypropylene adjustment rings **ASTM D3575** and **ASTM D4819**
   C. Rubber adjustment rings **ASTM D573**
2. Furnish high density polyethylene rings listed below:
   A. Manhole adjustment and grade rings by Ladtech, Inc.
3. Furnish expanded polypropylene rings listed below:
   A. Pro-Ring by Cretex Specialty Products. Use with manufacturer recommended sealant.
4. Furnish rubber rings listed below:
   A. INFRA-RISER by EJ. Use with manufacturer recommended polyurethane sealant.

413.3.6 Manhole Frames and Covers

1. Furnish materials conforming to the following:
   A. Gray iron **ASTM A48 Class 35B**
2. Ensure that castings are true to pattern in form dimensions, free from pouring faults, sponginess, cracks, blowholes, and other defects in positions affecting strength and value for the service intended. Ensure that castings are boldly filleted at angles and that the risers are sharp and perfect. Sandblast castings or otherwise effectively clean scale and sand so as to present a smooth, clean, and uniform surface.
3. Furnish valve manhole frames and covers listed below with the word “WATER” cast into the cover, with concealed pick holes, self-sealing with a continuous flat “T” seal gasket, and which fits securely in a machined bearing surface. Non-rocking covers are not allowable.
   A. Neenah R-1550 frames with a solid Type B lid.

413.3.7 Non-Shrink Grout

1. Furnish a non-shrink grout product found on the WisDOT approved products list for non-shrink grout.

413.4 Construction

413.4.1 General

1. Excavate trenches for all valve manholes as specified in 404.4.
2. Limit the excavation to the size required for the structure to be constructed and sheath and brace as necessary to protect the workers and prevent loss of ground.
3. The proposed elevations for the structures, as shown on the plans, are subject to revisions in order to fit field conditions, and the engineer may adjust the grades from those shown on the plans.
4. Install steps in all manholes in excess of 4 feet deep. Install manhole steps in true vertical alignment at intervals of 16 inches with an allowable tolerance of 1 inch plus or minus.

5. Embed all manhole steps into the riser or eccentric cone wall a minimum of 3 inches and project uniformly from the inside face of the wall 5 inches to the centerline of the step.

413.4.2 Constructing Foundation

1. Construct foundations for all valve manhole bases as specified in 404.4.2.7.

413.4.3 Manhole Bases

1. **Precast Manhole with Integral Base**: Excavate deep enough so that after the bottom has been placed thereon, set to grade and plumbed, there remains a 6 inches minimum depth of bedding material below the bottom of the base. Backfill the annular space between the manhole excavation and the outside wall of the manhole section with bedding material conforming to 404.3 to a point 12 inches above the top of the water main pipe.

413.4.4 Concrete Walls and Chimneys

1. Precast Concrete Manholes:
   A. Set manhole base on graded bedding material, conforming to 404.3, making sure that boots or pipe connections match design elevations. Level top of manhole base section in both directions.
   B. Provide manholes that have manhole walls with an inside diameter of 60 inches, a reducing cover, and a 48-inch diameter eccentric cone unless shown otherwise.
   C. Use appropriate lifting slings that will adequately lift weight of units. The use of an appropriately rated spreader bar is preferred. When lifting manhole bases and risers, make sure chain or cable lengths are long enough to prevent contact with tongue and groove area, and are kept at appropriate lifting angles. Use wooden blocks between sling and manhole wall, if necessary.
   D. Clean and inspect tongue and groove surfaces. Surfaces should be clean from all dust and debris. On tongue-up manholes, place butyl material next to the vertical surface or tongue. Wrap material completely around unit overlapping ends. Knead the ends together to form a uniform splice. Make sure all protective paper is removed. Lower bell end of the next section making sure steps are aligned into final position. If bell is up, place butyl material next to vertical surface of groove and follow above procedure. All sections, as shown on the shop drawings, should be completed in this manner.
   E. Concealed pick holes are required for manhole barrel sections. Lifting holes penetrating through the manhole sidewalls are not permitted. Seal lifting holes by inserting a rubber plug or other approved material into the hole and filling it with non-shrink mortar.
   F. Backfill around manhole equally to prevent tipping. Compact fill in lifts as specified in 404.4.2.9.

413.4.5 Valve Manhole to Pipe Connections

1. Cast pipe to manhole connectors into the precast concrete manhole base section. Locate the connector in the manhole section to allow for a minimum of 6 inches of concrete below the bottom of the water main. Size the connector specifically for the type of pipe being used and install according to the recommendations of the manufacturer.

413.4.6 Water Main Valve and Corporation Stops

1. Place a gate valve and tap and install two ¾-inch corporation stops into the water main in valve manholes. Construct the manhole so that the main valve is clearly visible and operable after removing the manhole cover. Install the corporation stops at the top of the water main and with one on each side of the gate valve.

413.4.7 Manhole Chimneys and Adjustment Rings

1. Conform the adjustment rings to pavement slope using wedge shapes, and other thickness adjustment rings as required. Install wedge rings at the top of the ring stack. A maximum ¼-inch thick solid adjustment shim ring may be used over the wedge ring.
2. Secure grade riser rings and adjustment rings with engineer-approved butyl rubber sealant or using the manufacturer's recommended method.
3. For polyethylene rings, a ⅜-inch diameter, continuous bead of butyl rubber adhesive is required to be installed between each ring. A double ring of sealant is required between the concrete manhole and adjacent ring. A double ring of sealant is also required between the casting and adjacent rings unless concrete is to be vibrated between the casting and rings for concrete paving. For concrete paving, include a double ring of adhesive, ¼ inch thick, between the top solid shim ring and the first polyethylene ring below the shim with the ring adjustment.
4. Where asphalt pavement is constructed, place adjustment rings so the manhole casting rim is no more than ¼ inch below pavement grade, as measured with a 10-foot straight edge, and conforms to the pavement slope.

413.4.8 Manhole Frames and Covers

1. Set valve manhole frames on flexible joint sealant. Adjust to required alignment and grade while adjacent concrete is plastic. Hand vibrate concrete adjacent to fixtures to fill voids and openings between fixtures and support structures. Fill remaining voids beneath the base of these fixtures with an engineer-approved non-shrink grout before opening to traffic.
2. Set the frames, grates, and lids accurately so the complete installation will be at the correct elevation required to fit the adjoining surfaces. Make sure the grates or lids are not in place while striking off and finishing the adjoining concrete.
3. Ensure that surfaces of contact between frames and covers are sufficiently true so that no rattling occurs when vehicles pass over the cover. If rattling does occur, remove the cover and machine so as to eliminate the rattling.

413.4.9 Adjust Manhole Covers

1. Adjust existing covers, including frames and lids, to the required elevation as specified in 209.4.11.

413.4.10 Clean Out

1. Thoroughly clean all valve manholes of an accumulation of soil, debris, or foreign matter of any kind. Ensure that valve manholes are clear of such accumulations at the time of final inspection.

413.5 Basis of Payment

1. The owner will measure the valve manhole bid item as each individual manhole acceptably completed. Payment for valve manhole is full compensation for providing materials, including masonry, sealant, conduit and water main connections, steps, valves, corporation stops, and other fittings; for providing new covers, including adjustment rings, frames, lids, and other required materials and for installing and adjusting each cover; for excavating, backfilling, disposing of surplus material, and for cleaning out and restoring the work site.
2. The owner will measure adjust existing valve manholes as each individual unit acceptably completed. Payment for adjust existing valve manholes is full compensation for providing required materials, including frames and lids when the existing cover will not be reinstalled; and for removing, installing or reinstalling covers, and adjusting the covers. Replace covers rendered unusable by the contractor’s operations, at no expense to the owner.

414 Sacrificial Anode Bags

414.1 Scope

1. This section describes furnishing magnesium sacrificial anode bags and Cad welding sacrificial anode bags to iron water main or fittings.

414.2 General Requirements

1. Submit manufacturer's data for anode bags, copper wire sleeves, primer, and welding caps as specified in 106.2.2.

414.3 Materials

414.3.1 Anode Bags

1. Furnish 32-pound high-potential magnesium anode bags with 10 linear feet of type TW 12 AWG solid copper wire lead.

414.3.2 Copper Wire Sleeves

1. Furnish copper wire sleeve to Cad weld copper wire lead of bag to iron water main.

414.3.3 Primer

1. Furnish an aerosol primer to install welding caps listed below:
   A. Royston Roybond 747 by Chase Corporation.

414.3.4 Welding Caps

1. Furnish welding caps to protect Cad weld on main listed below:
   A. Royston Handy Caps by Chase Corporation.

414.3.5 Locking Connectors

1. Furnish a locking connector to connect copper wire lead of the anode bag to the jumper wire listed below:
   A. SnakeBite Locking Connectors by Copperhead Industries

414.4 Installation

414.4.1 Straight Pipe

1. Strip off approximately 1 inch to 1½ inch of coating from end of wire on anode bag. Slide copper sleeve onto wire and crimp with a wire crimping tool to secure it to the wire. Copper wire sleeve and copper wire must be bright, clean, and dry. Remove scale and bituminous coating on outside of iron pipe in preparation for Cad weld. Iron pipe should be bright, clean, and dry. Cast iron surface must be free from large pits and flaws.
2. Under some conditions of temperature and humidity, the surface to be welded will sweat causing porous welds. Eliminate sweating by warming the surface with a hand torch prior to welding.
3. Use 25-pound charge with powder marked C.I. for cast iron. Do not use regular powder. Check mold tag for material to be welded and proper cartridge size.
4. Make sure all surfaces and conductors are clean and dry.

5. Prepare Cad weld furnace. Inspect furnace for damage or overuse. If the combustion chamber shows signs of erosion or loss of wall thickness, it may not properly contain the weld causing a blowout to weld material. Replace the furnace when such deterioration is found.
6. Open the door on top of furnace. Insert metal disk into bottom of furnace. Open Cad weld cartridge and dump into furnace on top of metal disk. The cartridge may have to be tapped to remove hardened powder from cartridge bottom. Close the door. Place furnace on top of pipe with slot opening, located at the bottom of the furnace, facing the anode wire. Slide end of wire into slot of furnace. Use an igniting tool or a small torch to ignite the Cad weld cartridge. Follow all safety rules for personal protection. Hold furnace on pipe until weld has solidified. The appearance of weld should match the mold of the furnace closely.
7. Tap weld with a hammer to remove any slag and to check for a sound weld. Clean weld with a wire brush, prime, and install handy cap to protect mold. If cast iron main or unwrapped ductile iron main, the installation is complete. If ductile iron water main with polyethylene wrap, rewrap the main with polyethylene wherever the existing wrap has been damaged or removed.

414.4.2 Bell and Spigot Joint or Fitting

1. If a pipe joint or fitting is uncovered, install a jumper wire across the joint with 12 AWG copper wire Cad welded onto the pipe on each side of the pipe joint or fitting. Install the copper wire lead of the anode bag on the jumper wire with a locking connector. Seal the wire connector with 2 layers of polyethylene wrap.

414.5 Testing

1. Electrical continuity will be tested by visual inspection of welds.

414.6 Basis of Payment

1. The owner will measure the anode bag bid items as each individual anode bag acceptably completed. Payment for the anode bag bid items is full compensation for Cad welding; for installing jumper wire; and for testing.

415 Polyethylene Water Service

415.1 Scope

1. This section describes excavating required trenches, laying or constructing 1-inch to 2-inch polyethylene water service lines inside, including corporation stop, saddle if required, coupling, curb stop, and curb box, for new water services, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

415.2 General Requirements

1. Submit manufacturer’s data and shop drawings for corporation stops, service saddles, couplings, curb stops, curb boxes, polyethylene water service piping, tracer wire, insulation, pipe fittings, and polyethylene wrap as specified in 106.2.2.

415.3 Materials

415.3.1 Service Pipe

1. Furnish copper tube size high density polyethylene tubing service pipe manufactured from PE3608/PE4710 conforming to **AWWA C901** and **ASTM D2737**. Use DR 9 and pressure class 200

or higher pipe unless otherwise noted. The use of stainless steel pipe insert stiffeners with fittings will be based on the pipe manufacturer's recommendations.
2. Furnish pipe with the name or trademark of the manufacturer and a mark indicating the type permanently and plainly marked on tubing at intervals not greater than 1½ feet.

415.3.2 Approved Corporation Stops, Curb Stops, and Fittings Manufacturer List
1. Furnish corporation stops, curb stops, and fittings made by a manufacturer listed below:
   A. The Ford Meter Box Company, Inc.
   B. A.Y. McDonald Mfg. Co.
   C. Mueller Water Products, Inc.

415.3.3 Fittings
1. Furnish cast brass fittings for polyethylene water service piping. Provide fittings with a uniform wall thickness and strength, and free of defects, which may affect their serviceability. Use compression type fittings only.
2. Furnish extra heavy 3-part type unions.
3. Furnish fittings with the name or trademark of the manufacturer permanently and plainly marked.

415.3.4 Corporation Stops, Couplings, and Curb Stops

415.3.4.1 Corporation Stops
1. Furnish ball valve type corporation stops with AWWA taper thread inlet listed below:
   a. 74701B-22 series corporation stops by A.Y. McDonald Mfg. Co.
2. For 1-inch services, use corporation stops with ¾-inch inlet, ¾-inch valve and 1-inch outlet.
3. For 1¼-inch services, use corporation stops with 1-inch inlet, 1-inch valve, and 1¼-inch outlet.

415.3.4.2 Couplings
1. Furnish couplings for tube compression to tube compression listed below:
   a. 74758T series couplings by A.Y. McDonald Mfg. Co.

415.3.4.3 Curb Stops
1. Furnish ball valve type curb stops as specified below:
   a. 76104-22 series curb stops by A.Y. McDonald Mfg. Co.
2. For 1-inch services, use curb stops with 1-inch valve size, 1-inch inlet, and 1-inch outlet.
3. For 1¼-inch services, use curb stops with 1-inch valve size, 1¼-inch inlet and 1¼-outlet.
4. For 1½-inch and 2-inch polyethylene services, use a valve size the same as the service pipe.

415.3.5 Curb Boxes
1. Furnish adjustable cast iron service boxes consisting of a lid and base, adjustable from 72 to 84 inches, a 47-inch stainless steel curb box rod, a stainless steel cotter pin, and listed below:
   A. For 1-inch and 1¼-inch curb stops, use 5607ALR 7 small arch pattern curb boxes (part number 4517-047) by A.Y. McDonald Mfg. Co.
   B. For 1½-inch and 2-inch curb stops, use 5602ALR 7 large arch pattern curb boxes (part number 4510-024) by A.Y. McDonald Mfg. Co.

415.3.6 Service Saddles

415.3.6.1 Ductile Iron Pipe

1. Furnish double stainless steel strap type service saddles with ductile iron bodies, with saddle castings covered by a 10-12 mil. thickness black nylon fused coating, and listed below:
   a. Style 202NS by Romac Industries, Inc.
2. Use service saddles when the service size exceeds the maximum direct tap size in ***Table 415-1***.

415.3.6.2 PVC Pipe

1. Furnish full circle double bolt style saddles, all 18-8 type 304 stainless steel, fully passivated, sized for C900 PVC main, and listed below:
   a. Style 306 by Romac Industries, Inc.
   b. Style FS303 by The Ford Meter Box Company, Inc.
2. Use service saddles on all services.

415.4 Construction

415.4.1 General

1. To prevent the entry of highly chlorinated water into the water service pipe, connect services to the new water main only after final flushing has been completed and a safe bacteriological sample has been obtained.
2. Install a 1¼-inch minimum size of water service, unless noted otherwise.
3. Polyethylene water services consist of a corporation stop, service saddle if required, service pipe, tracer wire if required, insulation if required, and curb stop with box. Provide corporation stops and curb stops of the same size as the service pipe except for 1¼-inch services.
4. Extend the polyethylene service pipe from the corporation stop to the curb stop without additional joints or couplings. A kink or gouge that deforms the diameter of the pipe will be subject to rejection.

415.4.2 Joining Pipe

1. Join the pipe with compression type fittings according to the manufacturer's instructions for the fittings provided.
2. The use of stainless steel pipe insert stiffeners in the polyethylene tubing with fittings will be based on the pipe manufacturer's recommendations.
3. Cut all ends squarely and remove rough edges or burrs.

415.4.3 Constructing Foundation

1. Construct foundations for all polyethylene water services as specified in 404.2.7.

415.4.4 Connection to Water Main

1. Two layers of pipe thread sealant tape are required on each corporation stop. Locate the tap for the corporation stop a minimum of 2 feet from any pipe or fitting joint for 12-inch or smaller pipes and a minimum of 3 feet from any pipe or fitting joint for 14-inch or larger pipes. Provide a minimum of 1½ feet of clearance between taps. Stagger multiple taps in a single pipe around the circumference. Encase all service connections (including the saddle and corporation stop) in 2 layers of polyethylene wrap.

415.4.4.1 Ductile Iron Pipe

1. Make service connections using service saddles or by directly tapping the water main. Do not exceed the maximum direct tap size in ***Table 415-1***.

Table 415-1
Maximum Direct Tap Size

Pipe Diameter (Inches)	Maximum Direct Tap Size (Inches)
4	¾
6	1
8	1
10	1
12	1¼
14	1½
16 and larger	2

415.4.4.2 PVC Pipe

1. Use service saddles for all service connections.

415.4.5 Alignment and Grade

1. Unless otherwise indicated, construct the service pipe at a right angle to the roadway or parallel to the sanitary sewer lateral.
2. Construct new water services with a minimum cover of 6.5 feet and a minimum of 2 feet of vertical separation between any storm sewer. Place curb stops at a depth between 6 and 7 feet below established or proposed grade. Where 6.5 feet of cover or the 2-foot vertical separation from a storm sewer cannot be maintained, insulate the water service.

415.4.6 Curb Box Installation

1. Install the curb box in the right-of-way approximately 6 feet off of right-of-way line so the box will not fall into the sidewalk. Center the curb box over the curb stop and bring to proper grade. Rest the legs of the curb box firmly upon a 2 x 6 x 8-inch wood block. Provide clearance so that the curb box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, furnish such support by the use of a 2 x 6-inch plank placed across the building sanitary sewer trench and firmly supported in each bank.
2. Use cotter pin to attach curb box rod to service valve.
3. Plumb and brace the curb box so it will remain vertical throughout the backfilling. Make sufficient excavation for the curb box installation to insure proper setting and backfilling around the curb box. Entirely uncover and reset curb boxes that become shifted or filled during backfilling.
4. Before placing backfill around the curb box, wrap polyethylene around the base and tamp bedding material in place to a point 6 inches above the blocking to prevent entrance of backfill materials into the openings at the base of the curb box.
5. Make final curb box adjustments. Adjust curb boxes to a final depth of 1 inch below the finished topsoil grade.

415.4.7 Curb Boxes in Concrete Sidewalk or Driveway

1. Install a Neenah R-7506-C Hudson box at all curb boxes placed in concrete sidewalks or driveways. The City of Fond du Lac Water Utility will provide the boxes.
2. Place the Hudson boxes to match the new sidewalk or driveway grade, and ensure that the covers are free of all concrete. Ensure that each casting is in place before the concrete is poured. Adjust the curb box to approximately 3 inches below finish grade for the casting to fit

properly. After the contractor has determined finish grade, the owner will adjust the curb box to the correct grade with 24 hours' notice. Install the rim of the casting within ¼ inch of the final concrete surface elevation.

415.4.8 Curb Stop and Service Pipe Closure

1. Insert a copper or plastic disc in the curb stop on the building side if no service pipe is provided.

415.4.9 Backfill

1. Backfill all polyethylene water services as specified in 404.4.2.9.
1. Install trench dams as specified in 404.4.1.6 approximately 1 foot from the end of new services.

415.5 Testing

1. Test the water service installation for leaks prior to the placement of backfill and before the curb box is installed. Turn on the corporation stop at the water main and open the curb stop until a full flow of water is obtained. Then turn off the curb stop and check all joints and couplings for leaks.
2. Upon acceptance of the service piping, complete the remainder of the installation work.

415.6 Basis of Payment

1. The owner will measure the water service including corp, stop, box saddle, and union bid items as each individual water service acceptably completed. Payment for the water service including corp, stop, box saddle, and union bid items is full compensation for site preparation; for excavating, backfilling, and disposing surplus material; for testing; for placing and adjusting Hudson boxes; and for cleaning out and restoring the work site.
2. Replace any new sidewalks or driveways where the Hudson boxes have been damaged, are not adjusted to the proper grade, or not installed in the concrete properly at no expense to the owner.
3. The owner will measure the polyethylene water service pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe, from the water main to the connection of the existing water service or to the end of the installed service pipe.
4. Payment for the polyethylene water service pipe bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for installing tracer wire system; for insulating; for backfilling; for testing; for cleaning out; and restoring the work site.

416 Copper Water Service

416.1 Scope

1. This section describes excavating required trenches, laying or constructing ¾-inch to 2-inch copper water service lines with polyethylene wrap inside, including corporation stop, saddle if required, coupling, curb stop, and curb box, for new water services, testing under actual operating conditions, and then backfilling and cleaning out as necessary.

416.2 General Requirements

1. Submit manufacturer's data and shop drawings for corporation stops, service saddles, couplings, curb stops, curb boxes, copper water service piping, insulation, pipe fittings and polyethylene wrap as specified in 106.2.2.
2. Copper water services may only be used where shown on the plans, where indicated in the special provisions, or as directed by the engineer. Unless specifically indicated otherwise, use polyethylene piping for all water services as specified in 415.

416.3 Materials

416.3.1 Service Pipe

1. Furnish Type K soft annealed seamless copper tubing service pipe conforming to **ASTM B88**.
2. Furnish pipe with the name or trademark of the manufacturer and a mark indicating the type permanently and plainly marked on tubing at intervals not greater than 1½ feet.

416.3.1.1 Approved Service Pipe Manufacturer List

1. Furnish service piping made by a manufacturer listed below:
   a. Mueller Streamline Co.
2. Do not use Cerro Flow Products LLC copper service pipe.

416.3.2 Approved Corporation Stops, Curb Stops, and Fittings Manufacturer List

1. Furnish corporation stops, curb stops, and fittings made by a manufacturer listed below:
   A. The Ford Meter Box Company, Inc.
   B. A.Y. McDonald Mfg. Co.
   C. Mueller Water Products, Inc.

416.3.3 Fittings

1. Furnish cast brass fittings for copper water service piping. Provide fittings with a uniform wall thickness and strength, and free of defects, which may affect their serviceability. Use flared or compression type fittings only.
2. Furnish extra heavy 3-part type unions.
3. Furnish fittings with the name or trademark of the manufacturer permanently and plainly marked.

416.3.4 Corporation Stops, Couplings, and Curb Stops

1. Furnish a ball valve type corporation stop with AWWA taper thread inlet listed below:
   A. 74701B-22 series by A.Y. McDonald Mfg. Co.
2. Furnish couplings for copper to copper joints listed below:
   A. C44 series by The Ford Meter Box Company, Inc.
3. Furnish ball valve type curb stops listed below:
   A. 76104-22 series by A.Y. McDonald Mfg. Co.

416.3.5 Curb Boxes

1. Furnish adjustable cast iron service boxes consisting of a lid and base, adjustable from 72 to 84 inches, a 47-inch stainless steel curb rod box, a stainless steel cotter pin, and listed below:
   A. For ¾-inch to 1¼-inch curb stops, use 5607ALR 7 small arch pattern curb boxes (part number 4517-047) by A.Y. McDonald Mfg. Co.
   B. For 1½-inch and 2-inch curb stops, use 5602ALR 7 large arch pattern curb boxes (part number 4510-024) by A.Y. McDonald Mfg. Co.

416.3.6 Service Saddles

416.3.6.1 Ductile Iron Pipe

1. Furnish double stainless steel strap type service saddles with ductile iron bodies, with saddle castings covered by a 10-12 mil. thickness black nylon fused coating, and listed below:
   a. Style 202NS by Romac Industries, Inc.

416.3.6.2 PVC Pipe

1. Furnish full circle double bolt style saddles, all 18-8 type 304 stainless steel, fully passivated, sized for C900 PVC main, and listed below:
   a. Style 306 by Romac Industries, Inc.
   b. Style FS303 by The Ford Meter Box Company, Inc.
2. Use service saddles on all services.

416.3.7 Polyethylene Wrap for Copper Tubing

1. Furnish polyethylene wrap conforming to the requirements of **ASTM D1248** and with a nominal thickness of 6 mils.

416.4 Construction

416.4.1 General

1. To prevent the entry of highly chlorinated water into the water service pipe, connect services to the new water main only after final flushing has been completed and a safe bacteriological sample has been obtained.
2. Install a 1¼-inch minimum size of water service, unless noted otherwise.
3. Copper water services consist of a corporation stop, service saddle if required, service pipe with polyethylene wrap, insulation if required, and curb stop with box. Provide corporation stops and curb stops of the same size as the service pipe.
4. Extend the copper service pipe from the corporation stop to the curb stop without additional joints or couplings. A kink or bend that deforms the diameter of the pipe more than ¼ inch will be subject to rejection.

416.4.2 Joining Pipe

1. Join the pipe with flared or compression type fittings according to the manufacturer's instructions for the fittings provided.
2. When the pipe is joined with flared type fittings, accurately size and round the ends of the copper tubing with copper tubing sizing tools to remove any imperfections in the tubing due to coiling or handling.
3. Cut all ends squarely and remove rough edges or burrs.
4. Form the flare on the flange-end of the copper tube which is to be joined only with the proper size and type of flange tool designed for that purpose. Fit the flared end against the bevel of the fitting and secure against leakage by tightly screwing and fitting into the sleeve nut.

416.4.3 Bedding

1. Construct foundations for all copper water services as specified in 404.2.7.

416.4.4 Connection to Water Main

1. Two layers of pipe thread sealant tape are required on each corporation stop. Locate the tap for the corporation stop a minimum of 1 foot from any pipe or fitting joint and provide a minimum of 1 foot of clearance between taps. Encase all copper service connections in polyethylene wrap.

416.4.4.1 Ductile Iron Pipe

1. Make service connections using service saddles or by directly tapping the water main. Do not exceed the maximum direct tap size in ***Table 416-1***.

Table 416-1
Maximum Direct Tap Size

Pipe Diameter (Inches)	Maximum Direct Tap Size (Inches)
4	¾
6	1
8	1
10	1
12	1¼
14	1½
16 and larger	2

416.4.4.2 PVC Pipe

1. Use service saddles for all service connections.

416.4.5 Alignment and Grade

1. Unless otherwise indicated, construct the service pipe at a right angle to the roadway or parallel to the sanitary sewer lateral.
2. Construct new water services with a minimum cover of 6.5 feet and a minimum of 2 feet of vertical separation between any storm sewer. Place curb stops at a depth between 6 and 7 feet below established or proposed grade. Where 6.5 feet of cover or the 2 foot vertical separation from a storm sewer cannot be maintained, insulate the water service.

416.4.6 Curb Box Installation

1. Install the curb box in the right-of-way approximately 6 feet off of right-of-way line so the box will not fall into the sidewalk. Center the curb box over the curb stop and bring to proper grade. Rest the legs of the curb box firmly upon a 2 x 6 x 8-inch wood block. Provide clearance so that the curb box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, furnish such support by the use of a 2 x 6-inch plank placed across the building sanitary sewer trench and firmly supported in each bank.
2. Use cotter pin to attach curb box rod to service valve.
3. Plumb and brace the curb box so it will remain vertical throughout the backfilling. Make sufficient excavation for the curb box installation to insure proper setting and backfilling around the curb box. Entirely uncover and reset curb boxes that become shifted or filled during backfilling.
4. Before placing backfill around the curb box, wrap polyethylene around the base and tamp bedding material in place to a point 6 inches above the blocking to prevent entrance of backfill materials into the openings at the base of the curb box.
5. Make final curb box adjustments. Adjust curb boxes to a final depth of 1 inch below the finished topsoil grade.

416.4.7 Curb Boxes in Concrete Sidewalk or Driveway

1. Install a Neenah R-7506-C Hudson box at all curb boxes placed in concrete sidewalks or driveways. The City of Fond du Lac Water Utility will provide the boxes.
2. Place the Hudson boxes to match the new sidewalk or driveway grade, and ensure that the covers are free of all concrete. Ensure that each casting is in place before the concrete is poured. Adjust the curb box to approximately 3 inches below finish grade for the casting to fit properly. After the contractor has determined finish grade, the owner will adjust the curb box to

the correct grade with 24 hours' notice. Install the rim of the casting within ¼ inch of the final concrete surface elevation.

416.4.8 Curb Stop and Service Pipe Closure

1. Insert a copper or plastic disc in the curb stop on the building side if no service pipe is provided. Close the open end of the service pipe by peening the end.

416.4.9 Backfill

1. Backfill all copper water services as specified in 404.4.2.9.
2. Install trench dams as specified in 404.4.1.6 approximately 1 foot from the end of new services.

416.5 Testing

1. Test the water service installation for leaks prior to the placement of backfill and before the curb box is installed. Turn on the corporation stop at the water main and open the curb stop until a full flow of water is obtained. Then turn off the curb stop and check all joints and couplings for leaks.
2. Upon acceptance of the service piping, complete the remainder of the installation work.

416.6 Basis of Payment

1. The owner will measure the water service including corp, stop, box saddle, and union bid items as each individual water service acceptably completed. Payment for the water service including corp, stop, box saddle, and union bid items is full compensation for site preparation; for excavating, backfilling, and disposing surplus material; for testing; for placing and adjusting Hudson boxes; and for cleaning out and restoring the work site.
2. Replace any new sidewalks or driveways where the Hudson boxes have been damaged, are not adjusted to the proper grade, or not installed in the concrete properly at no expense to the owner.
3. The owner will measure the copper water service pipe bid items by the linear foot acceptably completed. The length measured equals the distance along the centerline of the pipe, from the water main to the connection of the existing water service or to the end of the installed service pipe.
4. Payment for the copper water service pipe bid items is full compensation for site preparation; for excavating; for providing and removing sheeting and shoring; for providing bedding material and granular backfill material; for constructing the foundation; for laying pipe; for installing tracer wire system; for insulating; for backfilling; for testing; for cleaning out; and restoring the work site.

417 Reconnection of Water Service

417.1 Scope

1. This section describes excavating required trenches, laying or constructing ¾-inch to 2-inch water service lines inside, including corporation stop, saddle if required, polyethylene wrap if required, coupling, curb stop, and curb box, for existing services, reconnecting water service, testing under actual operating conditions, and then backfilling and cleaning out as necessary. Use water main specifications for water services larger than 2-inch.

417.2 General Requirements

1. Submit manufacturer's data and shop drawings for corporation stops, service saddles, couplings, curb stops, curb boxes, water service piping, tracer wire, insulation, pipe fittings and polyethylene wrap as specified in 106.2.2.

417.3 Materials

417.3.1 Service Pipe

1. Furnish copper tube size high density polyethylene tubing service pipe manufactured from PE3608/PE4710 conforming to **AWWA C901** and **ASTM D2737**. Use DR 9 and pressure class 200 or higher pipe unless otherwise noted. The use of stainless steel pipe insert stiffeners with fittings will be based on the pipe manufacturer's recommendations.
2. Furnish pipe with the name or trademark of the manufacturer, and a mark indicating the type permanently and plainly marked on tubing at intervals not greater than 1½ feet.

417.3.2 Approved Manufacturer List

1. Furnish corporation stops, couplings, curb stops, curb boxes, and fittings made by a manufacturer listed below:
   A. The Ford Meter Box Company, Inc.
   B. A.Y. McDonald Mfg. Co.
   C. Mueller Water Products, Inc.

417.3.3 Fittings

1. Furnish cast brass fittings for polyethylene water service piping. Provide fittings with a uniform wall thickness and strength, and free of defects, which may affect their serviceability. Use compression type fittings only.
2. Furnish extra heavy 3-part type unions for the size and type of pipe indicated on the plans or special provisions.
3. Furnish fittings with the name or trademark of the manufacturer permanently and plainly marked.

417.3.4 Corporation Stops and Curb Stops

1. Furnish a ball valve type corporation stops with AWWA taper thread inlet listed below:
   A. 74701B-22 series by A.Y. McDonald Mfg. Co.
2. Furnish ball valve type curb stops listed below:
   A. 76104-22 by A.Y. McDonald Mfg. Co.

417.3.5 Service Saddles

417.3.5.1 Ductile Iron Pipe

1. Furnish double stainless steel strap type service saddles with ductile iron bodies, with saddle castings covered by a 10-12 mil. thickness black nylon fused coating, and listed below:
   a. Style 202NS by Romac Industries, Inc.
2. Use service saddles when the service size exceeds the maximum direct tap size in ***Table 41-1***.

417.3.5.2 PVC Pipe

1. Furnish full circle double bolt style saddles, all 18-8 type 304 stainless steel, fully passivated, sized for C900 PVC main, and listed below:
   a. Style 306 by Romac Industries, Inc.
   b. Style FS303 by The Ford Meter Box Company, Inc.
2. Use service saddles on all services.

417.3.6 Curb Boxes

1. Furnish adjustable cast iron service boxes consisting of a lid and base, adjustable from 72 to 84 inches, a 47-inch stainless steel curb box rod, a stainless steel cotter pin, and listed below:
   A. For ¾-inch to 1¼-inch curb stops, use 5607ALR 7 small arch pattern curb boxes (part number 4517-047) by A.Y. McDonald Mfg. Co.
   B. For 1½-inch and 2-inch curb stops, use 5602ALR 7 large arch pattern curb boxes (part number 4510-024) by A.Y. McDonald Mfg. Co.

417.4 Construction

417.4.1 General

1. Reconnection of water services consists of a corporation stop, service saddle if required, curb stop, curb box, coupling, and polyethylene tubing of the size indicated.
2. Connect the water services to the new water main only after a safe bacteriological sample has been obtained and all hydrostatic testing has been completed. Do not disconnect water services for more than 4 hours. Notify the owner prior to reconnection.
3. Extend the polyethylene service pipe from the corporation stop to the curb stop without additional joints or couplings unless previously approved by the engineer. Install a transitional coupling, if needed, after the curb stop to connect the new polyethylene service piping to the existing service piping. A kink or bend that deforms the diameter of the pipe will be subject to rejection.
4. Install tracer wire as specified in 402.4.18. Locate and connect to existing tracer wire for water main.

417.4.2 Joining Pipe

1. Join the pipe with compression type fittings according to the manufacturer's instructions for the fittings provided.
2. Cut all ends squarely and remove rough edges or burrs.

417.4.3 Connection to Water Main

1. Two layers of pipe thread sealant tape are required on each corporation stop. Locate the tap for the corporation stop a minimum of 2 feet from any pipe or fitting joint and provide a minimum of 1½ feet between connections. Protect all service connections (including the saddle and corporation stop) from corrosion by use of 2 layers of polyethylene wrap.

417.4.3.1 Ductile Iron Pipe

1. Make service connections using service saddles or by directly tapping the water main. Do not exceed the maximum direct tap size in ***Table 417-1***.

Table 417-1
Maximum Direct Tap Size

Pipe Diameter (Inches)	Maximum Direct Tap Size (Inches)
4	¾
6	1
8	1
10	1
12	1¼
14	1½

16 and larger	2

417.4.3.2 PVC Pipe

1. Use service saddles for all service connections.

417.4.4 Constructing Foundations

1. Construct foundations for all water services as specified in 404.2.7.

417.4.5 Location and Position of Curb Stop

1. Lay the water service as required to reconnect the existing service with the new water main. Remove the existing curb stop and install the new curb stop in the right-of-way, perpendicular to right-of-way line and approximately 6 feet off of right-of-way line so the box will not fall into the sidewalk. Place the curb stop below established or proposed grade at a minimum depth of 6 feet. If the existing water service has less than 6 feet of cover, make up the difference in depth between the new service and the existing service immediately on the property owner's side of the curb stop. Center the curb box over the curb stop and bring to proper grade. Rest the legs of the service box firmly upon a 2 x 6 x 8-inch hardwood block. Provide clearance so that the service box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, furnish such support by the use of a 2 x 6-inch plank placed across the building sanitary sewer trench and firmly supported in each bank.
2. Use cotter pin to attach curb box rod to service valve.
3. Plumb and brace the curb box so it will remain vertical throughout the backfilling. Make sufficient excavation for the curb box installation to insure proper setting and backfilling around the curb box. Entirely uncover and reset curb boxes that become shifted or filled during backfilling. Mark each curb box with a wooden stake.
4. Before placing backfill around the curb box, wrap polyethylene around the base and tamp bedding material in place to a point 6 inches above the blocking to prevent entrance of backfill materials in to the openings at the base.
5. Make final curb box adjustments. Adjust curb boxes to a final depth of 1 inch below the finished topsoil grade.

417.4.6 Curb Boxes in Concrete Sidewalk or Driveway

1. Install a Neenah R-7506-C Hudson box at all curb boxes placed in concrete sidewalks or driveways. The City of Fond du Lac Water Utility will provide the boxes.
2. Place the Hudson boxes to match the new sidewalk or driveway grade, and ensure that the covers are free of all concrete. Ensure that each casting is in place before the concrete is poured. Adjust the curb box to approximately 3 inches below finish grade for the casting to fit properly. After the contractor has determined finish grade, the owner will adjust the curb box to the correct grade with 24 hours' notice. Install the rim of the casting within ¼ inch of the final concrete surface elevation.

417.4.7 Backfill

1. Backfill all water services as specified in 404.4.2.9.
2. Install trench dams as specified in 404.4.1.6 at the location of the connection to existing service piping. Trench dams may be omitted, based on existing trench materials, with approval of the engineer.

417.5 Testing

1. Test the water service installation for leaks under normal main pressure prior to the placement of backfill and before the curb box is installed. Turn on the corporation stop at the water main and open the curb stop until a full flow of water is obtained. The turn off the curb stop and check all joints and couplings for leaks.
2. Upon acceptance of the service piping, complete the remainder of the installation work.

417.6 Basis of Payment

1. The owner will measure the reconnect existing water service including corp and box saddle bid items as each individual reconnection acceptably completed. Payment for the reconnect existing water service including corp and box saddle bid items is full compensation for site preparation; for excavating, backfilling, and disposing surplus material; for testing; for installing Hudson boxes; and for cleaning out and restoring the work site.
2. Replace any new sidewalks or driveways where the Hudson boxes have been damaged, are not adjusted to the proper grade, or not installed in the concrete properly at no expense to the owner.
3. The owner will measure and pay for polyethylene water service pipe as specified in 415.6.

418 Disinfection and Flushing of Water Mains

418.1 Scope

1. This section describes the disinfection, flushing, and testing of water mains.

418.2 General Requirements

1. Submit the proposed procedure for disinfecting and flushing the water mains to the engineer for review prior to performing the work. Perform disinfection in conformance with **AWWA C651**. If water services are involved in the disinfection procedure, provision will have to be made to flush each water service to rid the service line of the chlorinated water.
2. Provide a 48 hour notice, to the City of Fond du Lac Water Utility, prior to any proposed flushing of new water main. This will allow time to provide notice warning customers of potential rusty water conditions.

418.3 Materials

1. Disinfect water mains using chlorine compounds consisting of sodium hypochlorite solution or calcium hypochlorite granules or tablets. Furnish sodium hypochlorite solution containing 5% to 15% available chlorine and packaged in glass, rubber-lined, or plastic containers, 1 quart to 5 gallons in size. Furnish calcium hypochlorite containing approximately 65% available chlorine by weight and in tablet or granular form. Do not use calcium hypochlorite intended for swimming pool disinfection.

418.4 Procedure

418.4.1 Disinfecting

418.4.1.1 Tablet Method

1. If using the tablet method place calcium hypochlorite granules or tablets in the water main as it is being installed. Keep pipes and fittings clean and dry during construction. Use the quantity of granules or tablets shown in ***Table 418-1*** or ***Table 418-2***.

Table 418-1

Weight of Calcium Hypochlorite Granules to be Placed at Beginning of Main and at Each 500 Feet Interval

Pipe Diameter (Inches)	Calcium Hypochlorite Granules (Ounces)
4	1.7
6	3.8
8	6.7
12	15.1
14 and larger	D^2 x 15.1

Where D is the inside pipe diameter in feet D=d/12

Table 418-2
Number of 5 g Calcium Hypochlorite Tablets Required for Dose of 25 mg/l

Pipe Diameter (Inches)	Length of Pipe Section in feet		
	13 or less	18	40
	Number of 5 g Calcium Hypochlorite Tablets		
4	1	1	1
6	1	1	2
8	1	2	4
10	2	3	5
12	3	4	7
16	4	6	13

Based on 3.25 g available chlorine per tablet; any portion of tablet rounded to next higher number.

2. When installation has been completed, fill the main with water at a rate such that water within the main will flow at a velocity no greater than 1 foot per second and all air pockets are eliminated. Leave the water in the pipe for at least 24 hours. If the water temperature is less than 41 degrees Fahrenheit, keep chlorinated water in the water main for at least 48 hours. Position all valves so that the strong chlorine solution in the treated main will not flow into water mains in active service.

418.4.1.2 Continuous-feed Method

1. Place calcium hypochlorite granules or tablets in the pipe sections using the tablet method.
2. Perform a preliminary flushing of the water main to remove particles and refill the pipe with potable water. Provide a minimum flushing velocity of 2.5 feet per second in the water main.
3. Inject a chlorine solution in the water main at a point no more than 10 feet downstream of the beginning of the new main. Add the chlorine solution at a constant rate such that the water does not contain less than 25 mg/l of free chlorine. Do not stop chlorine application until the entire main is filled with heavily chlorinated water. Ensure that the treated water has a residual of not less than 10 mg/l free chlorine at the end of a 24-hour period. If the water temperature is less than 41 degrees Fahrenheit, keep chlorinated water in the water main for at least 48 hours.

418.4.1.3 Slug method

1. Place calcium hypochlorite granules or tablets in the pipe sections using the tablet method.

2. Perform a preliminary flushing of the water main to remove particles and refill the pipe with potable water. Provide a minimum flushing velocity of 2.5 feet per second in the water main.
3. Inject a chlorine solution in the water main at a point not more than 10 feet downstream of the beginning of the new main. Add the chlorine solution at a constant rate such that the water does not have less than 100 mg/l of free chlorine. Apply the chlorine continuously and for a sufficient period to develop a solid concentration or "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of 100 mg/l for at least 3 hours. Measure the free chlorine residual as the slug moves through the pipeline. If the concentration falls below 50 mg/l stop the flow and locate the chlorination equipment ahead of the slug. Add chlorine to the slug until a concentration of 100 mg/l is obtained.

418.4.2 Disinfection Procedures When Connecting to an Existing Main

1. Swab or spray with a 1% hypochlorite solution the interior of all pipe and fittings used in the connection to an existing main before they are installed. After swabbing or spraying, use every effort to prevent the contamination of the pipe and fittings being installed.

418.4.3 Final Flushing

1. Do not commence final flushing of the water main until after required retention period for disinfection. If the water temperature is less than 41 degrees Fahrenheit, keep chlorinated water in the water main for at least 48 hours. Provide a minimum flushing velocity of 2.5 feet per second in the water main.
2. Do not allow heavily chlorinated water to remain in the water main for prolonged periods. Flush the main until the chlorine measurements show the concentration in the water leaving the main is no higher than 1.0 mg/l.
3. Inspect the environment to which chlorinated water is to be discharged. Discharge chlorinated water using one the following methods:
   A. Discharge chlorinated water directly to a City of Fond du Lac sanitary sewer system manhole.
   B. Use a dechlorination device or practice to remove residual chlorine levels. Use procedures and materials specified in **AWWA C655**.
   C. Submit and obtain any required WNDR permits for the discharge of flushing water, including *Operation and Maintenance of Municipal Water Systems WPDES General Permit*. Perform suspended solids, turbidity, or any other required tests at the contractor's expense.

418.4.4 Temporary Blow Off

1. A temporary 2-inch blow off device may be used to flush sections of water mains where shown on the plans or at locations approved by the engineer.
2. Temporary blow off devices consist of a temporary MJ plug (tapped 2 inch) and 2-inch diameter potable water pipe and fittings. After all testing is complete, remove the plug and temporary blow off device and make a connection to the existing water main or install a permanent MJ plug without the 2-inch tap.

418.4.5 Testing

1. Complete testing for bacteriological safe samples for new water mains prior to placing the water main in service. Collect samples after a section has been installed and the trench is backfilled. Collect samples for every 1,200-feet of new water main, 1 set from the end of the line, and at every branch of water main exceeding 1 pipe length. Use one of the following methods:

   A. Take an initial set of samples after final flushing and then resample after a minimum of 16 hours between samples. Both sets of samples shall pass for the water main to be placed in service.
   B. Let the water main sit for a minimum of 16 hours after final flushing without any water use. Then collect 2 sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples shall pass for the water main to be placed in service.
2. Complete testing for bacteriological safe samples for repaired water mains that are depressurized and/or wholly or partially dewatered prior to placing the water main in service. Collect 1 set of samples. Depending on sanitary conditions, the engineer may allow the water main to be returned to service before completion of bacteriological safe samples.
3. The engineer will collect and submit samples for bacteriological testing. Assist engineer with sample collection, as required, from location determined by engineer. Coordinate sample collection times with the engineer to ensure samples can be submitted during the testing lab hours of operation. The contractor may elect to deliver and submit samples, at their expense, to another qualified testing lab, approved by the engineer, if lab chosen by engineer is not open. Do not put the newly installed water main into service until the engineer receives a safe bacteriological sample result from a certified lab.
4. Obtain the bacteriological safe samples in conformance with Wisconsin Administrative Code s. NR 810.09 (4).
5. If the initial disinfection fails to produce safe bacteriological samples, reflush the main and resample. If check samples fail, rechlorinate the main using the continuous-feed or slug method of chlorination until safe results are obtained.

418.5 Basis of Payment

1. Work specified in 418 is incidental to the contract, unless noted otherwise.
2. The owner will measure the temporary 2-inch blow off bid item as each individual blow off acceptably completed. Payment for temporary 2-inch blow off is full compensation for providing materials, including pipe, MJ plug, and fittings; for site preparation; for excavating, backfilling, and disposing surplus material; for flushing; for disassembling and removing blow off device; and for cleaning out and restoring the work site.
   A. The owner will pay separately for connecting to existing water main as specified in 402.5.
   B. The owner will pay separately for installing permanent plugs as specified in 407.6

419 Pressure Pipeline Testing

419.1 Scope

1. This section describes the pressure testing of water pipelines, including hydrostatic tests for pressure and leakage.

419.2 General Requirements

419.2.1 Hydrostatic Testing

1. All pressure pipelines are required to pass a hydrostatic test, performed by the contractor, composed of a pressure test and a leakage test on all pressure pipelines before acceptance by the owner.

419.2.2 Test Pressure

1. Use a pressure test gauge graduated in 5 psi increments at a maximum. Working pressure is defined as follows:
   A. Upper pressure zone 2 working pressure, psi=(1106-pipeline elevation, feet)(0.433 psi/foot)
   B. Upper pressure zone 1 working pressure, psi=(960-pipeline elevation, feet)(0.433 psi/foot)
   C. Lower pressure zone working pressure, psi=(900-pipeline elevation, feet)(0.433 psi/foot)
2. In lieu of separate leakage and pressure tests, a combination leak/pressure test can be run at a pressure of 150 psi for a duration of two hours at the discretion of the engineer.

419.2.3 Submittals

1. Submit 3 copies of the results of all hydrostatic tests to the engineer.

419.3 Procedure

419.3.1 Pressure Test

1. After the test connections are made and the main filled with water, expel all air from the pipe and subject the test section to water pressure normal to the area. After examination of exposed parts of the system, increase the pressure to 150 psi on the main at the lowest elevation. Examine the main and if any defects are found, the contractor shall immediately make the necessary repairs at their own expense. Repeat the pressure test until no defects can be found. The required duration of the final pressure test is one hour.
2. If it is found unnecessary to add water to maintain pressure during the duration of the pressure test, the leakage test may, with the approval of the engineer, be waived . If waived by the engineer, perform a combination leak/pressure test.

419.3.2 Leakage Test

1. Conduct the leakage test, if required, after satisfactory completion of the pressure test. Subject the test section to approximately 100 psi gauge pressure at the point of highest elevation of the main under test. The required duration of the leakage test is two hours unless otherwise specified.
2. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled.
3. The maximum allowable leakage for buried pipelines, expressed in gallons per hour, is determined by the following formula for rubber-sealed joints during the duration of the test.

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

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of main in inches
P = average pressure in pounds per square inch gauge

4. In case the section under test contains joints of various diameters, the allowable leakage will be the sum of the computed leakage for each size of joint.
5. When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gallons per hour per inch of nominal valve size is permitted.

6. The maximum allowable leakage for exposed piping (not buried) is zero throughout the duration of the test.
7. Should any test section fail to meet the leakage test, the contractor shall immediately make the necessary repairs at their own expense. The required duration of the final leakage test is one continuous hour.

419.4 Basis of Payment

1. Work specified in 419 is incidental to the contract.

420 Abandonments

420.1 Scope

1. This section describes the abandoning of existing water mains, services, fittings, hydrants, valves, air release assemblies, manholes, or structures either through abandoning in place, crushing, filling, or removal.

420.2 General Requirements

1. Remove abandoned utilities that conflict with new pressure pipeline construction from the trench and properly dispose materials.
2. The engineer will determine at the time of construction if certain pipes, services, hydrants, valves, air release assemblies, manholes, or structures are to be abandoned in place or if complete removal is required.

420.3 Construction

420.3.1 Remove Existing Water Mains

1. Completely remove existing water main, hydrant lead, and service piping within trenching limits for water line, sanitary sewer, storm sewer, or other excavations.
2. Excavate and remove abandoned water mains, hydrant leads, and service piping, outside trenching limits, as shown on the plans or as ordered by the engineer. Backfill and compact any resulting trenches with granular backfill as specified in 404.4.2.9.

420.3.2 Seal Existing Pipes

1. Construct a bulkhead at each exposed end of abandoned pipes consisting of an 8-inch cement brick and mortar wall.
2. Where trenching or excavating operations for this contract intersect or cut through old sanitary sewer, storm sewer, or water lines which the engineer determines are inactive or are being abandoned, seal such lines off on both sides of the trench or excavation before backfilling operations are commenced.
3. All those locations at which inactive pipe or pipes to be abandoned are likely to be encountered will be noted on the plans, insofar as existing records and field surveys indicate. However, the omission of any note regarding the requirement of such plugs or the existence of some unknown pipe requiring such plugging shall not absolve the contractor of their responsibility to seal all those pipes so encountered when directed by the engineer to do so.

420.3.3 Abandon Existing Curb Box

1. Completely remove abandoned curb boxes within the limits of excavation for new services. Remove abandoned curb boxes outside limits of excavation to a minimum depth of 2 feet below the finish grade and restore the terrace.

420.3.4 Abandon Existing Hydrants

1. Unless noted otherwise, remove abandoned hydrants by cutting off barrel to a depth of 2 feet below the proposed or existing grade, whichever is lower and backfill the opening.

420.3.5 Abandon Valves and Air Release Assemblies

1. Unless noted otherwise, remove abandoned valves and air release assemblies to a minimum depth of 3 feet below the proposed or established grade or existing street grade, whichever is lower and backfill the opening.

420.3.6 Abandon Existing Manholes and Structures

1. Remove all abandoned manholes and structures to a depth of 3 feet below the proposed or established grade or existing street grade, whichever is lower.
2. Crack the manhole or structure base to allow drainage.
3. Seal off all pipe entering or leaving such structure. Backfill the manhole or structure being abandoned as specified in 404.4.2.9.
4. All castings on such abandoned structures are the property of the owner. Salvage and deliver to the owner as directed or dispose as directed by the engineer.

420.3.7 Leaded Joint Fittings

1. Notify the engineer immediately upon discovery of tees or other fittings, proposed to be capped, with lead joints (no mechanical joints). The engineer may require the removal of the fitting and replacement with water main and solid sleeves. Do not proceed with work until authorized by the engineer.

420.3.8 Salvaged Materials

1. The owner retains the right to salvage and keep hydrants, valves and valve boxes, curb boxes, or other materials whenever shown on the plans and/or special provisions or as directed by the engineer. Carefully disconnect, disassemble, remove, and stockpile all materials retained by owner. Contact the engineer to coordinate an acceptable location to stockpile materials to be retained for the owner to pick up. Dispose any materials that the owner does not want to retain.

420.4 Basis of Payment

1. Work specified in 420 is incidental to the contract, unless noted otherwise.
2. The owner will measure the abandon existing hydrant bid item as each individual abandonment acceptably completed. Payment for abandon existing hydrant is full compensation for site preparation; for excavating, backfilling, and disposing surplus material; and for restoring the work site.
3. The owner will measure the remove water main bid items by the linear foot acceptably completed. Payment for the remove water main bid item is full compensation for removing existing water mains, hydrant leads, and service piping. It also includes providing granular backfill material, for backfilling, for compacting, and for cleaning up and restoring the site. Removing structures and sealing existing pipes are incidental to the work of removing water mains.
4. Removing and sealing pipes at locations within excavation or trenching operations is incidental to the work for new water mains, hydrant leads, and service piping.

421 Temporary Water Supply Systems

421.1 Scope

1. This section describes furnishing, installing, disinfecting and maintaining temporary water supply systems, as approved by the Water Utility General Manager, including any associated water quality testing, ramping or burying at pedestrian or vehicle crossings, preparation and distribution of customer notices, and restoration work.

421.2 General Requirements

1. Submit a proposed temporary water service plan depicting the proposed components, configuration/locations, protection measures, proposed disinfection and flushing methods, and contact information, including emergency and after-hours phone numbers, for the contractor's representative(s) responsible for routine maintenance and emergency response. The Water Utility General Manager shall approve temporary water service plans before the installation of any section of the temporary water system.
2. Ensure the temporary bypass system maintains a continuous supply of water to all affected customers for the duration of time that the existing main is out-of-service for repair or replacement. Maintain the temporary bypass system in a safe and operative condition at all times.
3. Maintain access as specified in 104.6.1. Protect the work and the public as specified in 104.6.2 and 104.6.3.
4. Protect temporary water piping from freezing weather at all times.

421.3 Materials

1. Furnish materials used as temporary water system pipe, water services, connections, and related appurtenances that come into contact with drinking water which are certified for compliance with **NSF/ANSI 61** by an ANSI approved third-party certification program or laboratory.
2. Furnish materials fully able to withstand the required water pressure and all other conditions of use and which provide adequate water tightness before being put into service.
3. Do not use materials which have previously been used for purposes other than providing potable water.
4. Furnish materials for use as temporary water system pipe, water services, connections, and related appurtenances with a minimum working pressure rating of 200 psi and made of materials that will not have an adverse effect on the taste or odor of the water.
5. Use 2-inch diameter or larger main temporary bypass pipe and provide at least 2 supply connections from either direct bulkhead connections to existing water main or hydrant connections equipped with reduced pressure zone valves.
6. Individual water service check valves are not permitted.

421.4 Construction

421.4.1 Notification Requirements for Service Interruptions

1. Comply with the customer notification requirements in 402.2.3. In addition, provide a door-hanger or similar pamphlet with the following information:
   A. The date and time of the planned service interruption.
   B. The proposed route of the temporary water system pipe and temporary service.
   C. The proposed location of temporary service connection.
   D. Contact information for the engineer and for the contractor's field representative.

421.4.2 Temporary Bypass Water System Set Up

1. Install and securely restrain compatible tee, tapping sleeves, or bulkheads (temporary line caps) on the existing water main to keep the section of the existing water main pressurized and capable of supplying a continuous flow of water. Fit the supply connection with a compatible outlet fitting to supply the temporary system. Secure and restrain all piping extending from the existing main to the above-ground supply piping.
2. For hydrant fed systems, disinfect the hydrant standpipe prior to connecting the bypass pipe to the hydrant by pouring 1 quart of commercially available bleach (solution containing approximately 5% sodium hypochlorite) into the hydrant. Fill the hydrant with clean water and let stand for a minimum of 20 minutes. Flush the hydrant and the bypass pipe connected to it. Cap all hydrant nozzles when not in use.
3. Make all temporary water supply connections off existing hydrants in such a manner that, if it becomes necessary, they can be easily removed so that the hydrant can be used for firefighting purposes with minimum effort.
4. Provide smooth bore sample taps where designated on approved temporary water service plan.
5. Install temporary valves and, if required, temporary hydrants on the bypass pipe at all appropriate locations, as designated on the approved temporary water service plan.
6. Install bypass pipe on the house-side of a sidewalk whenever possible to minimize or avoid crossing traffic or pedestrian routes. Where not possible, install bypass pipe to minimize crossing traffic or pedestrian routes. When crossing these routes, provide a ramping system to protect the bypass pipe at each location where pipe crosses roads or driveways. Provide ADA-compliant pedestrian access routes and curb ramps.
7. Cap all unconnected threaded main taps prior to disinfecting the temporary water supply system and keep capped for the duration of time the temporary system is in place.
8. Do not install any component of the temporary water supply system in a gutter or ditch.
9. If previously used materials are employed for use in the temporary water supply system, clean and/or pressure wash the piping.
10. Do not use or allow the use of water from the temporary water supply system for any purpose other than to supply the bypass system. Obtain water for filling water tanks or any other purpose other than supplying water to bypass pipes as specified in 107.18.
11. The owner will waive bulk water use service fees for hydrant meters, reduced pressure zone valves, volume charges, and related items used for temporary water supply systems. Coordinate the installation of reduced pressure zone valves with the Fond du Lac Water Utility. Adequately protect and support city-supplied reduced pressure zone valves at all times. Repair or replace all lost or damaged equipment rented from Fond du Lac Water Utility.

421.4.3 Bypass System Disinfection

1. Properly disinfect all bypass pipes and obtain a safe-water sample as specified in 418.4.5 prior to connecting any customers to the temporary water supply system.
2. Install a bulk chlorine disinfection station or stations for the disinfection of temporary water services. Furnish stations consisting of a large drum or container filled with disinfectant solution with an attached spigot. Disinfect and flush each water service adequately before entering into service.
3. Disinfect and flush water mains as specified in 418.
4. Properly dispose of any highly-chlorinated water as specified in 418.4.3.

421.4.4 Temporary Water Services

1. After completing the temporary bypass disinfection as specified in 421.4.3, thoroughly flush piping to be used for temporary services with potable water immediately prior to connection to

consumer's service. Notify consumers prior to shutting off the service and transfer services to the bypass system. Do not transfer services to the bypass system earlier than necessary.

2. Match the diameter of the temporary water service with the existing water service diameter for all services 1½-inch diameter and smaller. Use hoses or piping that is hydraulically equivalent to the service size for all services 2 inch in diameter and larger.
3. Protect all temporary water services, including the connection to the private plumbing system, from damage. Promptly fix any internal private plumbing issues resulting from the temporary water supply system at the contractor's expense.

421.4.5 Connecting Temporary Water Services to New Water Main

1. After completion of the water main repairs or replacement, clear the temporary water services by back flushing with potable water or as otherwise approved in the temporary water service plan. Disconnect and remove the temporary water service pipe, restore the water service back to normal conditions, and restore water flow. Properly restore all areas used while providing temporary service.
2. After permanent water services have been installed and tested, remove the bypass system and all associated materials used for maintenance and ramping. Restore all areas damaged by temporary bypass pipe and service connections.

421.4.6 24-Hour Maintenance

1. Maintain and repair the temporary water supply system and all associated protective equipment (barricades, flashers, ramps, etc.) at all times. Provide adequate equipment and materials necessary to make all repairs, at the project site, for the duration of the project.
2. Designate a permanent company employee to maintain the temporary water supply system and provide contact information as specified in 421.2 item 1.

421.5 Basis of Payment

1. The owner will measure temporary water supply system as each individual service connection acceptably completed. Payment for temporary water supply system is full compensation for providing materials, including pipe and fittings; for site preparation; for making connections to existing water main; for disinfecting; for testing; for maintaining temporary water supply system; for disassembling and removing temporary water system; and for cleaning out and restoring the work site.
2. The owner will only measure temporary water supply systems when included on the schedule of prices. If not included on the schedule of prices and the contractor decides to install a temporary water supply system for their own means and methods, all costs associated with temporary water supply systems are incidental.

500 Electrical Construction

501 Definitions and Acronyms

501.1 Acronyms

1. Interpret electrical construction related acronyms used in sections 501 through 510 as follows:

CCT	Correlated color temperature
IES	Illuminating Engineering Society
LED	Light emitting diode
NEMA	The National Electrical Manufacturer's Association
NRTL	Nationally Recognized Testing Laboratory
NEC	National Electrical Code
UL	Underwriters Laboratories, Inc.

502 General Requirements for Electrical Construction

502.1 Scope

1. This section describes general requirements for electrical construction.

502.2 General Requirements

502.2.1 Specifications

1. Conform all items not covered within sections 501 through 510, the special provisions, or the standard detail drawings to the requirements in latest edition of the WisDOT *Standard Specifications for Highway and Structure Construction* and the WisDOT standard detail drawings. Conform all work to the current edition of the NEC adopted by the State of Wisconsin.

502.2.2 Locating and Protecting Facilities

1. The contractor shall be responsible for protecting and locating the electrical conduit and wiring for Diggers Hotline locates until acceptance of the electrical system by the owner.

502.2.3 Project Closeout Requirements – Record Drawings

1. Provide as-built street lighting, traffic signal, fiber optic and communication system plans to be approved by the owner, which include all plan changes after the project is substantially complete as specified in 105.9.1.3 before final acceptance will be granted under 105.9.1.6. Redline and label all changes to the plan details on the record drawings. Required information includes the following:
   A. The final location of electrical services, street lights, traffic signals, access boxes, pull boxes, and conduit.
   B. Conduit size, type, and length.
   C. Wire and cable type, location, and length.

502.3 Materials

502.3.1 Material Certification

1. Provide UL or NRTL listed electrical materials.
2. Obtain the engineer's approval for materials that do not have a UL or NRTL standard.

502.4 Construction

502.4.1 Salvaged Lighting and Traffic Signal Equipment

1. Whenever the plans and/or special provisions call for lighting or traffic signal equipment to be salvaged and returned to the owner or reinstalled, arrange for an inspection of all equipment by the owner no later than 5 business days prior to removal. This inspection is intended to provide an inventory and assessment of the original condition of the equipment and to determine what equipment the owner would like to retain or reinstall.
2. At the direction of the engineer, carefully disconnect, disassemble, remove and stockpile all lighting and traffic signal equipment. Dispose of any lighting and traffic signal equipment that the owner does not want to retain or reinstall. Stockpile any lighting and traffic signal equipment to be reinstalled at an approved location. Replace any lighting and traffic signal equipment to be retained or reinstalled that is damaged in the removal, storage or reinstallation process with equipment that is of equal quality to that of the damaged piece. Remove from the right-of-way and dispose of any damaged equipment. Remove and dispose of all other equipment from the right-of-way. Contact the engineer to coordinate an acceptable location to stockpile lighting and traffic signal equipment to be retained for the owner to pick up.

502.4.2 Sign Clearance

1. Mount signs on street light or traffic signal poles as specified in 628.3.1. Ensure that signs, pedestrian signals, and traffic signals are all installed to provide required clearances as specified in the standard detail drawings and WisDOT *Sign Plate Manual*, unless approved otherwise by the engineer.

502.4.3 Unused Pole Connection Points

1. Plug any existing holes in poles if a connection point is in a different location using a watertight cap of the same color as the pole as approved by the engineer.

502.4.4 Final Hookup

1. Upon completion of the conduit, wire and cable, pole, and service installations; hard wiring of the luminaires; electrical testing; and inspection and approval by the City of Fond du Lac Electrical Division, connect the service and light the system.

502.5 Basis of Payment

1. Work specified in 502 is incidental to the contract.
2. The word installation is used in the names of bid items in sections 503 through 510 where some or all of the materials will be provided by the owner as specified in the basis of payment subsection for that section.

503 Electrical Structures

503.1 Scope

1. This section describes providing and installing electrical and fiber optic access boxes and pull boxes.

503.2 General Requirements

1. Submit manufacturer's data for the access boxes and pull boxes as specified in 106.2.2.

503.3 Materials

503.3.1 Foundation Materials

1. Furnish well graded coarse aggregate conforming to the gradation requirements in ***Table 503-1***:

Table 503-1
Foundation Material (AASHTO M43 – Size No. 4)

U.S. Standard Sieve Size	Percent Passing by Weight
2-inch	100
1½-inch	90-100
1-inch	20-55
¾-inch	0-15
⅜-inch	0-5

503.3.2 Plastic Electrical Access Box Assemblies

1. Furnish plastic electrical access boxes listed below:
   A. Black, 12-inch high, Carson Spec Grade 1419 access box with flush solid cover and hex head bolt fasteners by Oldcastle Infrastructure.
2. Furnish plastic access boxes listed below whenever the plans require the use of a large plastic electrical access box:
   A. Black, 12-inch high, Carson Spec Grade 1220 access box with flush solid cover and hex head bolt fasteners by Oldcastle Infrastructure.

503.3.3 Polymer Concrete Electrical Access Box Assemblies

1. Furnish polymer concrete access boxes listed below:
   A. 12-inch high Oldcastle Polymer 1212 polymer concrete box with flush solid cover and hex head bolt fasteners by Oldcastle Infrastructure with a Tier 15 load rating.
   B. 12-inch long, 12-inch wide, and 12-inch high tapered Fiberglass / PCX Polymer Concrete Assembly by Newbasis with “Electric” nameplate installed.
   C. 15-inch long, 10-inch wide, and 18-inch high flared wall Quazite polymer concrete box by Hubbell Power Systems, Inc. with a Tier 15 load rating.
2. Furnish polymer concrete access boxes listed below whenever the plans require the use of a large polymer concrete electrical access box:
   A. 12-inch high Oldcastle Polymer 1324 polymer concrete box with flush solid cover and hex head bolt fasteners by Oldcastle Infrastructure with a Tier load 15 rating.
   B. 24-inch long, 13-inch wide, and 12-inch high Fiberglass / PCX Polymer Concrete Assembly by Newbasis with “Electric” nameplate installed.
   C. 24-inch long, 13-inch wide, and 18-inch high flared wall Quazite polymer concrete box by Hubbell Power Systems, Inc. with a Tier 15 load rating.

503.3.4 Non-Conductive Pull Boxes

1. Furnish non-conductive handholes, frames, lids, and extensions listed on the WisDOT electrical qualified products list for “Non-Conductive Pull Boxes.”
2. Use non-conductive pull boxes that meet the requirements of the WisDOT specification “653 Non-Conductive Pull Boxes – Material Specification.”

503.3.5 Fiber Optic Access Boxes

1. Furnish one-piece polymer concrete vaults with minimum dimensions of 24 inches by 36 inches and at least 24 inches high, unless indicated otherwise.

2. Furnish a lid with a 15,000 pound minimum design load, water resistant gaskets, 2 slots measuring ½ inch by 4 inches for a pull out, and enough metal to detect with a metal detector. Lock vault lids with 2 stainless steel bolts with washers.

503.3.6 Fiber Optic Tracer Wire Marker Posts

1. Furnish fade resistant, ultraviolet stable, high-impact polycarbonate tracer wire marker posts a minimum of 62 inches long with an outside diameter of 3.5 inches and with "WARNING FIBER OPTIC CABLE BELOW" molded into the marker. Ensure that posts have stainless steel hardware, five standard terminals, a terminal enclosure for cathodic protection, and an anchor bar.

503.3.7 Fiber Optic Flush-Mounted Locating Boxes

1. Furnish flush-mounted tracer wire locating boxes with a minimum 2 terminals, an orange locking lid, and selective grounding isolation. Ensure lid is detectable by a ferrous metal detector. Use boxes rated for site traffic conditions. Ensure boxes installed in sidewalks are ADA compliant.
2. Furnish a Neenah R-7506 series Hudson box at all locating boxes placed in concrete sidewalks or driveways.

503.4 Construction

503.4.1 Access Boxes

1. Use plastic electrical access boxes or non-conductive pull boxes in restoration areas with pervious surfaces.
2. Use polymer concrete electrical access boxes or non-conductive pull boxes in areas with impervious surfaces.
3. Install access boxes on a 12-inch deep granular foundation conforming to the gradation requirements of ***Table 503-1***.
4. Place access boxes flush with the proposed finished ground grade.

503.4.2 Pull Boxes & Non-Conductive Pull Boxes

1. Install pull boxes on a 12-inch deep granular foundation conforming to the gradation requirements of ***Table 503-1***.
2. Conform grounding lugs and wire the detail drawings.
3. Do not install pull boxes in asphalt pavement. Construct a concrete pad with a width at least 12 inches greater than the outside diameter of the pull box cover when pull boxes are within asphalt pavement areas. Use a concrete pad with a minimum of 7 inches in depth in roadways or as directed by the engineer. Asphaltic overlay of concrete pavement is acceptable.

503.4.3 Fiber Optic Access Boxes

1. Install fiber optic access boxes on a 12-inch deep granular foundation conforming to the gradation requirements of ***Table 503-1***.
2. Install any additional openings in vaults according to manufacturer's specifications. Ensure that gaps between the conduit and vault are not greater than ½ inch. Caulk gaps on both the inside and the outside of the vault. Cure caulk according to manufacturer's specifications before backfilling. Install conduit into side of structure when depth allows. Stub conduit 3 inches into structure.
3. Install cable support brackets when required.
4. Place fiber optic access boxes flush with the proposed finished ground grade.

5. Install tracer wire marker posts or flush-mounted locating boxes at each access box. Install flush-mounted access boxes at locations with sidewalks and marker posts at other locations unless directed otherwise.

503.4.4 Fiber Optic Tracer Wire Marker Posts

1. Install posts so that they cannot be pulled out or removed manually.
2. Install conduit into the access point and connect the tracer wire to the tracer wire marker post terminals.

503.4.5 Fiber Optic Flush-Mounted Locating Boxes

1. Install conduit into the access point and connect the tracer wire to the tracer wire locating box terminals.
2. Place locating box flush with the proposed finished ground grade.
3. Install locating boxes, placed in concrete sidewalks and driveway, within Hudson boxes. Place the Hudson boxes to match the new sidewalk or driveway grade, and ensure that the covers are free of all concrete. Ensure that each casting is in place before the concrete is poured. Adjust the locating box to approximately 3 inches below finish grade for the casting to fit properly. Install the rim of the casting within ¼ inch of the final concrete surface elevation.

503.4.6 Adjust Existing Pull Boxes and Access Boxes

1. Adjust existing electrical access boxes, pull boxes, and fiber optic access boxes to finished ground grade. Excavate, adjust subsurface components as required, and backfill. Dispose of surplus or unsuitable material.

503.5 Basis of Payment

1. The owner will measure the access box, pull box, and non-conductive pull box bid items as each individual box acceptably completed.
2. Payment for the electrical access box bid items is full compensation for providing materials; and for excavating, backfilling, and restoring the grade.
3. Payment for the electrical access box installation bid items is full compensation for providing materials; and for excavating, backfilling, and restoring the grade. The owner will supply the access boxes.
4. No additional compensation will be made when a standard size plastic or polymer concrete electrical access box is specified and the contractor elects to install a non-conductive pull box or a larger sized electrical access box.
5. Payment for the pull box and non-conductive pull box bid items is full compensation for providing pull boxes; for materials including grounding lugs and wiring; for aggregate, manhole frames and covers; for required pull box extensions; conduit extensions less than 10 feet long including fittings; and for excavating and backfilling.
6. Payment for the fiber optic access box bid items is full compensation for providing materials, including marker posts, flush-mounted locating boxes, and Hudson boxes; and for excavating, backfilling, and restoring the grade.
7. Payment for the fiber optic access box installation bid items is full compensation for providing materials; and for excavating, backfilling, and restoring the grade. The owner will supply the access boxes, marker posts, flush-mounted access boxes, and Hudson boxes.
8. Payment for adjust existing pull boxes and access boxes is full compensation for resetting the box elevation; for required materials; and for excavating and backfilling.

9. The owner will measure adjust existing pull boxes and access boxes only when included in the schedule or prices. If not included on the schedule of prices, all costs associated with adjusting existing pull boxes and access boxes are incidental.

504 Electrical Conduit

504.1 Scope

1. This section describes providing and installing electrical conduit for electrical and communications wiring, including excavating and backfilling.

504.2 General Requirements

1. Submit manufacturer's data for the conduit and fittings as specified in 106.2.2.

504.3 Materials

1. Furnish materials conforming to the following:
   A. Schedule 40 PVC conduit and fittings **UL 651**
   B. Schedule 80 PVC conduit and fittings **UL 651**
   C. HDPE **ASTM F2160**
2. Use PVC fittings, unless noted otherwise. Furnish PVC fittings of the same schedule as the PVC conduit they adjoin. Furnish fittings meeting manufacturer’s specifications when using HDPE conduit.
3. Furnish red colored, smooth, SDR 13.5, solid-wall HDPE conduit rated for outdoor and underground use.
4. Clearly mark conduit as follows at intervals of 5 feet or less:
   A. Manufacturer’s name or trademark.
   B. ASTM or UL designation and material designation for HDPE conduit.
   C. Nominal size.
   D. Type, wall thickness, schedule or dimensional ratio.
   E. Extrusion date, period of manufacture, or lot number.
5. Package, handle, and ship electrical conduit and fittings according to manufacturer’s instructions and specifications. Replace any conduit damaged in shipment as directed by the engineer.
6. Store conduit and fittings in the supplier’s yard or on the project site according to manufacturer’s recommendations.

504.4 Construction

504.4.1 General

1. Use schedule 40 PVC conduit and fittings, unless otherwise noted.
2. Use schedule 80 PVC conduit and fittings at meter pedestals or locations exposed to the elements.
3. Use HDPE conduit where noted on the plans or approved by the engineer.
4. Use conduit of the nominal inside diameter the plans show.
5. Provide a tight-glued coupling at the connection of two straight pieces of PVC conduit.
6. Plug dead end conduit locations, the ends of conduit at each light pole, and any underground openings on poles with an appropriate size PVC plug fitting.
7. Carefully preserve all curb and gutter during conduit installation. No additional payment will be made for replacement of damaged curb and gutter or other facilities.
8. Install conduit by plowing or trenching.

9. Use directional drilling when indicated on the plans. Use conduit suitable for the installation method used. Perform work as specified in 206. Provide a drilling plan as specified in 206.4.1 when required by engineer.
10. Install a tracer wire in any conduit not containing other wire or cable.
11. Install tracer wire inside conduit except where the engineer approves installing tracer wire outside conduit. If tracer wire is installed outside conduit, furnish tracer wire materials as specified in 202.3.4.1 and 202.3.4.2 and install tracer wire as specified in 202.4.10. Terminate both ends of the tracer wire in an electrical or fiber optic access box or pull box.
12. If conduit is installed using directional drilling, furnish tracer wire materials as specified in 202.3.4.1 and 202.3.4.2 and install tracer wire as specified in 202.4.10. Terminate both ends of the tracer wire in an access box or pull box.
13. Repairs are not allowed. Remove broken, chipped, cracked, or impaired lengths of fittings or conduit and replace with new materials.

504.4.2 Staking

1. The owner will stake the location of the proposed conduit. Obtain approval from the owner for any deviations from the staked location.

504.4.3 Location and Depth

1. Install conduit at the locations shown on the plans, standard detail drawings, or otherwise directed by the engineer.
2. Install conduit along both sides of the street for the entire length of the project and extend around intersections to the point of tangency of adjoining streets, unless shown otherwise.
3. Install conduit across the street at various points as indicated on the plans. At the crossing points, intersect conduit with an underground access box.
4. Place conduit at a minimum 18 inches to a maximum 24 inches behind the back of the curb and gutter, unless directed otherwise.
5. Place conduit at a minimum 18 inches to a maximum 24 inches depth below the top of the adjacent curb and gutter or drive approach concrete.
6. Place conduit installed under public roadways, driveways, and parking lots a minimum of 24 inches below the road surface measured from the finished roadway grade to the top of the conduit.
7. Place conduit installed for fiber optic or communications systems, including conduit designated for future fiber optic or communication cables, between 30 inches and 36 inches below the final surface grade.

504.4.4 Hand-Formed Curb and Gutter

1. At hand formed curb locations, place conduit within 4 inches of the back of the hand formed curb and at a minimum depth of 18 inches. Install the conduit in a manner that does not damage the curb and gutter or adjacent trees and so that the conduit is not placed under the curb and gutter.

504.4.5 Excavation

1. Limit excavation to the size required for the installation of the conduit.
2. Excavate the trenches true to line and grade to provide uniform bearing.

504.4.6 Backfilling

1. Backfill trenches with screenings, ¾-inch gradation crushed aggregate base course, or sand and compact the trench. Native soils may be used with the permission of the engineer.

2. Provide mechanical compaction at road crossings and whenever the conduit installation is installed in excavated trenches. Obtain approval and acceptance from the owner that adequate compaction has been provided.

504.4.7 Traffic Signal Conduit

1. Use two 3-inch schedule 40 PVC conduits for traffic signal conduit installations, unless shown otherwise.

504.4.8 Loop Detectors

1. Use 1-inch schedule 40 PVC conduit for loop detector and lead-out conduit, unless shown otherwise.
2. Use 2-inch schedule 40 PVC conduit for lead-in conduit, unless shown otherwise.
3. Install loop detector conduit in the base course at the depths shown on the plans and standard detail drawings and place above any other conduit for street lighting, traffic signals or other purposes shown on the plans.

504.5 Basis of Payment

1. The owner will measure the electrical conduit bid items by the linear foot acceptably completed.
2. Payment for the electrical conduit bid items is full compensation for providing the conduit and fittings; for pull wires or ropes; for expansion fittings and caps; for plowing in the conduit; and for excavating, bedding, and backfilling, including any sand, concrete, or other required materials.
3. Payment for the directional drilling electrical conduit bid items is full compensation for providing the conduit and fittings; for pull wires or ropes; for expansion fittings and caps; for mobilizing directional drilling equipment; and for installing conduit using directional drilling. The owner will pay for directional drilling of conduit per bore where multiple conduit runs are installed in the same bore hole. The owner will pay separately for electrical wiring under the appropriate electrical wire bid items specified in 505.5. The contractor is responsible for any damage resulting from any drilling fluid-induced blow out or any inadvertent return.
4. The owner will pay for conduit at hand formed curb locations under the applicable bid items for conduit. Include any additional costs to install conduit at hand formed curb locations in the bid items for hand formed curb and gutter as specified in 618.5.
5. No additional payment will be made for installing conduit to any of the specified depths.
6. Fittings are considered incidental to the construction of the conduit, and will not be paid separately.
7. Conduit at horizontal or vertical sweeps at electrical services, access boxes, pull boxes, light poles or street light bases is incidental, and will not be paid separately unless noted otherwise.
8. The owner will pay for conduit at horizontal sweeps at light poles by the linear foot acceptably completed whenever the distance between the center of the light pole and the conduit running parallel to the curb and gutter exceeds 3 feet.
9. Connections to existing conduit and connections to existing manholes, pull boxes, access boxes, communication vaults or other structures are incidental to the construction of the conduit, and will not be paid separately.

505 Electrical Wiring

505.1 Scope

1. This section describes providing and installing electrical wire and cable for traffic signal, roadway lighting, and other underground installations.

505.2 General Requirements

1. Submit manufacturer's data for the wire and cable as specified in 106.2.2.
2. Coordinate all wire and cable color assignments with the City of Fond du Lac Electrical Division. Unless indicated otherwise use grounded conductor wires with white insulation and equipment grounding wires with green insulation.

505.3 Materials

505.3.1 Electrical Wire for Lighting

1. Furnish 600 volt 7 strand single conductor copper wire, XLP insulated, and USE-2 rated.
2. Provide wire sizes as shown on the plans and standard detail drawings.

505.3.2 Electrical Wire THHN/THWN

1. Furnish 600 volt 19 strand single conductor copper wire.
2. Provide wire sizes as shown on the plans and standard detail drawings.

505.3.3 Grounded Conductor for Traffic Signals

1. Use the white wire in the traffic signal cable, unless specified otherwise.

505.3.4 Equipment Grounding Conductor for Traffic Signals

1. Furnish 10 AWG or 8 AWG, or both, XLP, USE-2 rated, 600 volt AC, single conductor, stranded copper for conductors.

505.3.5 Tracer Wire

1. Furnish 12 AWG THWN stranded copper wire with green insulation or 12 AWG, 600 volt 7 strand single conductor copper wire, XLP insulated, and USE-2 rated.

505.3.6 Cable Type UF

1. Furnish type UF cable with ground including the number and size of conductors as shown on the plans and standard detail drawings. Use cable conforming to ANSI/UL 493.

505.3.7 Traffic Signal Cable

1. Furnish 14 AWG cable with the number conductors specified on the plans.
2. Furnish 14 AWG cable with 7 conductors for wiring that extends from the terminal strip in each signal head to the mounting base.
3. Conform all traffic signal cable to IMSA specification Number 20-1.

505.3.8 Loop Detector Wire

1. Furnish black 12 AWG, XLP insulated, USE-2 rated, single conductor, 7 strand copper wire.

505.3.9 Loop Detector Lead In Cable

1. Furnish shielded, 14 AWG, 2 conductor, polyethylene insulated cable, with 16 AWG drain wire conforming to IMSA specification number 50-2.

505.3.10 Emergency Vehicle Preemption Detector Cable

1. Furnish emergency vehicle preemption cable listed below:
   A. Opticom Model 1070 GPS Installation Cable by Global Traffic Technologies, LLC.

505.3.11 Video Detection System Cable

1. Furnish cables and connectors required to transmit video and camera control data between the camera assembly and the camera controller assembly. Conform to the following:
   A. Outdoor rated category 5e, or better, UTP cable with water-blocking flooded core and UV-resistant polyethylene jacket. Furnish cable consisting of 4-pairs of 24 AWG solid copper conductors and according to ANSI/TIA/EIA 5 68A Category 5e, CENELEC EN50173, ICEA S-90-661, and ISO/IEC 11801.
   B. Outdoor rated CSA, certified for outdoor use, 3-conductor 16 AWG power, UL listed cable in a UV resistant jacket. Furnish MSHA approved and RoHS compliant cable according to CSA flexible cord - C22.2-49.

505.3.12 Direct Burial Terminal Blocks

1. Furnish direct burial terminal blocks listed below:
   A. PDSS series by Ilsco Corporation.
   B. Polaris ISPB series by NSi Industries.

505.3.13 Insulated Terminal Blocks

1. Furnish insulated terminal blocks, with an appropriate number of ports for the application, listed below:
   A. PBTS series by Ilsco Corporation.
   B. Polaris IPL series by NSi Industries.

505.3.14 Fuse Holders

1. Furnish fuse holders with insulated rubber boots listed below:
   A. Bussmann series HEB type by Eaton.
2. Fuse luminaires at 5 amps unless otherwise noted.
3. Fuse outlets on decorative poles at 15 amps unless otherwise noted.

505.4 Construction

505.4.1 Street Light Wiring

1. Install 2 electrical wire 6 AWG ungrounded “hot” conductors, an electrical wire 6 AWG grounded “neutral” conductor, and an electrical wire 8 AWG equipment grounding conductor in all street lighting conduit unless indicated otherwise.
2. Make one of the “hot” conductors black and one red unless indicated otherwise.
3. Alternate the street light wiring between the black and red conductors so that half of the street lights use the black conductor and half use the red conductor and the lights using each conductor are as evenly spaced as possible.
4. Provide 3-foot loops of each wire in each street light access box, pull box and street light base.
5. When there is more than one multi-wire branch circuit, bundle the circuit conductors with nylon cable ties or engineer approved electrical tape at all access points. At each handhole, identify the line side of each circuit with a tape colored as the plans specify.

505.4.2 Tracer Wire

1. Splice the tracer wire into the equipment grounding conductor.
2. Provide 3-foot loops of tracer wire in each access box and pull box.

505.4.3 Splices

1. Avoid splices at pull boxes and access boxes whenever feasible and make splices at street lights.

2. Use an approved direct burial terminal block with all splices made underground or in access and pull boxes.
3. Splices that are made with tracer wire only may be made with a split bolt rated for underground use. When splicing a tracer wire to an equipment grounding conductor, make a loop in the equipment grounding conductor and use a split bolt to make the connection without adding a splice to the equipment grounding conductor.
4. Use an approved insulated terminal block with all above ground splices made in a direct burial light pole handhole, a transformer base, or a decorative pole. Arrange terminal blocks to avoid pooling of water or condensation.
5. Make splices of traffic signal cable in a transformer base using wire nuts. Do not twist or tape cables. Tape may be used below the wire nut. Install wire nuts upright to prevent pooling of water or condensation.

504.4.4 Fuse Assembly

1. Use an in-line fuse holder between the terminal block and the ungrounded “hot” wire going to a luminaire.

504.4.5 Traffic Signals Wiring

1. Install a 10 AWG ground wire and 14 AWG traffic signal cable in all traffic signal conduit, unless shown otherwise.
2. Make home-run connections to each signal base.
3. Provide a minimum of 3 feet of additional traffic signal cable and wiring, loop detector lead-in cable, video detection cable and communication cable at the control cabinet and at traffic signal bases for connections.
4. Provide an additional 10 feet of traffic signal cable and wiring, loop detector lead-in cable, video detection cable and communication cable at the last pull box before the traffic signal.
5. Provide an additional 3 to 4 feet of traffic signal cable, loop detector lead-in cable, video detection cable and communication cable at any intermediate pull boxes.
6. Provide 20 feet of extra emergency vehicle preemption detector cable in the last pull box before the emergency vehicle preemption location, and 4 feet in each pull box. Do not exceed a total length of 250 feet of emergency vehicle preemption detector cable from EVP card to antenna.

505.4.6 Loop Detectors

1. Provide a separate lead in cable for each loop. Make this cable run from the cabinet base to the loop pull box used as the splice point. At the splice point pull box, extend the detector cable 3 feet above the pull box cover for splicing purposes. At the control cabinet, extend the detector cable 3 feet above the top of the control cabinet. Make splices between the loop detector wire and the lead-in cable at the pull box at the side of the road.
2. Install loop wire with the number of turns specified on the plans in each loop.

505.5 Basis of Payment

1. The owner will measure the electrical wiring bid items by the linear foot acceptably completed.
2. Payment for the electrical wiring bid items is full compensation for providing electrical wire or cable; for making connections; for providing connectors, including wire nuts, fuses, fuse holders, splices, tape, insulating varnish or sealant; and for testing the circuits.
3. Payment for the electrical wiring installation bid items is full compensation for making connections; for providing connectors, including wire nuts, fuses, fuse holders, splices, tape, insulating varnish or sealant; and for testing the circuits. The owner will supply the electrical wire or cable.

4. The owner will pay for electrical wire and tracer wire at hand formed curb locations under the applicable bid items for electrical wire and tracer wire. Include any additional costs to install electrical wire or tracer wire at hand formed curb locations in the bid items for hand formed curb and gutter as specified in 618.5.
5. Electrical wire and tracer wire at conduit sweeps, at light poles from the conduit to the handhole of ornamental lights, and extra loops of wire are incidental, and will not be paid separately unless noted otherwise.
6. The owner will pay for electrical wire from the conduit to the handhole of ornamental lights per linear foot whenever the distance between the center of the light pole and the conduit running parallel to the curb and gutter exceeds 3 feet.
7. The owner will pay for electrical wiring in light bases, poles, and arms at the length shown on the standard detail drawings or as shown on the plans.
8. The additional traffic signal cable and wire, loop detector lead-in cable, emergency vehicle preemption detector cable, video detection cable, and communication cable required at the control cabinet, traffic signal bases and pull boxes will be paid at the lengths specified in 505.4, as shown on the standard detail drawings, as shown on the plans, or as required by the engineer.
9. Electrical wiring in pull boxes, lights, and traffic signals required to connect grounding lugs to the equipment grounding conductors is incidental, and will not be paid separately unless noted otherwise.

506 Electrical Services

506.1 Scope

1. This section describes providing an electrical service.

506.2 General Requirements

1. The owner will complete the service application with Alliant Energy.
2. Conform all underground meter pedestals to the Alliant Energy service manual.

506.3 Materials

506.3.1 Underground Meter Pedestals

1. Furnish 200-amp meter sockets.
2. Furnish underground meter pedestals listed below:
   A. Model number U5701-O-200S by Milbank Manufacturing Company.
   B. Model number U6221-O-200-10GR by Milbank Manufacturing Company.
3. When noted on the plans and/or specifications, furnish a 100-amp meter socket and an underground meter pedestal listed below:
   A. Model number U5701-O-100S by Milbank Manufacturing Company.
   B. Model number U6221-O-100-10GR by Milbank Manufacturing Company.

506.3.2 Ground Rods

1. Furnish ⅝-inch diameter, 8-foot length copper clad ground rods.

506.3.3 Branch Circuit Breakers

1. Furnish 50 amp, 120/240 volt, 22,000-AIC rated circuit breakers.

506.4 Construction

1. The contractor is responsible for installing a 2½-inch PVC conduit from the utility side of the underground meter pedestal to the base of a pre-determined utility pole. Terminate the PVC conduit at the bottom of the pole just below grade and install plug.
2. Place underground meter pedestals a minimum of 12 feet from the utility pole.
3. Install ground rods in conformance with the NEC.
4. Provide 4 AWG bare copper wire, sleeved in ½-inch or ¾-inch PVC conduit, from the meter to the ground rods. Install the PVC conduit from the bottom of the enclosure to 6 inches below final surface grade.
5. Install pedestals at the manufacturer's specified bury depth.
6. Provide an expansion joint for the 2-inch street light conduit between the bottom of the enclosure and the final surface grade.
7. Contact the City of Fond du Lac Inspection Division, at 920-322-3570, after installation. Upon approval of the installation, the Inspection Division will contact Alliant Energy to energize the service. Energize and test the system when ready. The owner will approve the final installation and operation of the system.

506.5 Basis of Payment

1. The owner will measure the electrical services bid items as each individual service acceptably completed.
2. Payment for the electrical service meter pedestal bid items is full compensation for providing materials including the meter breaker pedestal, conduit and fittings, circuit breakers, grounding electrodes and connections.
3. Payment for the electrical service meter pedestal installation bid items is full compensation for providing materials including the conduit and fittings, circuit breakers, grounding electrodes and connections. The owner will supply the meter breaker pedestal.

507 Concrete Bases

507.1 Scope

1. This section describes providing and installing concrete bases for traffic signals, street lights and control cabinets.

507.2 Materials

507.2.1 Bar Steel Reinforcement

1. Furnish bar steel reinforcement conforming to Section 505.2.4 of the *Standard Specifications for Highway and Structure Construction.*

507.2.2 Concrete

1. Furnish Grade A, A-FA, or A-S concrete conforming to Section 501 of the *Standard Specifications for Highway and Structure Construction.*

507.2.3 Anchor Bolts

1. Furnish anchor bolts conforming to **ASTM F1554 Grade 105 and Supplementary Specification S4**, **ASTM A563** nuts, and **ASTM F436** washers. Use bolts with an "L" bend on one end and galvanized according to **ASTM A153, class C**, supplemented by **ASTM F2329**.

507.2.4 Control Cabinet Anchors

1. Furnish either mechanical or adhesive stainless steel masonry anchors and stainless steel bolts or studs, nuts, and washers.

507.3 Construction

507.3.1 Concrete Bases

1. Provide a leveled and troweled surface with a smooth broomed finish to shed water off the perimeter of the concrete base and a 1-inch chamfer around the perimeter.
2. Provide a level surface and a broom or smooth troweled finish.
3. Cure concrete bases by covering the exposed surfaces with polyethylene sheeting or by applying clear curing compound. Avoid coating the anchor bolts and PVC conduit when applying curing compound.
4. Meet the requirements of Section 502.3.10 of the *Standard Specifications for Highway and Structure Construction* for applying loads to concrete before erecting the structure on the base.
5. The minimum bending radius of conduit is equal to six times the diameter.
6. Install anchor bolts with misalignments of less than 1:40 from vertical. Extend concrete base anchor bolts out of the concrete 4 inches for “Cobra Head” and “Tear Drop” style lights, 3 inches for traffic signals, and 2 inches for “Decorative” style lights. Ensure all anchor bolt projections are within ¼ inch of the specified height. Ensure all threads are anti-seized. Remove concrete bases not meeting these requirements and replace at the contractor’s expense.
7. Level using stainless steel shims only, no leveling nuts will be allowed.
8. Place concrete bases so that the poles mounted on them provide a continuous clear width of pedestrian access of 4 feet minimum on sidewalks and 5 feet minimum at medians and pedestrian refuge islands.

507.3.2 Bar Steel Reinforcement

1. Welding of the anchor rods to the cage is unacceptable. Use coated tie wires.

507.3.3 Control Cabinet Bases

1. Install additional conduit for future use as directed by the owner.
2. Provide a broom finish and a chamfer per plan details.
3. Cure concrete bases by covering the exposed surfaces with polyethylene sheeting or by applying clear curing compound. Avoid coating the PVC conduit when applying curing compound.
4. Meet the requirements of Section 502.3.10 of the *Standard Specifications for Highway and Structure Construction* for applying loads to concrete before erecting the structure on the base.

507.3.4 Removal of Concrete Bases

1. Remove existing concrete light pole, traffic signal and control cabinet bases within the excavation limits or where noted on the plans.
2. Backfill and compact crushed aggregate base course meeting the ¾-inch gradation as indicated in Section 305 of the *Standard Specifications for Highway and Structure Construction.*

507.3.5 Basis of Payment

1. The owner will measure the concrete base and remove concrete base bid items as each individual unit acceptably completed.
2. Payment for the concrete bases bid items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; for excavating, drilling, and backfilling; and for providing and removing casing.

3. Payment for concrete bases is included in the bid items for street lights and traffic signals specified in 508.5 and 509.5 and will not be paid separately unless noted otherwise.
4. Payment for the remove concrete bases bid items is full compensation for removing concrete bases; for excavating, drilling, and backfilling; and for providing and removing casing.
5. Removal of concrete bases will be paid as common excavation as specified in 608.2.1 except when outside of the grading limits.

508 Lights

508.1 Scope

1. This section describes providing and installing street lights and other outdoor lights.

508.2 General Requirements

1. Submit manufacturer's data for the poles, bases, arms, and luminaires as specified in 106.2.2.
2. Use LED luminaires that meet the requirements of the WisDOT specification “Material and Performance Specifications Luminaires Utility and Underdeck LED.”

508.3 Materials

508.3.1 Cobra Head Street Lights

1. Furnish cast aluminum alloy transformer bases with a black powder-coated finish listed on the WisDOT electrical qualified products list for “Transformer Base 11½ inch bolt circle.”
2. Furnish aluminum alloy poles with an overall height of 30 feet and a black anodized finish listed on the WisDOT electrical qualified products list for “Poles Type 5.” Use aluminum bolt covers with black powder-coated finish and stainless steel attachment screws. Use different poles when shown on the plans.
3. Furnish aluminum alloy mast arms with black anodized finish, fitting a 4½-inch diameter pole top and with a 6-foot arm length listed on the WisDOT electrical qualified products list for “Luminaire arm, single member, 4-½ inch, 6 ft.” Use multiple arms and different arm length when shown on the plans.
4. Furnish luminaires conforming to the following:
   A. LEOTEK GreenCobra Midsize LED Streetlight J-series GCM3 luminaires with multi-volt, 120-277v voltage; 4000k CCT; type 2 distribution; black finish; lumen performance code 190; ANSI 7-wire photocontrol receptacle; and utility wattage label by LEOTEK Electronics USA, LLC (model number Leotek GCM3-60J-MV-40K-2R-BK-190-PCR7-WL-WISDOT-C), unless shown otherwise.
5. Furnish 5 amp fuses for each luminaire.
6. Furnish 12 AWG USE-2 electrical wire for lighting as specified in 505.3.1 between the fuse holder and luminaire.
7. Provide all hardware, grommets, splices, etc.

508.3.2 Ornamental Street Lights

1. Furnish round tapered direct burial fiberglass reinforced composite poles with an overall height of 19 feet, a mounting height of 15 feet, a 2⅞-inch tenon mounting, and a black finish listed below:
   A. CMT Marathon by Valmont Composite Structures, Inc. (model number TB19X503HST3).
2. Furnish LED luminaires except when high pressure sodium luminaires are specified on the plans or special provisions.
3. Furnish luminaires conforming to the following:

   A. Holophane Utility Taft Postop LED series luminaires with LED performance package P20; 3000k CCT; MVOLT, 120-277v voltage; black finish; GL3 asymmetric glass refractor optics; a ball finial; a 7-pin NEMA twistlock internally mounted receptacle; a long life DTL twistlock photocontrol for solid state, MVOLT; and a solid 90 degree house side shield by Acuity Brands, Inc. (model number PTUE3 P20 30K MVOLT GL3 BK BL PR7 PCLL PHSS90).
4. Except for lights with a factory installed photocontrol or lights controlled by a lighting control cabinet, furnish photocontrols listed below:
   A. Tork series model number 5237A by NSi Industries.
5. Furnish a 5 amp fuse.
6. Furnish 12 AWG USE-2 electrical wire for lighting as specified in 505.3.1 between the fuse holder and luminaire.

508.3.3 Decorative Street Lights

1. For downtown decorative lights, furnish materials conforming to the following:
   A. Holophane North Yorkshire aluminum alloy poles with an overall height of 14 feet, a black finish, 2 outlets, 4 banner arms, and a flagpole holder by Acuity Brands, Inc.
   B. Holophane Washington Postlite Enhanced LED luminaires with LED performance package 40, 3000k CCT, black finish, IES type III distribution optics, gold band and ribs, and spike finial by Acuity Brands, Inc. (model number WSE2 P40 30K BK GL 6 PSC P7).
2. For residential decorative lights, furnish materials conforming to the following:
   A. Holophane Utility Granville series luminaires with a 100-watt mogul base ballast, multitap voltage, bronze finish, and IES type IV distribution optics by Acuity Brands, Inc.
   B. Holophane North Yorkshire aluminum alloy poles with an overall height of 14 feet and a bronze finish as manufactured by Acuity Brands, Inc.
3. Except for lights with a factory installed photocontrol or lights controlled by a lighting control cabinet, furnish photocontrols listed below:
   A. Tork series model number 5237A by NSi Industries.
4. Furnish 5 amp fuses for luminaires and 15 amp fuses for outlets.
5. Furnish 12 AWG USE-2 electrical wire for lighting as specified in 505.3.1 between the fuse holder and luminaire.
6. Provide all hardware, grommets, splices, etc.

508.3.4 Tear Drop Street Lights

1. Furnish cast aluminum alloy transformer bases with a black powder-coated finish listed on the WisDOT electrical qualified products list for “Transformer Base 11½ inch bolt circle.”
2. Furnish aluminum alloy poles with an overall height of 30 feet and a black anodized finish listed on the WisDOT electrical qualified products list for “Poles Type 5.” Use aluminum bolt covers with black powder-coated finish and stainless steel attachment screws. Use different poles when shown on the plans.
3. Furnish luminaires conforming to the following:
   A. Holophane Esplanade Utility Tear Drop LED 2 series luminaires with P30S lumen/wattage package, 3000k CCT, auto-sensing 120-277v voltage, black finish, tear drop glass and door, type 4 asymmetric optics, and 1½-inch NPT pendant mount by Acuity Brands, Inc. (model number ESL2 P30S 30K AH BK TG 4 P).
4. Furnish a 5 amp fuse.
5. Furnish 12 AWG USE-2 electrical wire for lighting as specified in 505.3.1 between the fuse holder and luminaire.
6. Provide all hardware, grommets, splices, etc.

508.3.5 Mounting Hardware

1. Furnish bands with a factory-applied black finish when mounting all traffic signals and signs to street light poles.

508.3.6 Lighting Control Cabinets

1. Use a factory-installed shorting cap on lights controlled by a lighting control cabinet or other alternative to a photocontrol on each light.

508.4 Construction

508.4.1 Existing Lights

1. De-energize and remove any existing city owned poles, arms, luminaires, and electrical services which will not remain. Return poles, arms, and luminaires to the owner, reinstall, or dispose as directed by the owner.
2. Maintain existing street lighting until poles must be removed to complete other work.

508.4.2 Street Light Location

1. Mount street light poles 3 foot to center behind the back of curb or as shown on standard detail drawings or as directed by the engineer.

508.4.3 Transformer Bases

1. Bond bases to the equipment grounding conductor.

508.5 Basis of Payment

1. The owner will measure the street light bid items as each individual unit acceptably completed.
2. Payment for the street light bid items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; for excavating and backfilling; for providing transformer bases, pedestal bases, poles, arms, banner arms, flagpole holders, luminaires, and photocontrols including grounding lugs and related mounting hardware; for equipment grounding wires; for leveling shims; for hardware and fittings necessary to install the street light; and for corrosion prevention.
3. Payment for the street light installation bid items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; for excavating and backfilling; for equipment grounding wires; and for assembling and installing street lights. The owner will supply the anchor rods, transformer bases, pedestal bases, poles, arms, banner arms, flagpole holders, luminaires, and photocontrols. The contractor shall supply any miscellaneous tools, hardware, and components needed to complete the installation.
4. The removal of existing street lights is incidental and will not be paid separately unless noted otherwise.

509 Traffic Signals

509.1 Scope

1. This section describes providing and installing traffic signals including transformer bases, pedestal bases, poles, standards, arms, signal faces, controllers and detectors, cameras, push buttons, signal mounting hardware, and control cabinets.

509.2 General Requirements

1. Submit manufacturer's data for the poles, standards, bases, arms, signal faces, controllers and detectors, cameras, push buttons, and control cabinets as specified in 106.2.2.
2. The owner representative or subcontractor will be responsible for setting up the traffic signal timing, sequence of operation, detector logic, and controller logic.

509.3 Materials

509.3.1 Transformer Bases

1. Furnish cast aluminum alloy transformer bases with a black powder-coated finish listed on the WisDOT electrical qualified products list for “Transformer Base 11½ inch bolt circle.”

509.3.2 Pedestal Bases

1. Furnish cast aluminum alloy pedestal bases with a black powder-coated finish listed on the WisDOT electrical qualified products list for “Pedestal bases.”

509.3.3 Poles

1. Furnish aluminum alloy poles with black anodized finish listed on the WisDOT electrical qualified products list for specified pole type.
2. Furnish steel poles with a black powder-coated finish listed on the WisDOT electrical qualified products list for specified pole type.
3. Furnish monotube poles with a black powder-coated finish as specified in Section 657 of the S*tandard Specifications for Highway and Structure Construction*.

509.3.4 Standards

1. Furnish aluminum alloy standards with black anodized finish listed on the WisDOT electrical qualified products list for standards.

509.3.5 Arms

1. Furnish aluminum alloy arms with black anodized finish listed on the WisDOT electrical qualified products list for specified arm type.
2. Furnish monotube arms with a black powder-coated finish as specified in Section 657 of the S*tandard Specifications for Highway and Structure Construction*.

509.3.6 Signal Faces, Push Buttons, and Mounting Hardware

1. Furnish traffic signal faces, backplates, pedestrian signal faces, and LED modules listed on the WisDOT electrical qualified products list for “Traffic Signal Face”, “Backplates Signal Face”, “Pedestrian Signal Face” and “LED Modules.”
2. Furnish pedestrian push buttons listed on the WisDOT electrical qualified products list for “Pedestrian Push Buttons.”
3. Furnish signal mounting hardware listed on the WisDOT electrical qualified products list for “Signal Mounting Hardware.”
4. Furnish retroreflective traffic signal backplates with a black finish on backplates and mounting hardware.
5. Furnish bands with a factory-applied black finish when mounting all traffic signals and signs to poles and standards.

509.3.7 Controllers, Detectors, and Cameras

1. Use controllers, detectors, and cameras supplied by the owner, unless noted otherwise.

509.3.8 Control Cabinets

1. Use control cabinets supplied by the owner, unless noted otherwise. Use a black finish for all traffic control cabinets.

509.4 Construction

509.4.1 Existing Traffic Signals

1. De-energize and remove any existing city owned traffic signals, control cabinets, and electrical services which will not remain. Return poles, arms, signals heads, detectors, and control cabinets to the owner, reinstall, or dispose as directed by the owner.
2. Maintain existing traffic signals until poles must be removed to complete other work. The contractor is responsible for installing temporary stop signs or other necessary traffic control until new signals are operational.

509.4.2 Transformer Bases

1. Bond bases to the equipment grounding conductor.

509.4.3 Control Cabinet

1. The contractor is responsible for installing the controller, making all connections and for all testing.

509.4.4 Detection Systems

1. Install and test detection processors, video detection cameras, and microwave detectors. Coordinate the installation of detectors and cameras and setting up the detection zones with the City of Fond du Lac Electrical Division.

509.4.5 Signal Activation

1. Cover traffic signal faces and pedestrian signal faces with a hood or turn away from view by the traveling public until the signal is accepted for use and activated.

509.5 Basis of Payment

1. The owner will measure the traffic signal bid items as by each individual unit acceptably completed. Payment for the traffic signal items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; for excavating and backfilling; for providing transformer bases, pedestal bases, poles, standards, arms, signal faces, pedestrian push buttons, luminaires, and photocontrols including grounding lugs and related mounting hardware; for equipment grounding wires; for leveling shims; for hardware and fittings necessary to install the traffic signal; and for corrosion prevention.
2. The owner will measure the traffic signal installation bid items as each individual unit acceptably completed. Payment for the traffic signal installation items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor templates, rods, nuts, and washers; for bar steel reinforcement; for excavating and backfilling; for equipment grounding wires; and for assembling and installing traffic signals and luminaires. The owner will supply the transformer bases, pedestal bases, poles, standards, arms, signal faces, pedestrian push buttons, signal mounting hardware, luminaires, and photocontrols. The contractor shall supply any miscellaneous tools, hardware, and components needed to complete the installation.
3. The owner will measure the control cabinet bid items as each individual unit acceptably completed. Payment for the control cabinet installation items is full compensation for assembling and installing

control cabinets. The owner will supply the control cabinets. The contractor shall supply any miscellaneous tools, hardware, and components needed to complete the installation.

4. The owner will measure the controllers, detectors, and cameras bid items as a single lump sum unit for each intersection acceptably completed. Payment for the controllers, detectors, and cameras items is full compensation for assembling and installing traffic signal controllers, detectors, and cameras including positioning, setting up, programming and testing. The owner will supply the controllers, detectors, and cameras. The contractor shall supply any miscellaneous tools, hardware, and components needed to complete the installation.
5. The removal of existing traffic signals is incidental and will not be paid separately unless noted otherwise.

510 Lighting Control Cabinets

510.1 Scope

1. This section describes providing lighting control cabinets.

510.2 General Requirements

1. Submit manufacturer's data for the lighting control cabinets as specified in 106.2.2.

510.3 Materials

510.3.1 Lighting Control Cabinets

1. Use lighting control cabinets supplied by the owner, unless noted otherwise.
2. Use a black finish for all lighting control cabinets. Prime all inside and outside surfaces of the cabinet with phosphate treatment and primer. After priming, give all exterior surfaces a minimum of 2 coats of rust resistant powder-coated black finish; furnish interior surfaces with rust resistant high gloss white enamel. Continuously weld all seams. Ensure that the surface is smooth and free of marks and scratches.

510.4 Construction

1. The contractor is responsible for installing the cabinet, circuit wiring connections, hardware, and fittings the plans show.

510.5 Basis of Payment

1. The owner will measure the lighting control cabinet bid items as each individual unit acceptably completed.
2. Payment for the lighting control cabinet bid items is full compensation for providing cabinets including circuit wiring connections, hardware, and fittings the plans show.
3. Payment for the lighting control cabinet installation bid items is full compensation for providing materials including circuit wiring connections, hardware, and fittings the plans show. The owner will supply the lighting control cabinet.

600 Paving and Miscellaneous Construction

601 Definitions and Acronyms

601.1 Acronyms

1. Interpret the acronyms used in sections 601 through 629 as follows:

EBS	Excavation below subgrade
HMA	Hot mix asphalt
QMP	Quality management program

601.2 Definitions

1. Interpret definitions used in sections 601 through 629 as follows:
   Carriage Walk. A private walkway connecting the public sidewalk and the street curb or a private walkway outside the right-of-way connected to the public sidewalk.

   City Arborist. The City Arborist of the City of Fond du Lac, Wisconsin.

602 General Requirements for Paving and Miscellaneous Construction

602.1 Scope

1. This section describes general requirements for earthwork, bases, pavements, and other miscellaneous construction.

602.2 General Requirements

602.2.1 Alternate Bids

1. Where alternate bids are requested for asphalt or concrete pavement, the estimated quantity for common excavation base bid will be the amount of common excavation required to construct the pavement section, including pavement and base courses, with the least thickness, whether asphalt or concrete, as shown on the typical cross-section and plan grades. The additional common excavation for the pavement with the greatest thickness will be included in the alternate bid for the pavement type with greater thickness. Additional drilled dowel bars will be included in the alternate bid when additional drilled dowel bars are required for the concrete alternative compared to asphalt pavement due to adjacent existing concrete pavement.

602.2.2 Maintenance of Existing Streets

1. Maintain existing streets through the utility construction phases except for the pavement that is necessary to remove for utility trenches. Provide and maintain trench backfill screenings to match the existing pavement grade as necessary to maintain required traffic.

602.2.3 Maintenance of Improvements and Restoration

1. When the work is completed on construction of improvements, leave that portion of the surface disturbed by construction under this contract in an equal or better condition as it was before the commencement of the work. Promptly and regularly maintain all restoration work in such condition for a period of one year after acceptance of the work. Maintenance measures needed for ordinary wear and tear from normal use shall not be at the expense of the contractor. All repairs required because of unsatisfactory trench backfilling, however, shall be at the expense of the contractor.

602.2.4 Structures

1. Rebuild all structures removed in as good a condition as found, and repair all existing structures which may be damaged as a result of the work under this contract.

602.2.5 Curbs, Gutters, Driveways, and Sidewalks

1. Reconstruct all curbs, gutters, driveways, sidewalks, and similar structures that are broken, damaged, or otherwise affected due to the contractor's operations. Reconstruct using the same kind of material with the same finish and in not less than the same dimensions as the original work. Make repairs by removing and replacing the entire portions between joints or scores and not merely refinishing any damaged part. At the discretion of the engineer, the existing curb, gutter, driveway, or sidewalk may be sawed to provide a straight, clean line and vertical edge and have joint filled. Match the appearance of the existing improvements as nearly as possible.

602.2.6 Roads and Streets

1. Completely reconstruct all roads and streets in which the surface is removed, broken or damaged, or in which the ground has caved or settled due to work under this contract, to the original thickness and brought to the original grade and crown section unless otherwise indicated. Before resurfacing material is placed, trim edges of pavements back far enough to provide clean, solid, vertical faces, and free of any loose material. Remove and reconstruct the entire portions of concrete pavement between joints. The minimum replacement width of asphaltic pavement is 10 feet. Clean and repair roadways used by the contractor for hauling materials, equipment, supplies, or other work, if the condition of the roadway is damaged or otherwise affected due to the contractor's operations.

602.2.7 Cultivated Areas and Other Surface Improvements

1. Restore all cultivated areas, either agricultural or lawns, and other surface improvements which are damaged by actions of the contractor as nearly as possible to their original condition, or as required by the terms of the easements or permits on file with the owner.

602.2.8 Waterways, Channels and Drainage Ditches

1. Restore as nearly as possible to their original condition all waterways, channels, drainage ditches and similar facilities, which are damaged by actions of the contractor. Where necessary, provide temporary facilities or temporarily realign such watercourses to maintain a continuously serviceable facility until it is restored to its original location and condition. Restore such facilities as shown and specified.

602.3 Construction

602.3.1 Grade and Alignment Staking

1. The owner will provide line and grade stakes for construction. The owner will not furnish subgrade stakes (blue tops) or base course stakes (red tops) unless noted otherwise.
2. Make staking requests a minimum of 3 working days prior to the time the stakes are needed.
3. Preserve all stakes and markings as specified in 105.5 item 2.

602.3.2 Finishing the Roadway

1. Trim, shape, and restore the shoulders to the finished cross-section using graders and other equipment, supplemented by hand work, if necessary, to produce smooth surfaces and slopes and uniform cross-sections. For graded roadbed without surfacing, trim and dress the entire roadbed in the same manner.
2. Do not drag, push, or scrape material across or along the finished pavement or surface course.

3. During the life of the contract, destroy noxious weeds within the grading limits by cutting or by other means and prevent the weed plants from maturing to the bloom or flower stage in compliance with § 476-10 of the Code of the City of Fond du Lac.
4. Before requesting acceptance of the work, if grading or structures are a part of the contract, clean out soil, silt, or debris, and fully restore the waterways of drainage installations and structures constructed under the contract. Remove materials deposited or lodged in the waterways of other drainage installations or structures due to contractor's operations.
5. Trim and dress the slopes of the roadway embankments and excavations to restore them to the established or specified lines and grades. Clear ditches and channels of debris and obstructions, and trim slopes and beds to true line and grade. Remove, shape, trim, and leave in a neat condition excess earth, debris, spoil banks, or other waste material next to culverts, bridges, ditches, channels, poles, posts, trees, or other objects. Remove stones, roots, or other waste materials exposed on embankment or excavation slopes that may become loosened and dislodged. Dispose of slash and debris from clearing and grubbing operations, and leave the entire roadway in a neat condition. Fill holes and depressions that appear on the surface within the grubbing limits, caused by grubbing operations, with suitable material.

602.3.3 Site Restoration and Final Clean Up

1. Upon completion of the work and before acceptance and final payment will be made, remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. Leave the work site in a condition free from all waste or surplus materials or excavations. Remove and dispose all such items in some other acceptable disposal site.

602.4 Basis of Payment

1. Work specified in 602 is incidental to the contract, including removing, replacing, repairing, and cleaning existing improvements, unless noted otherwise.
2. The word installation is used in the names of bid items in sections 603 through 629 where some or all of the materials will be provided by the owner as specified in the basis of payment subsection for that section.

603 Mobilization

603.1 Scope

1. This section describes the work and operations necessary to move personnel, equipment, supplies, and incidentals to the project site and to establish the contractor's offices, buildings, sanitary accommodations, and other facilities necessary to work on the project. It also includes all other work and operations whose performance is required, or for costs necessarily incurred before beginning work on various items on the project site.

603.2 Basis of Payment

1. The owner will measure mobilization once for the contract acceptably completed. If multiple crews are required at various times throughout the project or the contractor demobilizes and remobilizes to the site, only one mobilization will be measured.
2. Payment for mobilization is full compensation for supplying and providing materials, facilities, and services, and for performing all work necessary to complete this contract bid item. The owner will make incremental payments as indicated in ***Table 603-1***.

Table 603-1

Mobilization Payment Schedule

When Mobilization Is Equal to or Less Than 10%		When Mobilization Is Greater Than 10%	
% of Contract Complete	Payment Percentage (%)	% of Contract Complete	Payment Percentage (%)
5	25	5	5
25	25	25	5
50	25	50	5
75	25	75	5
		*	80

* Pay the remaining mobilization when the project is substantially complete as defined in 105.9.1.3.

3. If the contract does not include a separate mobilization bid item, the work necessary for mobilization is incidental to work included under other contract bid items.

604 Traffic Control

604.1 Scope

1. This section describes providing, maintaining, repositioning, and removing temporary traffic control devices.

604.2 General Requirements

1. Conform all traffic control signs and devices to Sections 637 and 643 of the *Standard Specifications for Highway and Structure Construction*.
2. Provide temporary traffic control conforming to the requirements for barricades, warning signs, and flagmen as specified in 104.6.2.

604.3 Materials

604.3.1 Portable Changeable Message Signs

1. Furnish portable changeable message signs from the WisDOT APL for work zone traffic control.

604.4 Construction

604.4.1 Traffic Control

1. Provide, maintain, reposition, and remove temporary traffic control devices and “No Parking Signs” as necessary to meet the access requirements specified in 104.6.1 and access restriction specified in 104.6.4.
2. Provide, maintain, reposition, and remove temporary traffic control devices, use flagging operations, or install and maintain temporary fencing as necessary to delineate and protect the public from temporary hazards as specified in 104.6.3.

604.4.2 Portable Changeable Message Signs

1. When indicated on the plans or directed by the engineer, provide a portable changeable message sign in each oncoming direction 7 calendar days prior to closure streets or lanes. Coordinate the exact location and message with the engineer a minimum of 3 working days in advance of the deployment of the signs. Portable changeable message signs may also be required to inform the traveling public of special events, traffic pattern changes, or access restrictions as directed by the engineer.

604.5 Basis of Payment

1. The owner will measure traffic control once for the contract acceptably completed divided evenly among each street or work location required under the contract. Measure the traffic control bid item at each street or work location as follows:
   A. The first 50% will be measured when equipment and materials required to perform work has been delivered to site and installed.
   B. The final 50% will be measured when other contract work has been completed, the roadways have been opened to traffic, and traffic control signs and devices have been removed from the site.
2. The lump sum price for traffic control is full compensation for furnishing and maintaining traffic control signs and devices. The owner will not pay for replacing or repositioning temporary traffic control zone devices damaged or displaced.
3. If the contract does not include a separate traffic control bid item, the work necessary for traffic control is incidental to work included under other contract bid items.
4. Flagging is incidental to the contract and includes costs for advance signing, temporary portable rumble strips, and pilot vehicle guidance service.
5. The owner will measure the portable changeable message sign bid item by the number of calendar days that each sign is in use. The owner will not measure a sign on days it is not required. The owner will deduct one day for each calendar day a sign is required but out of service for more than 2 hours. Payment is full compensation for furnishing and maintaining portable changeable message signs.

605 Sawing

605.1 Scope

1. This section describes sawing of existing concrete or asphalt including pavement, curb and gutter, driveways, sidewalks, and similar work.

605.2 Construction

605.2.1 Sawing Timing

1. Saw existing asphalt and concrete before asphalt or concrete is broken or removed and ensure a straight clean line and vertical edge is provided after removal of asphalt or concrete.
2. Ensure a straight clean line is provided at the time of paving. Re-saw as necessary due to damage from contractor operations.

605.2.2 Equipment

1. Use diamond blades for sawing concrete where a full-depth cut is required. The contractor may use carbide cutting wheels to saw concrete that will be overlaid or for full-depth cuts where the cut face does not join the new concrete.

605.2.3 Sawing Asphalt

1. Make straight saw cuts at least 2 inches deep. Saw so the surface remaining is generally vertical over its full depth. Saw to the depth the plan indicates or as the engineer directs or allows.

605.2.4 Sawing Concrete

1. Do not extend saw cuts into newly placed concrete pavement or into existing pavements more than 4 inches beyond the limits the engineer designates. Saw full-depth unless the plans indicate otherwise or the engineer directs or allows otherwise.

2. Remove sawing sludge after completing each saw cut. Minimize sludge on live traffic lanes. Remove sludge from traffic control devices each day before dark. Dispose of sludge at an acceptable material disposal site.
3. Saw cut curb and gutter on a neat line at right angles to the curb face.
4. If a saw cut in curb and gutter falls within 3 feet of a construction joint, cold joint, expansion joint or edge, remove the concrete to the joint or edge.

605.2.5 Profile Sawcut Concrete Curb

1. Provide a drive approach opening or an ADA-compliant wheelchair opening in existing vertical-faced concrete curb pavement with flares. Chipping, grinding, and polishing may be required.

605.3 Basis of Payment

1. The owner will measure the sawing bid items by the linear foot acceptably completed. The owner will not measure overcuts beyond the limits the plans show or the engineer directs. The owner will measure sawing once per location. Payment for the sawing bid items is full compensation for sawing and sludge removal.
2. The owner will measure sawing to back of curb when sawing through curb and gutter. Sawing of the curb and gutter will be measured as concrete sawing where sawing of the curb and gutter is necessary for asphalt saw cuts.
3. The owner will measure composite cuts through both asphalt and concrete as concrete sawing.
4. Sawing performed at the following locations is incidental to the work it is associated with:
   A. Sawing required for sidewalk removal and drive approach removal.
   B. Sawing required for concrete and asphalt removal outside of the right-of-way.
   C. Sawing for trench excavation.
   D. Sawing at locations other than the project limits made for the convenience of the contractor.

606 Clearing and Grubbing

606.1 Scope

1. This section describes cutting and disposing of trees, brush, windfalls, logs, and other vegetation occurring within the clearing limits; and removing and disposing of roots, stumps, stubs, logs, and other timber occurring within the grubbing limits.

606.2 General Requirements

1. Unless noted otherwise tree removal will be done by owner contracted forces prior to the contractor arriving on the project. The stumps will be ground to a minimum of 4 inches below the existing ground. If stump removal is necessary it will be incidental.

606.3 Construction

1. Clear and grub all areas within the clearing and grubbing limits defined as follows:
   A. All undesirable trees, brush, shrubs, stumps, and other vegetation designated for removal.
   B. Designated clear zone and clear vision areas.
   C. With the engineer's approval, areas with vegetation that interferes with excavation.
2. Preserve vegetation within the clearing limits as the plans show or engineer directs. Limit excavation around preserved trees to the minimum areas necessary to complete the project work. Cut off and dispose of other trees, brush, shrubs, or other vegetation occurring within the clearing limits. Within the grubbing limits, remove debris not suitable for the foundation or surface, stumps and associated roots, logs, timber, brush, and matted roots to the following minimum depths:
   A. In cut areas, one foot below final subgrade.
   B. In embankment areas, one foot below the existing grade.

C. In streambank armoring areas, 3 inches below slope face. In addition, remove all debris, protrusions, rocks, sticks, or other hindrances. Tree roots may be left in place at the edge of work as directed by the engineer. Grubbing will not be required outside the limits of the bank armoring unless shown otherwise on the plans.

3. Do not remove trees and shrubs located beyond the clearing limits unless the engineer specifically authorizes their removal. If clearing where grubbing is not required, cut shrubs and brush to within 3 inches of the ground surface. Cut trees as nearly flush with the ground surface as practicable with tools ordinarily used for these operations.
4. Prevent the spread of oak wilt by treating cut surfaces and abrasions sustained between April 1 and September 30 by healthy oak trees and saplings with a thorough application of tree paint immediately upon discovering a wound. Between these dates, also paint the cut surfaces of the stumps of healthy oak trees and saplings immediately after cutting, whether remaining in place or grubbed.
5. If feasible, fell trees toward the center of the area being cleared. If this is not possible due to danger to traffic or injury to other trees, structures, or property, cut them into sections from the top down.
6. Do not injure or damage trees and shrubs left in place within or adjacent to the clearing limits. Obtain the owners approval prior to trimming overhanging limbs and branches and perform the work under the direction of the City Arborist. Trim privately owned trees with special care to ensure that no other parts of the tree or other property are damaged. Symmetrically trim lower limbs or branches of trees left in place and overhanging the roadbed to at least 14 feet above the finished grade. Trim using generally accepted horticultural practices.
7. Cut and remove all tree roots necessary to allow for paving, excavation, or sidewalk construction. Cut roots of trees to remain in place to a point 3 inches below subgrade. Cut roots by means of a mechanical root-cutting machine and do not indiscriminately chop roots. Saw major roots. Perform all cutting of roots in a manner that is not injurious to the tree and complete in the presence of the engineer. The root foundation must remain adequate to withstand heavy windstorms.
8. Unless the contract specifies otherwise, consult with the adjacent owners about disposing of trees cut on the land adjacent to their property. The property owners have first right to the cut wood. If the adjacent property owner rejects the cut wood, remove and dispose of trees or portions of trees.
9. Dispose of stumps, roots, brush, waste logs and limbs, timber tops, and debris resulting from clearing and grubbing or occurring within the clearing and grubbing limits by chipping and removing from the right-of-way.
10. For disposal by mechanical chipping, recover all material as it leaves the chipping machine.
11. Unless disposed of in another manner, dispose of material off the right-of-way according to applicable solid waste disposal regulations. Obtain written permits for this disposal from the owner of the property where placing the material, unless disposing of this material at a licensed waste disposal operation. Provide copies of permits to the engineer before disposal begins.
12. Chip, burn, or bury under not less than one foot of earth elm wood consisting of trees, logs, stumps, stubs, branches, or windfalls with adhering bark, and elm bark and debris within clearing and grubbing limits or resulting from clearing and grubbing operations.
13. Debark elm logs salvaged, and elm wood or stumps not disposed of by chipping, burning, or burying; and chip, burn, or bury the bark. For clearing and grubbing operations performed between April 1 and September 30, perform final disposal of elm wood, bark, or debris within 30 days. For clearing and grubbing operations performed between October 1 and March 31, perform final disposal of elm wood, bark, or debris before the succeeding May 1.
14. Burning or burying is not allowed within the right-of-way or on city property.
15. Dispose of clearing and grubbing debris before proceeding with grading operations.
16. Replace sidewalk or pavement that is to remain in place and is damaged during the tree or stump removal process at the expense of the contractor.

606.4 Basis of Payment

1. The owner will measure the clearing and grubbing bid items within the designated limits, either by the inch of diameter, square yard, or lump sum acceptably completed as the contract indicates.
   A. When measuring by the square yard, the owner will calculate the horizontal area bounded by the line of trunks cut or grubbed.
   B. When measuring by the inch of diameter, the owner will determine the tree diameter by measuring the circumference approximately 4½ feet above the existing ground level, but above the ground swell, and dividing by 3. The owner will determine stump diameter, for stumps not resulting from the contractor's clearing operations, by computing the average diameter of the stump top. The owner will include only those in-place trees or stumps with a 3-inch or greater diameter. The owner will round circumference measurements and diameters to the nearest inch.
2. Payment for the clearing and grubbing bid items is full compensation for clearing and grubbing within the designated limits; and for handling, hauling, piling, trimming, chipping, wound treatment, rehandling, and disposing of waste and debris. The owner will pay for clearing and grubbing ordered and performed beyond the clearing and grubbing limits, at the contract unit price.
3. The owner will measure the clearing brush bid item by the square yard acceptably completed. Clearing brush includes the removal of trees less than 3 inches in diameter, logs, light brush, shrubs and other vegetation. Clearing brush will only be measured where specified in the contract and is incidental in all other situations. Payment for clearing brush is full compensation for clearing brush within the designated limits; and for handling, hauling, piling, trimming, chipping, wound treatment, rehandling, and disposing of waste and debris.
4. The owner will not measure clearing and grubbing completed by other forces outside the contract.
5. Unless specified otherwise in the contract, the owner will not measure or pay for incidental clearing and grubbing operations required to perform the following:
   A. Clearing areas of light brush, shrubs, and other vegetation that the contractor can cut with a brush scythe or mowing machine.
   B. Clearing areas containing logs, tree roots, roots of brush and shrubs, and other vegetation having a woody structure that the contractor can remove with a rooter.
   C. Clearing small trees of less than the minimum number and size specified for measurement.
   D. Trimming overhanging limbs and branches to provide required clearance.
   E. Cutting and sawing tree roots.

607 Crack and Damage Survey

607.1 Scope

1. This section describes the requirements of performing a crack and damage survey for affected properties, as required by the contract.

607.2 General Requirements

1. Conduct a crack and damage survey of the businesses and residences located adjacent to the project limits. Crack and damage survey limits are to be established by the contractor, as required by the scaled-distance equation specified in Wisconsin Administrative Code Chapter SPS 307 but, at a minimum, should include the properties outlined in the special provisions.
2. The crack and damage survey consists of two parts. The first part, performed prior to construction activities, includes a visual inspection, digital images, and a written report describing any existing defects in the buildings and pavements being inspected. The second part, performed after construction activities, includes a visual inspection, digital images, and written report describing any changes in the structure or pavement condition.

3. The owner will send a letter to all affected property owners, informing them of the crack and damage survey process, prior to the contractor making initial contact with the property owners.
4. Notify the owner a minimum of 3 working days prior to making initial contact with the property owners. Ensure the engineer is present when contacting the property owners concerning access for the survey work. Should a property owner refuse entry to a property, have the property owner sign a waiver indicating they have refused entry and are releasing the contractor and the owner from any potential liability related to a claimed change in condition of the structure. If the property owner refuses all requests, create written documentation of the refusal and have both the contractor and engineer present at the time of the property owner visit sign the documentation.
5. The absence of the requirement to perform a crack and damage survey does not relieve the contractor of the requirement to perform trenching, backfilling, compaction, and other work operations in a manner which does not adversely impact adjacent properties.

607.3 Construction

1. Before any construction activities, thoroughly inspect the building structures for existing defects, including interior and exterior walls. Electronically submit a written report to the engineer with the inspector's name, date of inspection, descriptions and locations of defects, and digital images. The intent of the written report and digital images is to procure a record of the general physical condition of the building's interior and exterior walls and foundation.
2. Use a digital camera capable of producing sharp, grain free, high contrast colored digital images with good shadow details. Label each digital image with the following information:
   A. I.D.
   B. Building Location.
   C. View Looking.
   D. Date.
   E. Photographer.
3. Before the start of any construction activities related to this survey, submit a copy of the written report and digital images to the engineer electronically.
4. After the construction activities are complete, conduct another survey in the same manner, take digital images, and submit another written report to the engineer electronically.
5. Instead of digital images, a digital video camera capable of producing sharp, high contrast, colored digital video with good shadow detail may be used to perform this work.

607.4 Basis of Payment

1. The owner will measure the crack and damage survey bid item as each individual survey acceptably completed. Payment for crack and damage survey is full compensation for providing the before and after written reports, and for photographs or video. Payment of 50% of this bid item will be made after the successful completion of the pre-construction report. The final payment of this bid item will be made after the successful completion of the post-construction report.

608 Excavation

608.1 Scope

1. This section describes excavating and disposing of material taken from within the grading limits for project construction.

608.2 General Requirements

608.2.1 Common Excavation Limits

1. Common excavation includes all removals to the limits indicated below unless noted otherwise on the plans or special provisions.
   A. For streets where the entire existing sidewalk or portions of the existing sidewalk will remain, common excavation includes all excavation and removals to the face of walk except trees and stumps, concrete bases, and signs. In addition, items indicated to be removed or removed and replaced, including pavements, curb and gutter, sidewalks, and other items, will be excluded from common excavation.
   B. For new street construction or reconstruction of existing streets where the entire existing sidewalk will be replaced or where no sidewalk exists or will be installed, common excavation includes all excavation and removals to the grading limits except trees and stumps, concrete bases, and signs. In addition, items indicated to be removed or removed and replaced, including pavements, curb and gutter, sidewalks, and other items, will be excluded from common excavation.
   C. For projects other than street construction projects, common excavation includes all excavation and removals within the grading limits except trees and stumps. In addition, items indicated to be removed or removed and replaced, including pavements, curb and gutter, sidewalks, and other items, will be excluded from common excavation.
   D. Owner contracted forces will remove trees and stumps as specified in 606.2. The owner will remove signs as specified in 628.2. Remove concrete bases as specified in 507.3.4. Remove or remove and replace items as specified in 610.2. Remove and replace concrete pavement as specified in 617.4.10. Remove and replace curb and gutter as specified in 618.4.9. Remove and replace concrete sidewalk, carriage walk, and drive approaches as specified in 619.4.7. Remove and replace asphalt pavement as specified in 622.4.8.

608.3 Materials

608.3.1 Classification

1. The owner classifies excavation as common excavation or rock excavation.

608.3.1.1 Common Excavation

1. Common excavation is any material not classified as rock and includes removing base course, pavement, curb and gutter, sidewalk, concrete bases, manholes, catch basins, inlet, walls, foundations, stone piles and stone fences, marsh, and all other materials not paid separately under the contract and which are required to be removed to construct pavement, curb and gutter, sidewalk and other items to the line and grade as shown on the plans.

608.3.1.2 Rock Excavation

1. Rock is any hard, solid material in ledges, bedded deposits, and unstratified masses, and conglomerate deposits or any other material so firmly cemented they present the characteristics of solid rock, and the engineer determines it is impracticable to excavate this material without blasting or using rippers. Rock also includes removing rock boulders having a volume of one cubic yard or more.
2. The classification of rock excavation does not apply to crushed aggregate or asphaltic base or surface courses, or to concrete base or surface courses.

608.3.2 Existing Pavements

1. The owner has made a reasonable estimate of the existing pavement type but the existing conditions may vary from information shown on the plans or indicated in the special provisions.

In particular, the extent of concrete base may be unknown. The contractor is responsible for verifying existing pavement type and thickness.

608.4 Construction

608.4.1 General

1. Perform common excavation as specified in Sections 205 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. Perform rock excavation as specified in 609.

608.4.2 Utilities and Side Slopes

1. During construction, the contractor must provide support for any affected utilities and side slopes. The contractor must protect the affected utilities and will be required to pay repair costs due to lack of required support and protection.

608.4.3 Drain Tile

1. Notify the engineer whenever drain tile is encountered. Locate and protect drain tile until the engineer determines whether the drain tile will be abandoned, replaced to maintain continuity, or connected to existing or proposed drainage systems.

608.4.4 Incorporating Surplus Material

1. Use all suitable material removed from the excavation, insofar as practicable, for backfilling between curb and sidewalk and for such other purposes as directed by the engineer.

608.4.5 Over-Excavation

1. Where the contractor over-excavates, place fill material to the proposed subgrade elevation. Obtain the engineer's approval of fill material and placement methods.

608.4.6 Proof Roll

1. Prior to the placement of base course or sub-base course, proof roll the subgrade with a fully loaded quad axle dump truck to the satisfaction of the engineer to insure that soft and yielding areas are corrected. It is the responsibility of the contractor to protect the subgrade from damage due to construction activities or avoidable contamination by water or other soils. EBS may be required in yielding areas as directed by the engineer. If no EBS is required, the engineer will approve that area for subsequent operations. Ensure all proof rolls are verified by the on-site owner representative.

608.4.7 Excavation Below Subgrade

1. Remove deposits of frost-heave material, unstable silty soils, wet and unstable soil, material salvaged from old road cores in marshes, topsoil containing considerable humus or vegetable matter, rocks, or other undesirable foundation material to a depth of 6 inches below subgrade or as the engineer directs. If possible, slope and drain the excavation bottoms to prevent water accumulation.
2. Dispose excavated material.
3. Place 3-inch dense-graded base as specified in 615.

608.4.8 Filling and Embankment

1. In areas of fill or embankment within the grading limits, remove all topsoil, humus, bushes, trees, and roots, etc. prior to depositing the select fill material. Ensure the select fill material is

free from sod, stumps, logs, and other perishable matter. Deposit, spread, level, and compact the material in layers which do not exceed 12 inches in thickness.

2. Perform embankment as specified in Sections 207 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

608.5 Basis of Payment

1. The owner will measure the common excavation bid items by the cubic yard acceptably completed. Payment for common excavation is full compensation for preparing roadway foundation; for excavation; for grading; for dust control; for hauling; for disposing; for proof rolling; and for constructing and removing temporary drainage installations.
2. The owner will measure common excavation as the absolute volume within the lines and grades established on the plans and specifications. Volumes have been computed by the average end area method. Cross sections will be provided upon request. With the exception of approved EBS or changes to the project limits, the quantities listed within the schedule of prices for common excavation shall be the final contract quantities for which compensation will be made to the contractor and no additional compensation will be provided for excavation below the established subgrade.
3. The owner will measure the excavation below subgrade and 3-inch dense base bid item by the square yard acceptably completed. Payment for excavation below subgrade and 3-inch dense base is full compensation for preparing roadway foundation; for excavation; for grading; for dust control; for hauling; for disposing; for proof rolling; and for furnishing and installing dense-graded base.
4. The owner will only pay for engineer-approved EBS to correct problems beyond the contractor's control. No additional compensation will be provided for over-excavation or fill in over-excavated areas.
5. If the contract does not include the rock excavation bid item, the owner will pay for the removal of hard solid rock and boulders larger than one cubic yard as extra work.
6. Any dewatering will be considered incidental to the contract.
7. No additional compensation will be provided for any filling or embankment required to meet the line and grade established on the plans unless noted otherwise.

609 Rock Excavation

609.1 Scope

1. This section describes excavating, loading, transporting, and disposing of hard solid rock and boulders larger than one cubic yard taken from within the grading limits for project construction.

609.2 General Requirements

609.2.1 Rock

1. Rock is any hard, solid material in ledges, bedded deposits, and unstratified masses, and conglomerate deposits or any other material so firmly cemented they present the characteristics of solid rock, and the engineer determines it is impracticable to excavate this material without blasting or using rippers. Rock also includes removing rock boulders having a volume of one cubic yard or more.

609.2.2 Blasting

1. Perform all blasting in conformance with Wisconsin Administrative Code Chapter SPS 307. Conduct all blasting operations by persons holding a valid Class 4 or 5 blasters license issued by the State of Wisconsin Department of Safety and Professional Services. Submit proof of the

blaster's license to the engineer for review. When blasting is used, have a seismograph available at all times, which is acceptable to the engineer, to be used at any location designated by the engineer. Secure all permits or licenses required for blasting or use of explosives.

2. Perform blasting only when shown on the plans or with the approval of the engineer.

609.2.3 Dust Control

1. Take all necessary precautions to minimize construction dust. Fit all plant and equipment with suitable dust control devices such as continuous water spray systems or vacuum filter systems, and maintain in good working order. The engineer will decide on the adequacy of provision and maintenance of dust control systems. When instructed in writing by the engineer, immediately withdraw any item of plant or equipment from service and carry out all necessary additions, replacements, or repairs to the dust control systems to the satisfaction of the engineer.

609.3 Materials

1. Furnish explosives made from fresh stable materials manufactured to the standards of the "Institute of Makers of Explosives".

609.4 Construction

609.4.1 Inspection and Measurement

1. When rock is encountered, expose by removing the material above it and notify the engineer so that the amount of material to be removed can be measured and recorded. In lieu of exposing the rock surface, the engineer and the contractor may agree on a method to define the vertical limits of the rock. The owner will not measure or pay for any rock excavated before such measurement is made.

609.4.2 Method of Removal

1. After measurement of the rock, the contractor may proceed with drilling or breaking the rock with power operated tools specially designed for rock excavation. After the rock is broken, load and dispose of unless the engineer allows its temporary storage or reuse on-site.

609.4.3 Use of Explosives

1. Avoid the use of explosives as far as practicable. Perform such blasting as must be done, in a controlled manner which will avoid possible shattering or loosening of materials outside of the project area and does not cause damages to property or injury to persons resulting from blasting or handling explosives. Give adequate warnings to all affected persons or adjacent property owners prior to blasting. Use blasting mats or other acceptable type of protective material to prevent scattering of rock fragments outside the excavation area.

609.4.4 Limits of Removal

1. For sewer construction, remove rock to provide a minimum of 6 inches of clearance on the sides and 6 inches of clearance below all pipes and pipelines. The minimum trench width is 30 inches.
2. For water construction, remove rock to provide a minimum of 6 inches of clearance below all pipe, valves, and fittings. Remove rock to provide a minimum of 6 inches clearance on the sides of pipe, valves, and fittings for pipe sizes 24 inches or smaller and 9 inches clearance for pipe sizes 30 inches or larger. The minimum trench width is 30 inches.
3. For excavations for base courses and pavements, remove rock to provide a minimum of 6 inches of clearance below the earth subgrade between the grading limits.

609.5 Basis of Payment

1. The owner will measure rock excavation by the in place cubic yard acceptably completed. Measure the rock excavation bid item as follows:
   A. For sewer construction and for water construction:
      a. Measure this work vertically from the top of the rock to the bottom of the rock, or to an elevation 6 inches below the bottom of the pipe, pipeline, catch basin, manhole, or inlet, whichever is higher.
      b. For sewer construction and for water construction of pipe sizes 24 inches or smaller, measure this work horizontally in trenches as the outside diameter of the pipe or pipeline plus 12 inches but not less than 30 inches.
      c. For water construction of pipe sizes 30 inches or larger, measure this work horizontally in trenches as the outside diameter of the pipeline plus 18 inches.
      d. Measure this work horizontally in common trench construction as the outside diameter of the pipe or pipeline plus 48 inches.
   B. For excavations for base courses and pavements, the owner will perform this measurement by making vertical measurements for determining end areas within the limits of the roadbed as defined by the grading limits. These vertical measurements will extend from the surface of the rock to an elevation 6 inches below the subgrade or ground surface, or to the depth indicated on the plans, or to the bottom of the solid ledge or mass if the rock does not extend downward to the elevation specified, or indicated below the established grade. The owner will measure boulders and surface stone with a volume of one cubic yard or more individually and compute the volume from average dimensions taken in 3 directions.
2. Payment for rock excavation is full compensation for all rock excavation and disposal.

610 Removing, Adjusting, Replacing or Abandoning Miscellaneous Structures

610.1 Scope

1. This section describes wholly or partially removing, adjusting, replacing or abandoning existing miscellaneous structures, disposing of the resulting materials, or if required, salvaging and storing designated materials.

610.2 Construction

610.2.1 General Requirements

1. If retaining a portion of the existing structure, avoid damaging that portion during construction operations. Do not use any equipment or devices that might damage structures, facilities, or property to be preserved and retained. Complete operations necessary to remove or abandon an existing structure and that might endanger the new construction before constructing new work.
2. Unless specified otherwise, remove structures within the removal limits that the contract designates for removal or that interfere with the new construction or as directed by the engineer.
3. Unless the plans show otherwise, remove entirely or break down walls, piers, surface drains, foundations, and similar masonry structures as follows:
   A. Within the roadbed, to a depth at least 2 feet below the subgrade.
   B. Outside the roadbed, to a depth at least 2 feet below the finished grade.
   C. At any location, to the extent required to avoid interfering with the work.
4. If removing pavement, curb, gutter, sidewalk, crosswalk, and similar structures and portions of the existing structure are to remain in the surface of the finished work, remove the structure to

an existing joint, or saw and chip the structure to a true line with a face perpendicular to the surface of the existing structure. Remove enough of the structure to provide proper grades and connection to the new work. Maintain drainage during construction.

5. Crack the base of abandoned structures to allow drainage.

610.2.2 Backfilling

1. Backfill trenches, holes, and pits resulting from breaking down, removing, or abandoning miscellaneous structures as specified in 204.4.2.8.
2. Unless the contract specifies otherwise, backfill to the elevation of the natural ground, the proposed finished earth subgrade, or finished slopes, as necessary due to the location of the removed structure.

610.2.3 Salvaging or Disposing of Materials

1. Carefully remove materials designated for salvage to avoid damage. Place salvaged materials in neat piles at locations the engineer approves, without contaminating the material with dirt or foreign matter.
2. Dispose of concrete, stone, brick, and other material not designated for salvage.

610.2.4 Removing Sidewalk and Driveways

1. Remove concrete sidewalk, driveways, and steps. Sidewalk and driveway removal includes sidewalk, sections of sidewalk across driveways, concrete and asphalt driveways outside of the sidewalk limits or right-of-way, and steps. Sidewalk and driveway removal also includes the removal of base course as needed.
2. Remove the sidewalk only in the locations where utility work is being performed, prior to excavation operations. Backfill these locations with granular material, level, and compact until the sidewalk is replaced. Maintain the existing sidewalk as long as possible for pedestrian access along the project.
3. When adjacent panels of sidewalk, driveway, or steps, which are not identified for removal, are discovered to be cracked, chipped, or otherwise damaged, notify the engineer prior to commencing breaking or removal of the adjacent sidewalk. The engineer will make note of the type and extent of the pre-existing damage to ensure that the severity of the damage does not increase during the sidewalk replacement process. If adjacent panels are found to be damaged following the construction process, which were not previously approved by the engineer, repair or replace the damaged panel at the contractor’s expense.

610.2.5 Removing Concrete Curb and Gutter

1. Remove curb, gutter, or curb and gutter. The removal limits may be modified when near existing joints. Curb, gutter, or curb and gutter removal also includes the removal of base course as needed.

610.2.6 Removing Asphalt Pavement

1. Remove all types of asphaltic pavement, surfacing, and overlays of existing concrete pavements. Removal of asphalt driveways will be considered sidewalk and driveway removal. Asphalt pavement removal also includes the removal of base course as needed and asphaltic curbs.

610.2.7 Removing Aggregate and Preparing for Concrete Sidewalk

1. Private utility companies may be relocating services under the existing sidewalk prior to the work performed under this contract. Sidewalks removed by others are to be backfilled flush with the existing walk surface. Remove the existing aggregate base and utilize the material on-site, as

approved by the engineer, to prepare the base for new concrete sidewalk. Locations where sidewalk will be removed by others may not be known or shown on the plan details.

610.2.8 Removing Sanitary and Storm Sewer

1. Remove sanitary sewers, storm sewers, manholes, and catch basins as specified in 213.3.

610.2.9 Water System Removals

1. Remove curb boxes, hydrants, valves, air release assemblies, manholes, and structures as specified in 420.3.

610.2.10 Mailboxes

1. Remove and protect all mailboxes until such time that the street has been paved. Reset all mailboxes to a location at the same station as the existing mailboxes, or as directed by the engineer. Set the mailbox at a height of 41 to 45 inches above the road surface to the bottom of the mailbox, set back 6 to 8 inches from the face of the curb, road edge or shoulder to the front of mailbox and install post 24 inches into the ground, or as directed by the engineer.
2. Use posts of either 4-inch by 4-inch wood or 2-inch diameter steel or aluminum pipe per the Federal Highway Administration recommendation for all mailboxes. Furnish new posts where the existing posts do not meet these requirements or which are found to be insufficient for remounting of the mailbox.
3. Obtain approval of the Fond du Lac branch of the United States Post Office prior to removing any existing mailboxes.
4. If the existing mailbox will not be used during the project, place the existing mailbox on the owner's property outside the construction limits.
5. During project construction, set up temporary mailboxes at a location approved by the Fond du Lac branch of the United States Post Office. Adequately protect all temporary mailboxes from the elements.

610.2.11 Fences, Retaining Walls, Pavers, Decorative Stone, Signs, and Benches

1. When shown on the plans or directed by the engineer either remove or remove and replace existing fences, retaining walls, pavers, decorative stone, signs, benches, and similar miscellaneous landscaping items. Remove and dispose items designated for removal. Remove, salvage, and reinstall, at the original location or at location designated by engineer, items designated for removal and replacement. Protect salvaged items so that they can be replaced in similar condition to the existing condition. Clean up and restore work area as necessary.
2. Coordinate work with private property owners and protect and restore property as specified in 107.7.1.

610.2.12 Adjust Pull Boxes and Access Boxes

1. Adjust city-owned electrical, fiber optic, or similar structures as specified in 503.4.6.

610.2.13 Adjust Private Utility Vaults and Manholes

1. Coordinate with the utility owner a minimum of 3 business days prior to work performed adjacent to any electrical, telephone, cable, or fiber optic vaults or manholes so that their forces can adjust the vaults or manholes, including frames and covers, as needed and bring them to final grade.

610.3 Basis of Payment

1. The owner will measure the asphalt pavement removal bid item by the square yard acceptably completed regardless of depth or number of courses encountered. The owner will only measure asphalt pavement removal at locations shown on the plans or as directed by the engineer. The owner will measure and pay for asphalt pavement removal at other locations as common excavation as specified in 608.2.1. Payment for asphalt pavement removal is full compensation for sawing, breaking down, removing, and disposing; and for repairing or replacing facilities designated to remain which are damaged during removal operations. The owner will measure and pay for sawing separately as specified in 605.3.
2. The owner will measure the concrete curb and gutter removal bid item by the linear foot acceptably completed regardless of width, depth, or number of courses encountered. The owner will only measure concrete curb and gutter removal at locations shown on the plans or as directed by the engineer. The owner will measure and pay for concrete curb and gutter removal at other locations as common excavation as specified in 608. Payment for concrete curb and gutter removal is full compensation for sawing, breaking down, removing, and disposing; and for repairing or replacing facilities designated to remain which are damaged during removal operations. The owner will measure and pay for sawing separately as specified in 605.3.
3. The owner will measure the sidewalk and driveway removal bid item by the square yard acceptably completed regardless of depth or number of courses encountered. The owner will measure typical mainline sidewalk with a maximum width of 5 feet, unless noted otherwise. The owner will measure the remaining portion of the sidewalk and driveway under the common excavation bid item as specified in 608. The owner will include steps based on the area of the horizontal projection of the steps. Payment for sidewalk and driveway removal is full compensation for sawing, breaking down, removing, and disposing; for maintaining temporary granular fill; and for repairing or replacing facilities designated to remain which are damaged during removal operations.
4. Removal of aggregate, utilizing the material on-site, and preparing the base for new concrete sidewalk will be measured as sidewalk and driveway removal at one-half the area of removal.
5. The owner will measure the remove and replace mailbox bid item as each individual unit acceptably completed. Payment for remove and replace mailbox is full compensation for removing and permanently reinstalling existing mailboxes; for temporarily relocating and maintaining mailboxes; and for providing and installing posts as required.
6. The owner will measure the remove fence bid item as each individual location acceptably completed. Payment for remove fence is full compensation for removing and disposing fences; and for restoring the site of the work.
7. The owner will measure the remove and replace fence bid item as each individual location acceptably completed. Payment for remove and replace fence is full compensation for removing, salvaging, storing, and reinstalling fences; and for restoring the site of the work.
8. The owner will measure the remove and replace retaining wall bid item by the linear foot acceptably completed. Payment for remove and replace retaining wall is full compensation for removing, salvaging, storing, and reinstalling retaining walls; and for restoring the site of the work.
9. The owner will measure the remove and replace pavers bid item by the square foot acceptably completed. Payment for remove and replace pavers is full compensation for removing, salvaging, storing, and reinstalling pavers, including required base course; and for restoring the site of the work.
10. The owner will measure the remove and replace decorative stone bid item by the square foot acceptably completed. Payment for remove and replace decorative stone is full compensation for removing, salvaging, storing, and reinstalling decorative stone, including required base course; and for restoring the site of the work.

11. The owner will measure the remove and replace sign bid item as each individual unit acceptably completed. Payment for remove and replace sign is full compensation for removing, salvaging, storing, and reinstalling signs; and for restoring the site of the work.
12. The owner will measure the remove and replace bench bid item as each individual unit acceptably completed. Payment for remove and replace bench is full compensation for removing, salvaging, storing, and reinstalling benches, including required base course, concrete, hardware and components; and for restoring the site of the work.
13. If the contract does not include bid items for removing miscellaneous structures from within the roadway, the owner will measure the excavation for those removals as common excavation as specified in 608.5.
14. No additional compensation will be provided for the removal or adjustment of private utility vaults, manholes, or other structures.

611 Breaking Pavement

611.1 Scope

1. This section describes breaking and compacting existing concrete pavement to create a stable construction platform during utility construction.

611.2 Construction

611.2.1 Concrete Pavement

1. Break existing concrete pavement into pieces with a maximum size of less than 18 inches using a multi-head breaker, such as MHB Badger Breaker, or other method approved by the engineer. Cut off reinforcing steel at the surface which is exposed at the surface, or which pulls up during excavation, other work, or under traffic. Use a heavy, smooth steel drum roller to level off the broken surface.
2. Before breaking, saw full depth joints and completely sever load transfer devices to isolate the breaking area. Saw jointed pavements at an existing joint. Do not damage adjacent pavement during breaking. Repair damage to the adjacent pavement caused by contractor operations as the engineer directs.
3. Do not damage pipes, valve boxes, manholes, and other fixtures.
4. Use water to control dust as necessary.
5. Maintain the surface after pavement breaking to provide an adequate temporary surface for the local traffic to travel on.

611.2.2 Asphalt Pavement

1. Asphalt pavement and asphalt surface with concrete base pavement will not be pulverized, broken, or rubblized. The contractor shall be responsible for trench excavation, including pavement removal, through these asphalt surface pavements.

611.3 Basis of Payment

1. The owner will measure the break pavement bid item by the square yard acceptably completed. Payment for break pavement is full compensation for sawing; for breaking pavement; for removing reinforcing steel; for compacting; and for maintain the surface.
2. The owner will only measure breaking pavement when included on the schedule of prices. If not included on the schedule of prices and the contractor decides to break pavement for their own means and methods, all costs associated with breaking pavement are incidental.

612 Excavation, Hauling, and Disposal of Contaminated Soils and Groundwater

612.1 Scope

1. This section describes excavating, segregating, loading, temporarily storing, hauling, and disposing contaminated soils and groundwater.

612.2 General Requirements

612.2.1 Health and Safety Requirements

1. Ensure work performed under this section complies with all federal, state, and local statues, regulations, and ordinances regarding health and safety, including but not limited to, OSHA requirements as provided in Title 29 Code of Federal Regulations 1910.120. Prepare a site-specific health and safety plan.
2. All site workers taking part in remediation activities or will have the reasonable probability of exposure to safety or health hazards associated with the hazardous material shall have completed health and safety training that meets OSHA requirements. Before the start of remediation work, submit to the engineer a site-specific health and safety plan, and written verification that workers will have completed up-to-date OSHA training.
3. Develop, delineate, and enforce the health and safety exclusion zones for each contaminated site location pursuant to Title 29 Code of Federal Regulations 1910.120.

612.2.2 Public Safety

1. Provide adequate protection around all openings and stockpiles wherever required to safeguard work and the public.

612.3 Construction

612.3.1 Contaminated Soils and Groundwater

1. Immediately notify the engineer if any contaminated soils or groundwater are exposed or suspected during excavation.
2. If historic contaminated soils or groundwater are expected, notify the engineer a minimum of 3 days prior to excavating in or adjacent to the potential impacted areas so a representative can be on-site during the excavation.
3. If prior approval was obtained for the disposal of the contaminated soil, contaminated excavated soil may be placed directly onto trucks for hauling to a landfill designated by the owner. If no prior approval has been obtained, then place the soils on a 6-mil polyethylene sheet and, upon completion of work for the day, covered with a 6-mil polyethylene sheet. Ensure that the cover prevents exposure to storm water runoff and reduces public exposure. If the soils cannot be stockpiled on-site, work with the owner to find a suitable temporary storage location until appropriate testing and analysis can be completed and until approval for disposal at a landfill is obtained. The contractor shall have a licensed operator, driver, and truck for handling the contaminated soil to deliver the material to an approved facility. The contractor may be required to use liners in the trucks used to transport the material. Adequately dewater all soil prior to hauling to a landfill. The owner will not be responsible for additional charges from the landfill due to the contractor hauling improperly dewatered materials.
4. Temporarily store contaminated liquids collected from excavation and stockpiles until the liquid can be characterized and approved for disposal at a designated facility or discharged to the City of Fond du Lac sanitary sewer system. Ensure liquid storage containers are watertight and are located in an area approved by the engineer. Clearly label and date storage containers.

5. The owner will submit and obtain any required WNDR permits for pumping of contaminated groundwater, including *Contaminated Groundwater from Remedial Action Operations WPDES General Permit*.

612.3.2 Monitoring Wells

1. If active groundwater monitoring wells are encountered during construction, notify the engineer and protect wells to maintain their integrity. The owner will determine if the wells need to be maintained. Adjust monitoring wells that need to be maintained and do not conflict with structures or curb and gutter to be flush with final grade. Coordinate with the owner the abandonment or adjustment of wells that conflict with structures or curb and gutter and wells that are not required to be maintained. Abandon monitoring wells in conformance with Ch. NR 141, Wis. Adm. Code.

612.3.3 Spills

1. Provide adequate spill response materials. Make spill response materials available at all times in which hazardous materials or waste are being handled or transported. Ensure spill response materials are compatible with the type of materials and contaminates being handled.
2. In the event of a spill or release of a hazardous substance, pollutant, contaminate, or oil, notify the engineer immediately. Take immediate containment actions to minimize the effect of any spill or leak. Perform cleanup in conformance with applicable federal, state, and local regulations. As directed by the engineer, perform additional sampling and testing to verify spills have been cleaned up. Provide spill cleanup and testing at no additional cost to the owner.

612.3.4 Roll-off Units

1. Watertight roll-off units may be used to temporarily store contaminated material. Place an impermeable cover over the units to prevent precipitation from contacting the stored material. Locate the units in an area approved by the engineer.

612.4 Basis of Payment

1. The owner will measure the hauling and disposal of contaminated soil bid item in tons by the actual amount of impacted material as documented by weight tickets generated by the treatment and disposal facility. Payment for hauling and disposal of contaminated soil is full compensation for segregating, loading, hauling, and landfilling of contaminated soil; for obtaining solid waste collection and transportation service licenses; for assisting in the collection of soil samples for field evaluation; and for dewatering of soils prior to transport, if necessary.
2. The owner will measure the stockpiling, reloading, and hauling of contaminated soil bid item in tons by the actual amount of impacted material as documented by weight tickets generated by the treatment and disposal facility. Payment for stockpiling, reloading, and hauling of contaminated soil is full compensation for segregating, loading, temporarily storing, reloading, hauling, and landfilling of contaminated soil; for obtaining solid waste collection and transportation service licenses; for assisting in the collection of soil samples for field evaluation; and for dewatering of soils prior to transport, if necessary.
3. Excavating, placing material on polyethylene sheeting, covering materials, and maintaining stockpiles will be considered incidental to the contract, unless specified otherwise. Landfill tipping fees will be paid for by the owner, unless specified otherwise.
4. Dewatering, pumping, and storing contaminated groundwater will be considered incidental to the contract, unless specified otherwise. Disposal fees will be paid for by the owner, unless specified otherwise.

5. No additional compensation will be provided for delay of work due to encountering contaminated soils or groundwater.
6. If the contract does not include the hauling and disposal of contaminated soil bid item or the stockpiling, reloading, and hauling of contaminated soil bid item, the owner will pay for the removal and disposal of contaminated soils as extra work.
7. No additional compensation will be provided for abandonment or adjustment of monitoring wells.

613 Utility Line Opening

613.1 Scope

1. This section describes performing the necessary excavation to uncover utilities for the purpose of determining elevation and potential conflicts with proposed sewers and pressure pipelines, as shown on the plans or as directed by the engineer.

613.2 Construction

613.2.1 Utility Line Opening

1. Perform the excavation in such a manner that utility in question is not damaged and the safety of the workers is not compromised.
2. Perform the utility line openings as soon as possible and at least 10 days in advance of proposed utility construction to allow any conflicts to be resolved with minimal disruption. Prior to ordering structures, perform utility line openings. Where utilities are within 6 feet of each other at a potential conflict location, only one utility line opening is called for. In these cases, a single utility line opening will be considered full payment to locate multiple utilities. Utility line openings include a trench up to 10 feet long, as measured at the trench bottom, and of any depth to locate the intended utility.
3. Obtain prior approval for all utility line openings from the engineer and coordinate all utility line openings with the engineer. Notify the engineer of this work a minimum of 3 days prior to the work so they may be present when the work is completed. Verify the need for performing utility line openings as shown on the plans, since some of the utilities may have been or will be relocated prior to the start of construction.
4. After performing the excavation, allow engineer sufficient time to survey the elevation of the crossing utility. Backfill opening with granular material, compact, and place and maintain temporary pavement. Place temporary pavement consisting of a minimum of 4 inches of asphalt, cold mix, or concrete. Perform restoration on the same day as the opening.
5. Cover openings with the core hole or an OSHA approved cover secured to prevent accidental displacement.
6. The absence of the requirement to perform a utility line opening does not relieve the contractor of the requirement to verify the elevation and location of existing utilities and to make adjustments to the proposed utilities as required by the engineer.

613.3 Basis of Payment

1. The owner will measure the utility line opening bid item as each opening acceptably completed. Payment for utility line opening is full compensation for the excavation required to expose the utility line; for backfilling and compacting the opening; for restoring the site; and for cleanup. The owner will only measure and pay at locations specifically identified on the plans.

614 Preparing the Foundation

614.1 Scope

1. This section describes restoring, correcting, strengthening, or otherwise preparing the pavement foundation to a condition suitable for constructing and supporting a subbase, base, or surface course.

614.2 General Requirements

1. Prepare foundations as specified in Section 211 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

614.3 Basis of Payment

1. Work specified in 614 is incidental to the contract.

615 Base Courses

615.1 Scope

1. This section describes constructing a dense-graded base using crushed stone, crushed gravel, or crushed concrete. This section also describes providing breaker run used primarily for subgrade correction and improvement.

615.2 General Requirements

615.2.1 Concrete Crushing Operations

1. A Special Use Permit, issued by the City of Fond du Lac Community Development Department, is required for any crushing performed within the City of Fond du Lac municipal boundary. Submit the approved permit to the engineer for review prior to any commencement of crushing operations or placement of materials. If the contractor chooses to crush at an off-site location outside the City of Fond du Lac municipal boundary, grant the engineer access to the crushing site and stockpiles for inspection and quality verification sampling.

615.2.2 Quality Control Samples

1. The engineer may request quality control samples, to be tested by the contractor, for virgin crushed aggregate base course material, to assure compliance with the specifications.
2. QMP testing and reporting will not be required except as required in 615.3.3.

615.3 Materials

615.3.1 General

1. Provide dense-graded base and breaker run as specified in Sections 301, 305, and 311 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

615.3.2 Allowed Aggregate Classifications

1. Reclaimed asphalt, reprocessed material, blended material, by-product materials, and recycled existing base material will not be accepted as base course aggregate unless approved by the engineer.

615.3.3 Crushed Concrete Dense-Graded Base

1. If the contractor chooses to use crushed concrete dense-graded base instead of virgin material, then include the following requirements with the corresponding bid items for crushed aggregate base course.

A. The owner will allow crushed material conforming to Sections 301 and 305 of the *Standard Specifications for Highway and Structure Construction* to be used for 1¼-inch dense base. Do not crush the pavement in place. The bid price for the use of crushed concrete dense-graded base shall also include that the contractor provide for all sample collection, testing and reporting. Provide testing of crushed concrete dense-graded base by the contractor in conformance with Section 730 of the *Standard Specifications for Highway and Structure Construction*.
B. The engineer may reject crushed concrete aggregate base course if supplied material contains asphaltic pavement, excessive surface base, or a combination of asphaltic pavement, surface materials, and base, incorporated during the removal operation. The engineer may reject crushed concrete aggregate base course if steel reinforcement is present in the base material supplied to the project.

615.4 Construction

615.4.1 General

1. Conform construction methods for the materials specified to Sections 301, 305, and 311 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

615.4.2 Compaction

1. Spread crushed aggregate base course on an approved compacted sub-base, bladed and compacted to obtain a degree of compaction such that no further appreciable consolidation is evidenced under the compaction equipment. Use a maximum of 5½-inch lifts for 1¼-inch or ¾-inch gradation aggregate and use a maximum of 9-inch lifts for 3-inch gradation aggregate.

615.4.3 Preparing the Foundation

1. Prepare the subgrade, or resurface the previously placed base layer, as specified in 614 before placing base. 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.
2. Before placing material, identify areas of yielding subgrade and perform corrective work as specified in 608.

615.4.4 Watering Base Course

1. If the base course material is too dry to readily attain the required compaction, add water as necessary to achieve compaction.

615.5 Basis of Payment

1. The owner will measure the crushed aggregate base course bid items by the cubic yard or square yard of specified thickness acceptably completed. The owner may deduct for contaminated aggregate. Payment for the crushed aggregate base course bid items is full compensation for preparing the foundation; for placing, shaping, compacting, and maintaining the base; for watering; for dust control; and for required testing.
2. The number of square yards listed within the schedule of prices is based upon a calculation of the area of aggregate as described within the street cross section details. Final payment for the crushed aggregate base course bid items will be at the quantity listed within the schedule of prices. No additional compensation will be made to the contractor for aggregate placed outside the bounds of aggregate described on the plans and specifications, unless such additional aggregate is expressly

directed and agreed to by the engineer prior to placement. The aggregate limits are 12 inches beyond the curb unless specified otherwise.

3. The owner will measure the breaker run bid item by the ton or square yard acceptably completed. Payment for breaker run is full compensation for providing breaker run; and for dust control.
4. The owner will measure and pay for providing crushed aggregate base course or breaker run to additional depth beyond the depth specified on the plans, when directed by the engineer, in proportion to the unit bid price for the planned depth of crushed aggregate base course or breaker run.
5. For measurement by the square yard, the contractor shall provide a net weight ticket for each load of material delivered to the project, to be for the engineer's records only – not as a basis of payment.
6. Use the following conversion factors for converting base aggregate dense and breaker run from tons to cubic yards:
   A. Base aggregate dense 3-inch = 2.0 tons per cubic yard
   B. Base aggregate dense 1¼-inch = 1.9 tons per cubic yard
   C. Base aggregate dense ¾-inch = 1.9 tons per cubic yard
   D. Breaker run = 1.75 tons per cubic yard
7. For measurement by the ton, the owner will determine weight based on contractor-provided tickets submitted daily. For material with more than 7% moisture, the owner will reduce the ticket weight by the weight of water exceeding 7%. The owner will determine moisture content as a percent of dry weight.
8. For measurement by the cubic yard, the owner will determine the volume in the vehicle.

616 Geosynthetics

616.1 Scope

1. This section describes providing geotextiles for subgrade separation, drainage filtration, and under riprap. This section also describes providing geogrid for subgrade reinforcement.

616.2 General Requirements

1. Furnish and install geosynthetics as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction*.

615.3 Basis of Payment

1. The owner will measure and pay for geosynthetics as specified in Section 645 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. No additional compensation will be provided for required overlap of material.

617 Concrete Pavement

617.1 Scope

1. This section describes constructing concrete pavement as well as pavement gaps, drilling in tie bars to tie existing to new concrete and drilling in dowel bars to transfer load between existing and new concrete; concrete surface drains; and concrete pavement removal and replacement.

617.2 General Requirements

617.2.1 Specifications

1. Construct concrete pavement and concrete pavement gaps as specified in Section 415 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. Install drilled tie bars and drilled dowel bars as specified in Section 416 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
3. Construct concrete surface drains as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
4. Remove and replace concrete pavement as specified in Sections 415 and 416 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

617.2.2 QMP Requirements

1. Provide QMP testing and reporting as specified in sections 701, 710, 715, and 716 of the *Standard Specifications for Highway and Structure Construction.* Modify the requirements as follows:
   A. Aggregate testing during concrete production as specified in 710.5.6 of the *Standard Specifications for Highway and Structure Construction* will not be required.
   B. The engineer may modify or waive the quality verification testing requirements specified in 715.3.1.3 of the *Standard Specifications for Highway and Structure Construction*.
   C. City contract work is not eligible for incentives for concrete strength or ride quality.

617.2.3 Concrete Pavement Sequencing

1. The owner desires to cause as little disruption and inconvenience to the abutting property owners as possible. Schedule the work so there is a minimum of delay between grading and paving operations.

617.3 Materials

617.3.1 Concrete Mixtures

1. Provide concrete mixtures in conformance with Section 415 of the *Standard Specifications for Highway and Structure Construction*.
2. Where the plans call for a high early strength or 7 bag concrete mix, provide a Grade C concrete mixture as defined in Section 501 of the *Standard Specifications for Highway and Structure Construction*. Do not use calcium chloride in the mixture. Achieve a minimum compressive strength of 3000 psi within 3 equivalent curing days as defined in Section 415 of the *Standard Specifications for Highway and Structure Construction*. Additional cement may be added with the permission of the engineer to open pavements to service within the required timeframe.
3. Where the plans call for a special high early strength or 9 bag concrete mix, provide a SHES portland cement concrete mixture as specified in Section 416 of the *Standard Specifications for Highway and Structure Construction.* Achieve a minimum compressive yield strength of 5000 psi at 8 hours.
4. Provide concrete mix designs to the engineer for approval. Do not place concrete before concrete mix designs are approved.

617.3.2 Aggregate Quality

1. Use crushed limestone only for aggregate used for all concrete work on this project. Stockpile all aggregate used on this project. Take samples from the stockpile; therefore, no materials may be added after test samples have been taken.

617.3.3 Reinforcement

1. Furnish steel reinforcement as the plans show and conforming to 415.2.2 of the *Standard Specifications for Highway and Structure Construction*.

617.3.4 Expansion Joint Filler

1. Furnish expansion joint filler conforming to 415.2.3 of the Standard Specifications for Highway and Structure Construction.

617.3.5 Concrete Curing Compounds

1. Furnish linseed oil based liquid curing compounds conforming to **ASTM C309, type 2, class B** as modified below.
   A. Furnish linseed oil emulsion curing compound consisting of, by volume exclusive of the pigment, 46-54% linseed oil and 46-54% water. Ensure that the oil phase is, by weight, 80% boiled linseed oil and 20% high viscosity (Z-8) linseed oil. Modify **ASTM C309** as follows:
      a. Waive the drying time requirement.

617.3.5 Joint Filler

1. Furnish joint filler conforming to 415.2.6 of the Standard Specifications for Highway and Structure Construction.

617.4 Construction

617.4.1 Preparing the Foundation

1. Prepare the foundation as specified in 614.

617.4.2 Concrete Pavement Grade

1. Install concrete pavement with a cross slope within 0.2% of the proposed grade or as directed by the engineer.

617.4.3 Frames, Grates, and Lids

1. Set frames accurately so the complete installation is to the correct elevation required to fit adjoining surfaces and as specified in 209.4.10 and 413.4.8. Make sure the grates or lids are not in place while striking off and finishing the adjoining concrete.

617.4.4 Concrete Pavement Jointing Plan

1. Plan and locate all points necessary to establish the horizontal position of the transverse and longitudinal joints to prevent uncontrolled cracking. Submit a joint layout design to the engineer at least 14 calendar days before paving. Do not lay out joints until the engineer has reviewed the joint layout design. Mark the location of concrete joints in the field. Follow the concrete pavement jointing plan details making adjustments as required to fit field conditions. For unique project circumstances not covered in the plan details, review the joint layout plan with the engineer.

617.4.5 Tie Bars and Dowel Bars

1. Do not cut epoxy-coated reinforcement.

617.4.6 Curing Concrete

1. Cure concrete as specified in 415.3.12 of the *Standard Specifications for Highway and Structure Construction*. Use concrete curing compound specified in 617.3.5.

617.4.7 Cold Weather Concreting

1. Mix, place, and protect concrete placed in cold weather as specified in 415.3.13 of the *Standard Specifications for Highway and Structure Construction*.

617.4.8 Protecting Concrete

1. Protect concrete as specified in 415.3.14 of the *Standard Specifications for Highway and Structure Construction*. In addition, provide a minimum of one concrete finisher to remain on the project site after final finishing of all concrete surfaces until such time as the concrete has hardened sufficiently to resist surface scarring caused by footprints, handprints, or any other type of imprint, malicious or otherwise. The finisher shall actively and continuously patrol on foot the newly placed concrete and repair any damage to the surface that might be sustained as described above.

617.4.9 Filling Joints

1. Fill joints as specified in 415.3.20 of the *Standard Specifications for Highway and Structure Construction* unless shown otherwise on the plans.

617.4.10 Remove and Replace Concrete Pavement

1. Remove and replace existing concrete pavement at locations shown on the plans or as directed by the engineer. Use high early strength or special high early strength concrete when shown on the plans or as directed by the engineer. Perform work in conformance with WisDOT standard detail drawings for concrete pavement repair and replacement.

617.5 Basis of Payment

1. The owner will measure the concrete pavement bid items by the square yard acceptably completed. The owner will make this measurement using the centerline length and the width from outside to outside of completed pavement, but limited to the width the plans show or the engineer directs. The owner will include fillets for widened sections, or at drain basins and similar locations, placed monolithic with the pavement.
   A. The owner will not deduct for fixtures with an area of one square yard or less as measured in the plane of the pavement surface.
   B. The owner will deduct the curb head and a 24-inch wide gutter section when constructed integrally with concrete pavement. The owner will measure and pay for the integral curb and gutter section as specified in 618.5.
2. Payment for all concrete bid items includes providing materials, including aggregates and associated aggregate source testing, cement, fly ash, slag, and admixtures; and for preparing, transporting, storing, jointing, surface finishing, protecting, and curing concrete.
3. Payment for the concrete pavement bid items is full compensation for providing jointing plan; for preparing the foundation; for providing pavement; for providing tie bars and dowel bars within concrete placed under the contract; for thickness coring and filling core holes; and for filling joints.
   A. The owner will not pay for removal and replacement of pavement not meeting the surface smoothness tolerances specified in 415.3.10 of the *Standard Specifications for Highway and Structure Construction*.
   B. The owner will pay separately for tie bars and dowel bars used to connect the work to concrete not placed under the contract.
4. The owner will measure the drilled tie bar bid items as each individual bar acceptably completed. Payment for the drilled tie bar bid items is full compensation for providing tie bars, including coating; for drilling holes in concrete not placed under the contract; and for epoxying or driving.

5. The owner will measure the drilled dowel bar bid items as each individual bar acceptably completed. Payment for the drilled dowel bar bid items is full compensation for providing dowel bars, including coating; for drilling holes in concrete not placed under the contract; and for epoxying.
6. The owner will measure the remove and replace concrete pavement bid items by the square yard acceptably completed. Payment for the remove and replace concrete pavement bid items is full compensation for sawing, breaking down, removing, and disposing existing pavements and excavated materials; for providing additional base material; for placing, shaping, compacting, and maintaining the base; for preparing the foundation; for providing pavement; for providing and installing tie bars and dowel bars; for repairing asphaltic shoulders; for backfilling; and for filling joints.
7. The owner will measure and pay for removing and replacing concrete pavement with lesser thickness or greater thickness than the concrete thickness specified on the plans, when directed by the engineer, in proportion to the unit bid price for the planned thickness of concrete pavement.
8. The owner will measure and pay for coloring or coloring and stamping concrete separately as specified in 621.5.
9. The owner will measure concrete pavement gaps as each individual gap acceptably completed. The owner will measure gaps when shown on the plans or special provisions, but not solely to accommodate the contractor's means and methods. The owner will measure multiple gaps at one roadway location as required to conform to contract staging provisions, but not solely to accommodate the contractor's means and methods. Payment is full compensation for providing pavement gaps. Payment for furnishing and placing concrete material is included under the concrete pavement bid items.
10. The owner will measure the concrete surface drain and flume bid item as each individual surface drain and flume acceptably completed. Payment for concrete surface drain and flume is full compensation for providing surface drains; for steel reinforcement and dowel and tie bars; and for excavating, preparing the subgrade and aggregate base, and backfilling.
11. If required to remove and replace any concrete damaged by lack of proper protection. Perform this work at no expense to the owner.
12. No additional compensation will be provided for hot weather concreting.
13. The owner will measure concrete pavement joint filling by the square yard acceptably completed, measured as the concrete pavement area plus the length times nominal width of adjacent curb and gutter. Payment for concrete pavement joint filling is full compensation for filling concrete pavement joints; for filling adjacent curb and gutter joints; and for sawing. Include concrete pavement joint filling in the concrete pavement and concrete curb and gutter bid items where the concrete pavement joint filling bid item is not included separately in the schedule of prices.

618 Concrete Curb and Gutter

618.1 Scope

1. This section describes constructing concrete curb, gutter; or curb and gutter, with, or without reinforcement.

618.2 General Requirements

618.2.1 Specifications

1. Construct concrete curb, gutter, or curb and gutter as specified in Section 601 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. Install drilled tie bars as specified in Section 416 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

3. Cure the concrete as specified in 617.4.6.
4. Mix, place, and protect concrete for curb and gutter as specified in 617.4.7.
5. Protect the concrete as specified in 617.4.8.

618.2.2 QMP Requirements

1. Provide QMP testing and reporting as specified in sections 701, 710, and 716 of the *Standard Specifications for Highway and Structure Construction.* Modify the requirements as follows:
   A. Aggregate testing during concrete production as specified in 710.5.6 of the *Standard Specifications for Highway and Structure Construction* will not be required.

618.3 Materials

618.3.1 Concrete Mixtures

1. Provide concrete mixtures in conformance with Section 601 of the *Standard Specifications for Highway and Structure Construction*.
2. Where the plans call for a high early strength or 7 bag concrete mix, provide a Grade C concrete mixture as defined in Section 501 of the *Standard Specifications for Highway and Structure Construction*. Do not use calcium chloride in the mixture. Achieve a minimum compressive strength of 3000 psi within 3 equivalent curing days as defined in Section 415 of the *Standard Specifications for Highway and Structure Construction*. Additional cement may be added with the permission of the engineer to open pavements to service within the required timeframe.
3. Provide concrete mix designs to the engineer for approval. Do not place concrete before concrete mix designs are approved.

618.3.2 Aggregate Quality

1. Use crushed limestone only for aggregate used for all concrete work on this project. Stockpile all aggregate used on this project. Take samples from the stockpile; therefore, no materials may be added after test samples have been taken.

618.4 Construction

618.4.1 Curb and Gutter Type

1. Install the type of curb and gutter shown on the plans. When no curb and gutter type is specified use the following:
   A. Use 30-inch concrete curb and gutter – standard except at intersections.
   B. Use 36-inch concrete curb and gutter – standard at radial curb at intersections between tangents.
   C. Use 36-inch concrete curb and gutter – standard at radial curb and straight curb at hammerhead turnarounds.

618.4.2 Integral Curb and Gutter

1. Unless specified otherwise in the contract, the contractor may construct curb, gutter, or curb and gutter by slip forming integrally with the pavement. Construct to the section the plans show. Extend the transverse joints in the pavement through the integral curb, gutter, or curb and gutter.
2. Dowel bars are not required within the limits of the integral curb, gutter, or curb and gutter. A tied longitudinal joint may be required to limit panel width to the maximum the plan details specify.

618.4.3 Base Course

1. Place aggregate under all concrete curb, gutter, or curb and gutter. Place aggregate 12 inches beyond the curb, gutter, or curb and gutter to allow for installation using a curb machine. Place aggregate 36 inches beyond the curb when placing integrally with pavement. Modify the aggregate limits when shown on the plans or as directed by the engineer.

618.4.4 Tie Bars

1. Do not cut epoxy-coated reinforcement.

618.4.5 Finishing and Curing the Backside

1. Finish the backside of concrete curb and gutter in a manner to ensure a smooth face for expansion joint installation at curb ramps, curbside sidewalk, and driveway openings.
2. Cure the backside of concrete curb and gutter as specified in 617.4.6.

618.4.6 Backfilling Curb

1. Clean all loose and broken chunks or debris behind new curb, gutter, or curb and gutter prior to placing satisfactory backfill materials. Remove the excess “concrete cream” along the lower edge of the back of curb, gutter, or curb and gutter. Remove material either during the pouring process or shortly thereafter.
2. Perform rough backfilling to within 6 inches of the top of new curb prior to paving the street. Use clean fill and thoroughly compact. Backfill to the limits shown on the plans.

618.4.7 Filling Joints

1. Fill joints as specified in 415.3.20 of the *Standard Specifications for Highway and Structure Construction* unless shown otherwise on the plans.

618.4.8 Hand Formed Concrete Curb and Gutter

1. Construct hand formed concrete curb and gutter when shown on the plans or directed by the engineer for the purpose of protecting existing tree roots. Limit excavation behind the curb and gutter to 4 inches. Do not injure or damage trees and shrubs left in place. Install variable height curb heads as required. Install conduit at hand formed curb and gutter locations as specified in 504.4.4 when required.

618.4.9 Remove and Replace Concrete Curb and Gutter

1. Remove and replace existing concrete curb and gutter at locations shown on the plans or as directed by the engineer. Use high early strength when shown on the plans or as directed by the engineer.

618.5 Basis of Payment

1. The owner will measure the concrete curb, gutter, or curb and gutter bid items by the linear foot acceptably completed. The length measured equals the distance along the base of the curb face, or along the flow line of the gutter. The owner will measure continuously along a line extended across driveway and alley entrance returns or ramps. The owner will not make deductions in length for drainage structures installed in the curbing such as drop inlets, etc.
2. Payment for the curb, gutter, and curb and gutter bid items is full compensation for foundation excavation and preparation; special construction required at driveway and alley entrances, or curb ramps; for providing materials, including concrete and expansion joints; for placing, finishing, protecting, and curing; for providing tie bars within concrete placed under the contract; for sawing joints; for backfilling; and for restoring the site.

A. The owner will pay separately for tie bars used to connect the work to concrete not placed under the contract as specified in 617.5.
B. The owner will pay separately for excavation required for and performed during this work as specified in 608 and 610. However, if the contract does not provide a bid item for common excavation or concrete curb and gutter removal, it is incidental to the work.

3. The owner will measure the curb, gutter, or curb and gutter by the linear foot when constructed integrally with concrete pavement. The integral curb and gutter will be paid separately for 30-inch concrete curb and gutter – standard and 36-inch concrete curb and gutter – standard and includes a 24-inch wide gutter section. No additional compensation will be provided for integral curb, gutter, or curb and gutter when required by the contract or when the contractor elects to install integral curb, gutter, or curb and gutter. The owner will measure and pay for the integral pavement section as specified in 617.5.
4. No additional compensation will be provided for excavation, base course, or other expenses when the contractor elects to install integral curb, gutter, or curb and gutter and the contract does not require integral curb, gutter, or curb and gutter.
5. The owner will measure the concrete curb and gutter hand formed bid items by the linear foot acceptably completed. The length measured equals the distance along the base of the curb face. The owner will not make deductions in length for drainage structures installed in the curbing such as drop inlets, etc. The owner will measure the concrete curb and gutter, hand forming required bid items only where shown on the plans or directed by the engineer. Measurement will not be made at other locations where the contractor elects to hand form curb and gutter. The owner may deduct for damage to trees, shrubs, and their root systems.
6. Payment for the concrete curb and gutter hand formed bid items is full compensation for foundation excavation and preparation; special construction required at driveway and alley entrances, or curb ramps; for providing materials, including concrete and expansion joints; for placing using forms; for finishing, protecting, and curing; for providing tie bars within concrete placed under the contract; for sawing joints; for installing electrical conduit; for backfilling; for restoring the site; and for protecting trees and shrubs.
   A. The owner will pay separately for tie bars used to connect the work to concrete not placed under the contract as specified in 617.5.
   B. The owner will pay separately for excavation required for and performed during this work as specified in 608 and 610. However, if the contract does not provide a bid item for common excavation, it is incidental to the work.
7. The owner will measure the drilled tie bar bid items as each individual bar acceptably completed. Payment for the drilled tie bar bid items is full compensation for providing tie bars, including coating; for drilling holes in concrete not placed under the contract; and for epoxying or driving.
8. The owner will measure the remove and replace concrete curb and gutter bid items by the linear foot acceptably completed. The length measured equals the distance along the base of the curb face. Payment for the remove and replace concrete curb and gutter bid items is full compensation for sawing, breaking down, removing, and disposing existing curb and gutter and excavated materials; for providing additional base material; for placing, shaping, compacting, and maintaining the base; for preparing the foundation; for special construction required at driveway and alley entrances, or curb ramps; for providing materials, including concrete and expansion joints; for placing, finishing, protecting, and curing; for providing and installing tie bars; for sawing joints; for backfilling; for filling joints; and for restoring the site.
9. If required to remove and replace any concrete damaged by lack of proper protection. Perform this work at no expense to the owner.
10. No additional compensation will be provided for hot weather concreting.

619 Concrete Driveways, Sidewalks, Ramps, and Steps

619.1 Scope

1. This section describes constructing driveways, sidewalks, ramps, and steps including landings, of concrete, with or without reinforcement.

619.2 General Requirements

619.2.1 Specifications

1. Place base course as specified in 615 except as noted in this section.
2. Construct concrete sidewalk and carriage walk as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
3. Construct concrete drive approaches as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
4. Construct concrete steps as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
5. Construct curb ramps and embed detectable warning filed arrays as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
6. Construct concrete pedestrian curb as specified in Section 601 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
7. Install drilled tie bars and drilled dowel bars as specified in Section 416 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
8. Cure the concrete as specified in 617.4.6.
9. Mix, place, and protect concrete driveways, sidewalks, ramps, and steps as specified in 617.4.7.
10. Protect the concrete as specified in 617.4.8, except that the engineer may allow the contractor to open sidewalks to pedestrian traffic after the concrete has developed sufficient strength to prevent damage to the surface.

619.2.2 QMP Requirements

1. Provide QMP testing and reporting as specified in sections 701, 710, and 716 of the *Standard Specifications for Highway and Structure Construction.* Modify the requirements as follows:
   A. Aggregate testing during concrete production as specified in 710.5.6 of the *Standard Specifications for Highway and Structure Construction* will not be required.

619.2.3 Concrete Driveway, Sidewalk, Ramps, and Steps Timing

1. The owner desires to cause as little disruption and inconvenience to the abutting property owners as possible. Schedule the work so there is a minimum of delay between grading and paving operations.

619.3 Materials

619.3.1 Concrete Mixtures

1. Provide concrete mixtures in conformance with Sections 416, 601, and 602 of the *Standard Specifications for Highway and Structure Construction*.
2. Where the plans call for a high early strength or 7 bag concrete mix, provide a Grade C concrete mixture as defined in Section 501 of the *Standard Specifications for Highway and Structure Construction*. Do not use calcium chloride in the mixture. Achieve a minimum compressive strength of 3000 psi within 3 equivalent curing days as defined in Section 415 of the *Standard*

Specifications for Highway and Structure Construction. Additional cement may be added with the permission of the engineer to open pavements to service within the required timeframe.

3. Provide concrete mix designs to the engineer for approval. Do not place concrete before concrete mix designs are approved.

619.3.2 Aggregate Quality

1. Use crushed limestone only for aggregate used for all concrete work on this project. Stockpile all aggregate used on this project. Take samples from the stockpile; therefore, no materials may be added after test samples have been taken.

619.3.3 Expansion Joint Filler

1. Furnish a rubber expansion joint filler of appropriate thickness, depth, and length conforming to **AASHTO M153** and **AASHTO M213** and listed below:
   A. Reflex Rubber Expansion Joint by The J D Russell Company.
2. Where dowel bars are required, use filler with holes factory-punched at the dowel bar locations and with a diameter not greater than ⅛ inch larger than the nominal dowel bar diameter.

619.3.4 Sidewalk Reinforcement

1. Furnish tie bars and dowel bars as specified in Section 505 of the *Standard Specifications for Highway and Structure Construction*.
2. Use epoxy coated bars, ½-inch diameter, and 12 inches in length.

619.3.5 Reinforcing Rods

1. Furnish No. 4 epoxy-coated deformed reinforcing rods.

619.3.6 Detectable Warning Fields

1. Furnish cast iron detectable warning fields with a natural patina from the WisDOT APL.
2. Furnish radial detectable warning fields when shown on the plans or as directed by the engineer.

619.3.7 Curb Box in Concrete Sidewalk or Driveway

1. The owner will provide Neenah R-7506-C Hudson boxes for curb boxes placed in concrete as specified in 415.4.7, 416.4.7, and 417.4.6.

619.3.8 Gas Service Box in Concrete Sidewalk or Driveway

1. Alliant Energy will provide Neenah R-7506-C Hudson boxes for gas service boxes placed in concrete.

619.3.9 Street Sign and Parking Meter Breakaway Anchors

1. Furnish reusable, breakaway anchors, designed for installation in concrete, that can be installed flush to the ground, and listed below:
   A. V-Loc by TAPCO.
2. Provide u-channel, square, or round breakaway anchors as required for the proposed sign or parking meter. Provide anchor sized for proposed post.

619.3.10 Street Sign and Parking Meter Sleeves

1. Furnish 4-inch diameter, SDR 35 PVC pipe. Use a pipe length of 18 inches for signs and 6 inches for parking meters.

619.3.11 Tree Frames and Grates

1. Furnish tree frames and grates manufactured from gray iron conforming to the requirements for **ASTM A48 Class 35B**.
2. Use a tree frame and grate of the type and dimensions shown on the plans or special provisions.
3. Ensure tree frames and grates are ADA compliant.
4. When required on the plans, furnish engineered soil mix.

619.3.12 Engineered Soil Mix for Trees

1. Provide engineered soil mix design for approval by engineer prior to installation.
2. Furnish engineered soil consisting of 40% organic compost, 20% sand, and 20% loam topsoil. Use compost created from 75% leaf material and 25% grass material. Use torpedo sand.

619.4 Construction

619.4.1 Sidewalk, Carriage Walk, and Drive Approach Base Course

1. Place ¾-inch dense-graded base under all sidewalks, carriage walks, and drive approaches as follows:
   A. For 4-inch thick concrete, provide 3-inch thick base course.
   B. For 6-inch thick concrete, provide 5-inch thick base course.
   C. For 8-inch thick concrete, provide 8-inch thick base course.
2. Construct base 6 inches beyond each edge of sidewalk, carriage walk, or drive approach.

619.4.2 Sidewalk Joints

1. Place expansion joints at locations shown on the standard detail drawings and as specified in Section 602 of the *Standard Specifications for Highway and Structure Construction*.
2. Also place expansion joints in transverse joints on both sides of each corner at street intersections, and at sharp changes in thickness of concrete such as at the ends of driveway sections where sidewalk thickness changes from 4 inches to 6 inches or 8 inches.
3. Round sidewalk edges along forms, un-sawed joints, and metal slab division forms with a ¼-inch radius edger.

619.4.3 Carriage Walks

1. Construct carriage walks where shown on the plans or directed by the engineer. Make carriage walks the same width as the existing carriage walk when replacing an existing carriage walk unless directed otherwise by the engineer.

619.4.4 Stamping

1. At the beginning of each run and at the end of the run, stamp the contractor's name and the year of pavement construction into the pavement. Use 2-inch numbers for the year of construction.

619.4.5 Curb Ramps

1. Construct curb ramps at the locations and conforming to the details and dimensions the plans show. Conform all new and repaired ramps to ADA and WisDOT design standards.
2. The engineer will determine the curb ramp layout at each intersection. Provide curb opening as shown on the standard detail drawings.
3. Ensure compliance with the slopes, dimensions, and other details shown on the plans or standard detail drawings.

619.4.6 Picture Framing

1. Picture frame concrete sidewalk and carriage walk as specified in 621.4.2 when shown on the plans or as directed by the engineer.

619.4.7 Remove and Replace Sidewalk, Carriage Walk, and Drive Approach

1. Remove and replace existing concrete sidewalk, carriage walk, or drive approaches at locations shown on the plans or as directed by the engineer. Use high early strength when shown on the plans or as directed by the engineer.
2. Place ¾-inch dense-graded base under all sidewalks, carriage walks, and drive approaches as follows:
   A. For 4-inch thick concrete, provide 3-inch thick base course.
   B. For 6-inch thick concrete, provide 5-inch thick base course.
   C. For 8-inch thick concrete, provide 8-inch thick base course.
3. Construct base 6 inches beyond each edge of sidewalk, carriage walk, or drive approach.
4. The existing base course may be reused where adequate. If reusing existing base course, periodically sample the base course thickness. In locations where the existing base course is not adequate install an appropriate base course. The engineer will make the determination in all areas whether the existing base course may be reused.

619.4.8 Expansion Joint Filler

1. Extend all expansion joint filler the full depth of the concrete being placed and with the top placed slightly below the finished surface of the sidewalk.

619.4.9 Sidewalk Reinforcement

1. Place tie bars where new sidewalk will be constructed adjacent to existing sidewalk.
2. Drill a suitably sized hole into the edge of the existing concrete 18 inches from each edge of sidewalk. Force drive the tie bar to a depth of 6 inches into the prepared hole.
3. At expansion joints, place dowel bars 18 inches from each edge of sidewalk in existing concrete as specified in Section 416 of the *Standard Specifications for Highway and Structure Construction*.
4. Place tie bars or dowel bars in concrete sidewalk when there is an interruption in pouring adjacent concrete sidewalk long enough for the concrete to develop its initial set.
5. Do not cut epoxy-coated reinforcement.

619.4.10 Reinforcing Rods

1. Place reinforcing rods in new concrete over utility trenches when shown on the plans or at other locations directed by the engineer. Install 2 rods in each sidewalk panel with a minimum length of 17 feet. The engineer may approve shorter length rods depending on field conditions. Space rods 18 inches apart. Extend rods a minimum of 12 inches beyond any trench excavation. Use baskets or other means to ensure rods are installed at a uniform height of one-half of the sidewalk depth.

619.4.11 Concrete Pedestrian Curb

1. Construct concrete pedestrian curb where shown on the plans or as directed by the engineer. Vary curb height as required to match site conditions.

619.4.12 Concrete Steps

1. Construct concrete steps and landings to the dimensions shown on the plans, to match existing concrete steps and sidewalk, or as directed by the engineer.

619.4.13 Curb Boxes in Concrete Sidewalk or Driveway

1. Place Hudson boxes around curb boxes and match the new sidewalk or driveway grade. Ensure that the covers are free of all concrete. The contractor is responsible for making sure each casting is in place before the concrete is poured. Adjust the curb box to approximately 3 inches below finish grade for the casting to fit properly. After the contractor has determined finish grade, the owner will adjust the curb box to the correct grade with 24 hours' notice. Ensure that the rim of the casting is installed within ¼ inch of the final concrete surface elevation.

619.4.14 Gas Service Boxes in Concrete Sidewalk or Driveway

1. Place Hudson boxes around gas service boxes and match the new sidewalk or driveway grade. Ensure that the covers are free of all concrete. The contractor is responsible for making sure each casting is in place before the concrete is poured. Ensure that the rim of the casting is installed within ¼ inch of the final concrete surface elevation. Perform any necessary coordination with Alliant Energy.

619.4.15 Street Sign and Parking Meter Breakaway Anchors and Sleeves

1. Install PVC sleeves or breakaway anchors for the installation of street signs or parking meters, as shown on the standard detail drawings or at locations approved by the engineer, where parking meters or street signs will be installed in proposed concrete areas. Construct either a PVC sleeve or breakaway anchor as indicated on the plans. Embed the sleeve or anchor in concrete flush with the concrete surface. The owner will install the post and sign or parking meter, unless noted otherwise. Cover and protect opening until post or parking meter has been installed.

619.4.16 Tree Frames and Grates

1. Install tree frames and grates according to manufacturer recommendations.
2. When required on the plans, install engineered soil mix directly under the tree grate.

619.4.17 Engineered Soil Mix for Trees

1. Place engineered soil mix to a depth of 48 inches and covering an area of 48 inches by 48 inches. If alternate dimensions are specified on the plans, use the plan dimensions.

619.4.18 Sidewalk Shaving

1. The owner may have sidewalk faults shaved under separate contract. Sidewalk with faults or 1 inch or less may be shaved at a 12:1 slope at locations shown on the plans or as directed by the engineer. Removal and replacement of the sidewalk may be necessary if shaving is not performed.

619.5 Basis of Payment

1. The owner will measure the concrete sidewalk and carriage walk bid items by the square foot acceptably completed. Measurement includes the area of the curb ramp and warning field. Payment for the concrete sidewalk and carriage walk bid items is full compensation for providing concrete, reinforcement, and expansion joints; for placing, shaping, compacting, and maintaining granular subbase or aggregate base; for tie bars; for installing Hudson boxes; for placing, finishing, protecting, and curing; for sawing joints; for excavation and backfill; and for restoring the site. Payment also includes providing tie bars and dowel bars in unhardened concrete.
   A. The owner will pay separately for tie bars used to connect the work to concrete not placed under the contract as specified in 617.5.

B. The owner will pay separately for excavation required for and performed during this work as specified in 608 and 610. However, if the contract does not provide a bid item for common excavation or sidewalk and driveway removal, it is incidental to the work.

2. The owner will measure the remove and replace concrete sidewalk and carriage walk bid items by the square foot acceptably completed. Payment for the remove and replace concrete sidewalk and carriage walk bid items is full compensation for sawing, breaking down, removing, and disposing existing sidewalks, drive approaches, and carriage walks and excavated materials; for checking base thickness and providing additional base material; for placing, shaping, compacting, and maintaining the base; for preparing the foundation; for providing materials, including concrete and expansion joints; for placing, finishing, protecting, and curing; for installing Hudson boxes; for providing and installing tie bars and reinforcing rods; for sawing joints; for backfilling; and for restoring the site. The owner will pay separately for detectable warning fields and concrete pedestrian curb.
3. Replace any new sidewalks or driveways where the Hudson boxes, pull boxes, or access boxes have been damaged, are not adjusted to the proper grade, or not installed in the concrete properly at no expense to the owner.
4. The owner will measure and pay for coloring or coloring and stamping concrete separately as specified in 621.5.
5. The owner will measure the drilled sidewalk bar bid items as each individual bar acceptably completed. Payment for the drilled sidewalk bar bid items is full compensation for providing tie bars or dowel bars, including coating; for drilling holes in concrete not placed under the contract; and for epoxying or driving.
6. Tie bars or dowel bars placed in concrete sidewalk when there is an interruption in pouring adjacent concrete sidewalk long enough for the concrete to develop its initial set are incidental.
7. The owner will measure the reinforcing rod bid items by the linear foot acceptably completed. Payment for the reinforcing rod bid items is full compensation for reinforcing rods.
8. The owner will measure the detectable warning field bid items as each individual unit of specified dimensions or by the square foot acceptably completed. The owner will measure the area of radial warning fields, computed by multiplying the height by the length through the center of the warning field. Payment for the detectable warning field bid items is full compensation for providing the warning field arrays of the specified configuration and color.
9. The owner will measure the detectable warning field installation bid items as each individual unit of acceptably completed. Payment for the detectable warning field installation bid items is full compensation for installing the warning field arrays including cutting radial arrays. The detectable warning field will be supplied by the owner.
10. The owner will measure concrete pedestrian curb by the linear foot acceptably completed. The length measured equals the distance along the base of the curb face. Payment for concrete pedestrian curb is full compensation for foundation excavation and preparation; for placing, shaping, compacting, and maintaining the base; for providing materials, including concrete, expansion joints, and tie bars; for placing, finishing, protecting, and curing; for tie bars; for sawing joints; for backfilling; and for restoring the site.
11. The owner will measure concrete steps by the square foot acceptably completed. The measured area of steps, including landings equals the sum of the areas of the treads and landings, computed by multiplying the tread and landing width by the tread and landing length, out to out of integrally placed wall. Payment for concrete steps is full compensation for providing concrete and reinforcement; for granular subbase or aggregate base; for tie bars; for placing, finishing, protecting, and curing; for excavation and backfill; and for restoring the site. Payment also includes providing tie bars and dowel bars in unhardened concrete.

12. The owner will measure the PVC post sleeve bid item as each individual sleeve acceptably completed. Payment for PVC post sleeve is full compensation for providing PVC pipe; for embedding pipe in concrete; and for protecting sleeve.
13. PVC post sleeves are incidental to the concrete sidewalk and carriage walk bid items where the PVC post sleeve bid item is not included in the schedule of prices.
14. The owner will measure the breakaway post anchor bid item as each individual anchor acceptably completed. Payment for breakaway post anchor is full compensation for providing anchor; for embedding anchor in concrete; and for protecting anchor.
15. If required to remove and replace any concrete damaged by lack of proper protection, perform this work at no expense to the owner.
16. No additional compensation will be provided for hot weather concreting.
17. The owner will measure the tree frame and grate bid items as each individual unit acceptably completed. Payment for tree frame and grate is full compensation for excavating; for disposing of surplus material; for furnishing and installing engineered soil mix; and for furnishing and installing frames and grates.

620 Concrete Corrugated Median and Concrete Median Nose

620.1 Scope

1. This section describes constructing a concrete corrugated median or concrete median nose.

620.2 General Requirements

620.2.1 Specifications

1. Construct concrete corrugated medians and concrete median noses as specified in Section 620 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. Cure the concrete as specified in 617.4.6.
3. Mix, place, and protect concrete for concrete corrugated median and concrete median nose as specified in 617.4.7.
4. Protect the concrete as specified in 617.4.8.

620.2.2 QMP Requirements

1. Provide QMP testing and reporting as specified in sections 701, 710, and 716 of the *Standard Specifications for Highway and Structure Construction.* Modify the requirements as follows:
   A. Aggregate testing during concrete production as specified in 710.5.6 of the *Standard Specifications for Highway and Structure Construction* will not be required.

620.3 Materials

620.3.1 Aggregate Quality

1. Use crushed limestone only for aggregate used for all concrete work on this project. Stockpile all aggregate used on this project. Take samples from the stockpile; therefore, no materials may be added after test samples have been taken.

620.4 Basis of Payment

1. The owner will measure concrete corrugated median by the square foot acceptably completed, including the nose section. Payment for concrete corrugated median is full compensation for

preparing the foundation; for providing materials, including concrete, joint filler and tie bars; placing, consolidating, shaping, finishing, curing, and protecting the concrete.

2. The owner will measure concrete median blunt noseby the square foot acceptably completed, for the nose section only. Payment for concrete median blunt nose is full compensation for preparing the foundation; for providing materials, including concrete, joint filler and tie bars; placing, consolidating, shaping, finishing, curing, and protecting the concrete.
3. The owner will measure concrete median sloped nose by the square foot acceptably completed, for the nose section only. Payment for concrete median sloped nose is full compensation for preparing the foundation; for providing materials, including concrete, joint filler and tie bars; placing, consolidating, shaping, finishing, curing, and protecting the concrete.
   A. If required to remove and replace any concrete damaged by lack of proper protection. Perform this work at no expense to the owner.
   B. No additional compensation will be provided for hot weather concreting.

621 Coloring and Stamping Concrete

621.1 Scope

1. This section describes coloring and stamping concrete used to construct work under other contract bid items as well as any special materials and special construction techniques associated with using colored concrete.

621.2 General Requirements

1. Color and stamp concrete as specified in Section 405 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

621.3 Materials

621.3.1 Color

1. Use the color dark redwood unless shown otherwise on the plans or special provisions.
2. Integrally color concrete using non-fading pigments conforming to **ASTM C979**.
   A. For dark redwood: use synthetic non-fading iron oxide at a loading of 6% or more by weight of total cementitious material in the mix. Match the concrete color in reasonably close conformance with dark redwood color, which is similar to Aerospace Material Specification Standard 595 – AMS-STD 30166.
   B. For WisDOT red: use synthetic iron oxide at a loading of 6% or more by weight of total cementitious material in the mix. Match the concrete color in reasonably close conformance with WisDOT red color, which is similar to Aerospace Material Specification Standard 595A – AMS-STD 31136.

621.3.2 Stamping Colored Concrete

1. Furnish full-depth colored concrete.
2. Use a running bond new brick stamped tool pattern.
3. Use a slate grey releasing agent to provide a look of mortared joints.

621.3.3 Curing Compound

1. Furnish a liquid membrane-forming clear curing compound conforming to ASTM C1315, type 1.

621.4 Construction

621.4.1 Stamping Colored Concrete

1. Color concrete full-depth.
2. Stamp concrete surfaces according to the manufacturer's instructions.
3. Apply release agent according to manufacturer's instructions.

621.4.2 Picture Framing

1. Finish concrete sidewalk and carriage walks with a picture frame border at locations shown on the plans. Provide a picture frame border width as shown on the plans, detail drawings, or as directed by the engineer.
2. The owner will accept the picture framing based on comparison to existing picture framed sidewalk on Main Street from Johnson Street to Merrill Avenue.

621.5 Basis of Payment

1. The owner will measure colored concrete by the cubic yard acceptably completed. Payment for colored concrete is full compensation for developing mix designs and providing sample panels or test slabs; for furnishing pigments; for special construction procedures required to install colored concrete; for removing test slabs, restoring the site, and disposing of waste material; and for other costs associated with coloring the concrete.
2. The owner will measure stamped concrete by the square yard acceptably completed. Payment for stamped concrete is full compensation for stamping; for special construction procedures required to install stamped concrete; and for other costs associated with stamping the concrete.
3. The owner will measure and pay for concrete pavement and concrete sidewalks separately as specified in 617.5 and 619.5.

622 Asphaltic Pavement

622.1 Scope

1. This section describes plant mixed asphaltic bases and pavements including binders, tack coats, surfaces, and overlays.

622.2 General Requirements

1. Construct asphaltic bases and pavements as specified in Sections 450, 455, 460, and 465 of the *Standard Specifications for Highway and Structure Construction* and WisDOT additional special provision 6 except as noted in this section.
2. City contract work is not eligible for incentive for HMA pavement density or ride quality.
3. QMP testing and reporting will not be required.
4. The owner desires to cause as little disruption and inconvenience to the abutting property owners as possible. Schedule work so there is a minimum of delay between grading and paving operations.
5. Prepare all asphaltic mixes furnished under this contract in a batching-type asphalt plant having a minimum capacity of 100 tons per hour. Equip the plant with and operate effective dust collectors to prevent complaints and possible legal action from residents near the plants operation. Ensure plant equipment, trucking equipment, laying equipment, and all personnel are of such condition and caliber that work in progress can proceed as continuously as possible, with a minimum of delay from equipment failure or inadequate workmanship.

622.3 Materials

622.3.1 Asphalt Mixes

1. Furnish HMA pavement of the gradation, traffic volume, binder, and designation required by the plans and special provisions. Comply with the minimum layer thickness for the selected gradation. If no pavement type is specified use the following:
   A. For binder course, use 3 LT 58-28 S HMA pavement.
   B. For surface course, use 4 LT 58-28 S HMA pavement.

622.3.2 Tack Coat

1. Furnish tack coat in conformance with Section 455.2.5 of the *Standard Specifications for Highway and Structure Construction*.

622.3.3 Manhole Adjustment Rings

1. Furnish materials conforming to the following:
   A. Gray iron **ASTM A48 Class 35B**
2. Ensure that castings are true to pattern in form dimensions, free from pouring faults, sponginess, cracks, blowholes, and other defects in positions affecting strength and value for the service intended. Ensure that castings are boldly filleted at angles and that the risers are sharp and perfect. Sandblast castings or otherwise effectively clean scale and sand so as to present a smooth, clean, and uniform surface.
3. Furnish Neenah R-1979 series manhole adjustment rings. Use adjustment rings with rise necessary to meet final grade. For standard city manhole frames, use R-1550-7150 for 1.5-inch rise and R-1550-7200 for 2-inch rise. Contractor is responsible for selecting adjustment rings with appropriate rise and lid diameter and thickness. Notify the engineer if required rise cannot be obtained.

622.4 Construction

622.4.1 Preparing the Foundation

1. Prepare the foundation as specified in 614.

622.4.2 Tack Coat

1. Apply tack coat to all asphalt lower layer courses and all vertical surfaces such as curb and gutter and butt joints prior to laying asphalt surface courses.

622.4.3 Minimum Required Density

1. In the event pavement fails to meet the required density, the engineer has the right to order the inferior asphalt removed and replaced at the expense of the contractor or administer density disincentives according to Section 460 of the *Standard Specifications for Highway and Structure Construction*.

622.4.4 Surface Course Paving

1. Take special care to avoid cold joints between passes in placing of the surface course, and make every effort to obtain a smooth, uniform appearance in the finished street.

622.4.5 Asphalt Pavement Grade

1. Install manhole frames such that the frame is between ¼ inch lower than the asphalt pavement and flush with the asphalt pavement after the final rolling of the asphalt pavement. Verify that the adjusted elevations of manhole frames match the proposed pavement slope and grade prior to paving. Install asphalt pavement approximately ¼ inch above the flange line of the gutter

except at curb ramps. Construct the cross slope of asphalt pavement within 0.2% of the proposed grade or as directed by the engineer.

622.4.6 Asphalt Driveway

1. Saw or mill existing pavement at the removal limits and remove existing driveways, parking lots, trails, or areas outside right-of-way as specified in 605 for sawing; in 625 for milling pavement; in 608 for excavation; and in 610 for removing, adjusting, replacing or abandoning miscellaneous structures. Prepare the foundation as specified in 614. Construct base course as specified in 615. Construct base course to match the existing thickness or to 6 inches, whichever is greater, or as directed by the engineer. Construct HMA surface course pavement. Construct pavement to match the existing thickness or to 3 inches, whichever is greater, or as directed by the engineer.

622.4.7 Asphalt Overlays

1. When required on the plans mill existing pavements as specified in 625. Construct HMA binder and surface course to the depths shown on the plans, or as directed by the engineer.
2. If the proposed pavement grade will be raised, adjust existing frames and covers to meet the final grade. Install the required adjustment. In the event special conditions are encountered, contact the owner to accomplish work not included in this contract. If it is determined that this work is required, the owner will determine what manhole or other castings require adjustment to a satisfactory final grade, and the owner's forces will make any such necessary adjustments at city cost prior to the contractor's leveling binder and repaving operations.

622.4.8 Remove and Replace Asphalt Pavement

1. Remove and replace existing asphalt pavement at locations shown on the plans or as directed by the engineer. Construct pavement to match the existing thickness or to 4.5 inches, whichever is greater, or as directed by the engineer. Place binder and surface courses at a thickness approved by the engineer.

622.5 Basis of Payment

1. The owner will measure the asphalt binder course bid items by the ton or the square yard of specified thickness acceptably completed. Payment for the asphalt binder course bid items is full compensation for mixture design; for preparing the foundation; for furnishing, preparing, hauling, mixing and placing of all materials, including asphaltic materials and tack coat; for compacting mixtures; and for maintaining the completed work.
2. The owner will measure the asphalt surface course bid items by the ton or the square yard of specified thickness acceptably completed. Payment for the asphalt surface course bid items is full compensation for mixture design; for preparing the foundation; for furnishing, preparing, hauling, mixing and placing of all materials, including asphaltic materials and tack coat; for compacting mixtures; and for maintaining the completed work.
3. The owner will measure the asphalt overlay bid items by the ton or the square yard of specified thickness acceptably completed. Payment for the asphalt overlay bid items is full compensation for mixture design; for adjusting structures; for preparing the foundation; for furnishing, preparing, hauling, mixing and placing of all materials, including asphaltic materials and tack coat; for compacting mixtures; and for maintaining the completed work. The owner will measure and pay for adjusting existing manholes separately as specified in 209.5 and 413.5.
4. The owner will measure the asphalt driveway and trail bid items by the square yard of specified thickness acceptably completed. Payment for the asphalt driveway and trail bid items is full compensation for sawing or milling; for placing, shaping, compacting, and maintaining the base; for mixture design; for preparing the foundation; for furnishing, preparing, hauling, mixing and placing

of all materials, including asphaltic materials and tack coat; for compacting mixtures; and for maintaining the completed work.

5. The owner will measure and pay for providing asphalt surface course for asphalt driveways and trails to additional depth beyond the depth specified on the plans, when directed by the engineer, in proportion to the unit bid price for the planned depth of asphalt surface course.
6. The owner will measure the remove and replace asphalt pavement bid item by the square yard acceptably completed regardless of depth or number of courses encountered. Payment for remove and replace asphalt pavement is full compensation for sawing or milling, breaking down, removing, and disposing existing pavements and excavated materials; for providing additional base material; for placing, shaping, compacting, and maintaining the base; for mixture design; for preparing the foundation; for furnishing, preparing, hauling, mixing and placing of all materials, including asphaltic materials and tack coat; for compacting mixtures; and for maintaining the completed work.
7. For measurement by the square yard, provide a net weight ticket for each load of material delivered to the project, to be for the engineer's records only – not as a basis of payment. Submit tickets daily as work is completed.
8. For measurement by the ton, provide a net weight ticket for each load of material delivered to the project. Submit tickets daily as work is completed.
9. No additional compensation will be provided for cold weather paving unless approved by the engineer for circumstances beyond the contractor's control. If approved the owner will pay for the additional costs as extra work.
10. No additional compensation will be provided for applying tack coat.

623 Cold Patch

623.1 Scope

1. This section describes furnishing cold patch and filling potholes and other voids in pavement or sidewalk surfaces or providing temporary sidewalk or pavement patches as the engineer directs.

623.2 General Requirements

1. Cold patch may be used to provide temporary pavement or sidewalks when shown on the plans or special provisions or when approved by the engineer.

623.3 Materials

623.3.1 Mixture

1. Furnish a mixture of coarse aggregate, natural sand, and MC-250 bituminous material designed to have a workability range of 15-100 degrees Fahrenheit without heating. Ensure that the mixture:
   A. Adheres to wet surfaces.
   B. Resists damage from water, salt, and deicing products.
   C. Requires no mixing or special handling before use.
   D. Supports traffic immediately after placement and compaction.

623.3.2 Gradation

1. Conform to the gradation requirements in ***Table 623-1***.

Table 623-1
Cold Patch Gradation

U.S. Standard Sieve Size	Percent Passing by Weight
½-inch	100
⅜-inch	90-100
No. 4	90 max
No. 8	20-65
No. 200	2-10
Bitumen	4.8-5.4

623.3.3 Acceptance

1. The owner will accept cold patch based primarily on the engineer's visual inspection. The owner may test for gradation.

623.4 Construction

623.4.1 General

1. Stockpile cold patch on site on a smooth, firm, well-drained area cleared of vegetation and foreign material. Cover the stockpile and ensure that it is easily accessible. Replenish the stockpile throughout the project duration but limit the size at any given time to 10 tons on the site unless the engineer approves otherwise. Dispose of unused material at project completion unless the engineer directs otherwise.
2. Place cold patch by hand. Remove ponded water and loose debris before placement. Compact flush with a tamper, roller, or vehicle tire after placement.
3. Refill patched area as necessary to maintain a flush pavement surface until project completion.

623.5 Basis of Payment

1. The owner will measure the cold patch bid items by the square yard of specified thickness acceptably completed. Payment for the cold patch bid items is full compensation for providing and maintaining patches; for furnishing and replenishing stockpile material on-site; for maintaining the completed work during the project duration; and for disposing of excess material at project completion.
2. The owner will measure the cold patch bid items only when included on the schedule of prices. If not included on the schedule of prices, and the contractor places cold patch for their own means and methods, all costs associated with cold patch are incidental.

624 Gravel Roadways and Driveways

624.1 Scope

1. This section describes excavating existing gravel roadways, alleys, driveways, and parking areas, placing new gravel, and compacting.

624.2 Materials

1. Furnish materials for gravel areas that match the gradation and type of the existing materials whenever possible. Where the existing gradation and type is not known, use ¾-inch dense-graded base as specified in 615.3.1.

624.3 Construction

1. Excavate existing gravel areas and remove and dispose materials. Place and compact gravel as specified in 615.4. Place gravel to match the existing thickness or to a minimum of 6 inches, whichever is greater.

624.4 Basis of Payment

1. The owner will measure 6-inch gravel driveway by the square yard acceptably completed. Payment for 6-inch gravel driveway is full compensation for excavating existing gravel and for providing and compacting gravel.

625 Milling Pavement

625.1 Scope

1. This section describes partial depth in-place milling of the existing asphaltic or concrete pavements and removing and disposing millings. The section also describes relaying the milled material to construct a new base.

625.2 General Requirements

625.2.1 Mill and Relay

1. Mill existing asphaltic pavement and relay as specified in Section 330 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

625.2.2 Surplus Material

1. Pick up, transport, and unload material at city stockpiles when directed by engineer. If the owner does not require disposal at owner stockpile, surplus material will become property of the contractor and contractor is responsible for disposal.

625.3 Construction

625.3.1 General

1. Remove the existing asphaltic or concrete pavement without incorporating or damaging underlying material that will remain in place. Provide a uniform milled surface that is reasonably plane, free of large scarification marks, and has the grade and transverse slope the plans show or the engineer directs.
2. Use a self-propelled milling machine with depth, grade, and slope controls and minimum capabilities of removing, in one pass, a layer of existing asphaltic or concrete pavement 2 inches in depth, and simultaneously removing, picking up, and depositing the salvaged material in vehicles for transport to a site provided by the contractor or owner. Shroud the drum to prevent discharging loosened material into adjacent work areas or live traffic lanes. Provide an engineer-approved dust control system. Windrowing or storing of the salvaged material on the roadway will not be permitted except when milling and relaying.
3. Maintain one lane of traffic during working hours. Clear the roadway of materials and equipment during non-working hours. Grade shoulders adjacent to milled areas by the end of each work day to provide positive drainage of the pavement. The engineer may waive one or more of these requirements if the street is closed to traffic or if a particular operation does not endanger traffic.

625.3.2 Partial Depth Milling

1. Mill the existing asphaltic pavement to the depth the plans show and until 100% will pass the 1½-inch sieve.
2. Do not allow abrupt longitudinal differences of 2 inches or more between lanes during non-working hours. Repair surface damage, caused by intervening construction or public traffic, immediately before paving as necessary to provide a good riding pavement.

625.3.3 Edge Milling

1. Mill the existing asphaltic or concrete pavement to the depth and width the plans show, along the gutter flange, and until 100% will pass the 1½-inch sieve. Taper the milling pass from full depth to 0 inches deep at the specified width. Preserve the existing gutter edge. Decrease concrete milling depth to avoid reinforcing steel.

625.3.4 Ramps

1. Upon completion of milling operations, ramp all driveway entrances and butt joints along the project route, as directed by the engineer. Provide a reasonably smooth transition at the ramps from existing pavement to milled surface. Maintain these ramps until new asphalt is placed.

625.3.5 Grade and Slope Controls for Mill and Relay

1. Immediately after milling, relay the material with a paver, grader, or both a paver and grader. Use equipment with automatic grade and slope control systems for adjusting the slope through super-elevated curves, transitions, and tangent sections and an averaging device to achieve a smooth profile. If the automatic control systems break down, the contractor may use manual controls for the remainder of that day only.

625.4 Basis of Payment

1. The owner will measure mill and relay by the square yard acceptably completed. Payment for mill and relay is full compensation for milling, windrowing, relaying, furnishing and adding water, shaping, compacting, and removing waste material; for dust control; and for providing, maintaining, and removing ramps.
2. The owner will measure the mill bid items by the square yard acceptably completed. Payment for the mill bid items is full compensation for milling; for dust control; for removing, hauling, unloading, and disposing waste material; and for providing, maintaining, and removing ramps.
3. The owner will measure milling of areas with a slurry backfill for trench backfill or road repairs as asphalt milling.
4. The owner will measure and pay for milling to additional depth beyond the depth specified on the plans, due to pavement or base deterioration, in proportion to the unit bid price for the planned depth of milling.

626 Pulverized and Re-Laid Pavement

626.1 Scope

1. This section describes full depth in-place pulverizing of the existing asphaltic pavement along with a portion of the underlying base and relaying the pulverized material to construct a new base.

626.2 General Requirements

1. Perform work as specified in Section 325 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.
2. Thoroughly pulverize and mix the existing asphalt surface with a sufficient amount of existing gravel base to produce a homogenous, well-graded material. Grade and compact the pulverized material

to the required density to maintain traffic until new asphalt pavement is laid. Add water, as required, both before and during compaction.

626.3 Construction

626.3.1 Pavement Transitions

1. Ensure that the transition to the adjacent asphalt pavement is smooth and includes a 2-inch butt joint.

626.3.2 Streets with Shoulders

1. On streets with shoulders, place the pulverized material such that the final finished asphalt surface is no more than 3 inches above the average adjacent shoulder elevation. Fine grade pulverized material to form a 1-foot wide shoulder matching the finished asphalt pavement and the existing shoulder elevation.

626.3.3 Grade and Slope Controls

1. Immediately after pulverizing, relay the material with a paver, grader, or both a paver and grader. Use equipment with automatic grade and slope control systems for adjusting the slope through super-elevated curves, transitions, and tangent sections and an averaging device to achieve a smooth profile. If the automatic control systems break down, the contractor may use manual controls for the remainder of that day only.

626.4 Basis of Payment

1. The owner will measure pulverize and relay by the square yard acceptably completed, measured using the centerline length and the width from outside to outside of completed base, but limited to the width the plans show or the engineer directs. Payment for pulverize and relay is full compensation for pulverizing, windrowing, relaying, adding water, shaping, and compacting; and for water for compaction and dust control.

627 Landscaping and Restoration

627.1 Scope

1. This section describes furnishing, installing, and maintaining permanent site restoration including furnishing or salvaging, placing, and spreading topsoil; furnishing and incorporating fertilizing material in the soil on areas of proposed seeding; preparing seed beds and furnishing and sowing the required seed on the slopes; furnishing, placing, and anchoring a mulch cover; and furnishing, hauling, and applying water.

627.2 General Requirements

627.2.1 Seed Mixes

1. Use seed within one year of the test date appearing on the label.
2. Test seed for purity, germination and noxious weed seed content according to the Rules for Testing Seed, published by the Association of Official Seed Analysts.
3. Store seed delivered before use in a way that protects it from damage by heat, moisture, rodents, or other causes. Discard and replace any previously tested and accepted seed that becomes damaged.

627.2.2 Restoration Limits

1. Place topsoil and hydroseed all disturbed areas, outside of pavement yet within the construction limits, as designated on the plans, unless noted otherwise or directed otherwise by the engineer.

627.2.3 Work on Private Property

1. Whenever any of the work is performed on or through property other than that owned by the city, the contractor shall furnish the city, before final acceptance of the work by the city under 105.9.1.6, a written release from the owner, or proper authority acting for the owner of the property affected, stating that the restoration of structures and surfaces has been satisfactorily accomplished. If, in the opinion of the city, the release is arbitrarily withheld, the city may in its sole discretion, accept the portion of the work involved and cause final acceptance to be granted.

627.3 Materials

627.3.1 Topsoil

1. Topsoil consists of loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils adapted to sustain plant life, and in a pH range of 6.0 to 7.0.
2. Salvaged topsoil consists of the loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils available from overlying portions within the project limits.
3. Ensure that 100% of the topsoil passes a one-inch sieve, 99% passes a $^{9}/_{16}$-inch sieve and at least 90% pass the No. 10 sieve (2.00 mm). The owner may require testing of topsoil and approval by the engineer.

627.3.2 Fertilizer

1. Furnish type A fertilizer as specified in Section 629 of the *Standard Specifications for Highway and Structure Construction*.

627.3.3 Seed Mixes

1. Use a seed mix listed below in lawn areas:
   A. Fondy Special Lawn Seed Mix or CV Lawn Mix by Country Visions.
2. Use seed mixture No. 30 as specified in Section 630 of the *Standard Specifications for Highway and Structure Construction* for unimproved areas with the approval of the engineer.

627.3.4 Mulching

1. Furnish a mulch product listed below:
   A. ProMatrix Engineered Fiber Matrix by Profile Products.
   B. Excel Fibermulch II by American Exclesior Company.
   C. Seed Starter 3 Mulch with Tackifier by Lesco.
   D. Seed Aide CoverGrow by Profile Products in small restoration areas with the approval of the engineer.
2. Deliver products to the construction site in factory labeled packages. Store and handle in compliance with manufacturer's instructions. Protect product from weather damage, excessive temperatures and construction operations.

627.3.5 Tackifier

1. Furnish tackifier products from the PAL. A tackifier is not required when using ProMatrix mulch.

627.4 Construction

627.4.1 Restoration Limits

1. Where no terrace restoration is proposed, limit the restoration area around spot repair sidewalk to 6 inches beyond the front and back edge of the sidewalk and extending the length of sidewalk to be replaced.
2. The contractor is advised to limit the size and areas of operation of all construction equipment to the limits of construction. Repair and restore at the contractor's expense any lawns, landscaping, sidewalks, driveways, private property, or public property damaged during construction.

627.4.2 Topsoil

1. Cut or fill restoration areas to proper grade according to the typical cross-section and plan grades. If the plans do not indicated grades, uniformly level slopes between grade points and existing finish grade. Do not exceed a slope of 6:1 without permission of the engineer. Round abrupt changes in grade.
2. Scarify subgrade to a depth of one inch prior to placement of topsoil.
3. Place topsoil to the depth shown on the plans. If no depth is shown, place and spread the topsoil to a minimum depth of 4 inches. Compact any fill so as to guarantee no settlement.
4. Break down all clods and lumps using the appropriate equipment to provide a uniformly textured soil. Remove rocks, twigs, foreign material, and clods larger than 1-inch diameter that cannot be broken down.
5. Dress the entire surface to present a uniform appearance.
6. Salvaged topsoil may be used when indicted on the plans or approved by the engineer.

627.4.3 Salvaging Topsoil

1. Mow topsoil procurement areas to a height of approximately 6 inches. Remove litter such as brush, rock, and other materials that will interfere with subsequent vegetation establishment.
2. Strip off the humus-bearing soil. Take care to minimize removing the underlying sterile soil. Then stockpile the topsoil on the right-of-way or place it directly on the designated areas.

627.4.4 Fertilizer

1. Apply fertilizer during hydroseeding operations.
2. If not applied during hydroseeding operations uniformly apply the fertilizer to the seeding areas and incorporate into the soil by light discing or harrowing. If applying granular fertilizer, ensure it is well pulverized and free from lumps. Apply fertilizer just before, and in conjunction with, final discing or harrowing, or if hand manipulating the topsoil, apply it just before final raking and leveling.
3. Apply a total amount of 7 pounds per 1,000 square feet on all restorations areas.
4. Do not apply fertilizer within 25 feet of a waterway without approval by the engineer.

627.4.5 General Seeding Requirements

1. Perform seeding when and as the engineer directs or allows. Provide protective cover within 24 hours after sowing.

627.4.6 Seed Bed Preparation

1. Complete grading, shouldering, topsoiling, and fertilizing before permanent seeding, except the contractor may place the fertilizer and seed mixture in one operation if using equipment designed for the purpose.

2. Just before seeding, work the area being seeded with discs, harrows, or other appropriate equipment to obtain a reasonably even and loose seedbed.

627.4.7 Lawn Seeding

1. Sow the seed mixture using equipment adapted to the purpose, or by scattering it uniformly over the areas to be seeded. Lightly rake or drag to cover the seed with approximately ¼ inch of soil. After seeding, lightly roll or compact the areas using suitable equipment, preferably the cultipacker type, when the engineer judges the seedbed too loose, or if the seedbed contains clods that might reduce seed germination. Do not roll slopes steeper than 1:3.
2. If scattering seed by hand, perform this work with satisfactory hand seeders and only when the air is calm enough to prevent seeds from blowing away.
3. Apply a total amount of 5 pounds per 1,000 square feet on all restorations areas.

627.4.8 Manual Seeding

1. Perform seeding in two operations, manual seeding and hydromulch seeding, unless noted otherwise. Apply half of the total amount of seed manually and half during hydroseeding operations. Use a seeding rate of 2.5 pounds per 1,000 square feet during both the manual application and during hydroseeding application. Rake the manually applied seed into the topsoil prior to application of hydromulch seeding.

627.4.9 Hydroseeding

1. Use a well-trained, experienced application technician to perform hydroseeding.
2. Do not perform hydroseeding in the presence of free surface water resulting from rains, melting snow, or other causes; during periods of windy conditions that would prevent proper placement; or on top of snow.
3. Use mulch with all hydroseeding applications.
4. Dye mixture to allow metering of its application.
5. Sow or spread the seed and mulch upon the prepared bed using a stream or spray of water under pressure and operated from an engineer-approved machine designed for that purpose. Place the selected seed mixture, fertilizer, mulch, tackifier, and water into a tank, provided within the machine, in sufficient quantities that when spraying the mixture on a given area it is uniformly spread at the required application rate. During this process, keep the tank contents stirred or agitated to provide uniform distribution.
6. Apply the hydroseeding using a bidirectional application method to achieve desired coverage.
7. Spread the tank contents within one hour after adding the seed to the tank. The engineer will reject seed that remains mixed with the water for longer than one hour.
8. The engineer will not require dragging or rolling.

627.4.10 Seeding Timing

1. Perform seeding when soil temperatures remain consistently above 53 degrees Fahrenheit. Use dormant seed when soil temperature is consistently below 53 degrees Fahrenheit.
2. Do not perform seeding between June 15 and August 15 without approval by the engineer. Approval will be dependent on temperature and the contractor's plan for watering.
3. Use either a bonded fiber matrix or an erosion mat for late season restoration performed after September 15. When placing a bonded fiber matrix for late season restoration use ProMatrix Engineered Fiber Matrix or a product approved by the engineer. When installing erosion mats for late season restoration use a Class I, Urban, Type A product from the PAL.

627.4.11 Mulching

1. Place the mulch loosely or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce erosion.
2. Uniformly spread the mulching material over the designated areas at the manufacturer's recommended application rate. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.
3. Unless the contract specifies otherwise, install mulch during hydroseeding except in small restoration areas with the approval of the engineer.
4. Apply on all restorations areas at the rate recommended by the manufacturer or as approved by the engineer.
5. Install an erosion mat when shown on the plans or required by the engineer.

627.4.12 Tackifier

1. Treat mulch and seed with a tackifier, blow from a machine, and uniformly deposit over designated areas in one operation.
2. Mix and place tackifier according to the PAL.
3. Use an engineer-approved machine to place the mulch that blows or ejects by constant air stream a controlled quantity of mulch and applies a spray of tackifier to partially coat the mulch, sufficient to hold together and keep in place the deposited mulch. The contractor may apply the tackifier as an overspray in a separate operation after placing the mulch.

627.5 Maintenance

627.5.1 Watering

1. If rainfall is not sufficient, keep seeded areas thoroughly moist. Once the seed has germinated, do not let the top inch of soil dry out until the vegetation is well established. Maintain soil moisture until substantial vegetation is established unless the engineer directs or allows otherwise.
2. Water twice a week following the completion of seeding with no more than 3 working days between watering. If a precipitation event, greater than ½ inch, occurs the contractor may omit one watering requirement per precipitation event. Apply a total of 1 inch of water per week to restoration areas or until the soil is thoroughly moistened to a minimum depth of 1 inch. The contractor may be required to water additionally as directed by the engineer. Apply water in a manner that precludes washing or erosion.
3. The contractor may obtain water from the non-potable effluent water hydrant located at the Fond du Lac Regional Wastewater Treatment & Resource Recovery Facility at 700 Doty Street. Access is available Monday through Friday from 6:00 am to 3:00 pm. Gain access during these times.

627.5.2 Lawn Restoration

1. Correct any restored areas that have settlement (greater than ½ inch), do not exhibit adequate germination, or have excessive weed growth prior to final acceptance as specified in 105.9.1.6. Maintain the mulched areas and repair areas damaged by wind, erosion, traffic, fire or other causes.

627.6 Basis of Payment

1. The owner will measure the lawn restoration bid items by the square yard acceptably completed. The measured quantity will equal the actual number of square yards of restoration area within the limits of construction designated on the plans, or in the contract, or as the engineer directs.

Payment for the lawn restoration bid items is full compensation for providing, excavating, loading, hauling, and placing topsoil; for removing, stockpiling, reclaiming, hauling, and placing salvaged topsoil; for undercutting excavation, or underfilling embankments necessary to receive topsoil; for providing, hauling, placing, and incorporating fertilizer; for providing, handling, and storing seed; for preparing the seed bed, sowing, covering, and firming the seed; for providing mulch materials, including tackifiers; for hauling, treating, placing, spreading, and anchoring mulch material; and for maintaining the work and repairing damaged areas.

2. No additional compensation will be provided for restoration outside the areas of the grading limits or limits of construction unless approved by the engineer.
3. No additional compensation will be provided for any work required for late season restoration.
4. No additional compensation will be provided to complete any work after the project completion date including anything done to complete work items left uncompleted prior to the project completion date, to repair excessively settled areas (greater than ½ inch), to repair areas of sparse vegetation, to repair areas of excessive weeds, or other repair work required to satisfactorily complete the landscaping and restoration work items.
5. The owner will measure the restoration watering bid item by the 1000 gallons acceptably completed, measured as the volume indicated by engineer-approved meters or by the volume of tanks of known capacity. Payment for restoration watering is full compensation for providing, hauling, and applying the water.

628 Signing

628.1 Scope

1. This section describes furnishing and erecting posts to support signs. This section also describes providing signs, of the type or types specified, on supports in place or erected under the contract.

628.2 General Requirements

1. The owner will remove all existing signs and posts except when indicated otherwise in the contract. Coordinate any street sign removal with the City of Fond du Lac Municipal Service Center. Provide at least 24-hour notice to remove signs.
2. The owner will install all proposed supports and signs except when indicated otherwise in the contract. Coordinate sign installation with the City of Fond du Lac Municipal Service Center. Notify the owner at the earliest possible time to install signs.
3. When sign and sign support installation is required under the contract perform work as specified in Sections 634 and 637 of the *Standard Specifications for Highway and Structure Construction*.

628.3 Construction

628.3.1 Sign Mounting and Clearance

1. Mount signs and provide required clearances as specified in the WisDOT *Sign Plate Manual – A Series*. Use plate no. A4-3 for permanent type II signs on single posts.

629 Pavement Marking

629.1 Scope

1. This section describes providing and removing pavement marking.

629.2 General Requirements

1. The owner will install all proposed pavement markings except when indicated otherwise in the contract. Coordinate pavement marking installation with the City of Fond du Lac Municipal Service Center.
2. When pavement marking installation or removal is required under the contract perform work as specified in Section 646 of the *Standard Specifications for Highway and Structure Construction* except as noted in this section.

629.3 Materials

1. Unless noted otherwise use epoxy pavement marking products from the WisDOT APL.

629.4 Basis of Payment

1. The owner will measure the pavement marking removal line bid item by the linear foot of line acceptably completed. Pavement marking removal will not be measured separately for different line widths or removal types. Payment for pavement marking removal line is full compensation for removing the marking and for resealing areas of clear protective surface treatments.
2. The owner will measure the pavement marking arrow, word, or symbol removal bid item as each individual unit acceptably completed. Payment for pavement marking arrow, word, or symbol removal is full compensation for removing the marking and for resealing areas of clear protective surface treatments.
3. Marking will be measured and paid separately under the associated marking bid items as specified in Section 646 of the *Standard Specifications for Highway and Structure Construction*, except that no additional compensation will be provided for cold weather marking.

630 Landscaping and Restoration on Private Property

630.1 Scope

1. This section describes furnishing, installing and maintaining permanent site restoration on private property including concrete driveways, sidewalks, steps, and pedestrian curb; asphalt driveways; gravel driveways; lawn restoration; and appurtenant landscaping when installing or replacing private sanitary sewer laterals, storm sewer laterals, water services, or public sidewalks.

630.2 General Requirements

630.2.1 Work on Private Property

1. Whenever any of the work is performed on or through property other than that owned by the city, the contractor shall furnish the city, before final acceptance of the work by the city under 105.9.1.6, a written release from the owner, or proper authority acting for the owner of the property affected, stating that the restoration of structures and surfaces has been satisfactorily accomplished. If, in the opinion of the city, the release is arbitrarily withheld, the city may in its sole discretion, accept the portion of the work involved and cause final acceptance to be granted.

630.3 Construction

630.3.1 Driveway and Sidewalk Restoration

1. Construct concrete driveways, sidewalks, steps, and pedestrian curb as specified in 619.
2. Construct asphalt driveways as specified in 622.
3. Construct gravel driveways as specified in 624.

630.3.2 Lawn Restoration

1. Restore lawn areas as specified in 627.

630.3.3 Appurtenant Landscaping

1. Remove and replace appurtenant landscaping materials including, but not limited to, stone, block, retaining walls, pavers, fences, signs, benches, mulch, trees, or shrubs. Restore appurtenant landscaping materials to original state.
2. Do not remove or damage trees, shrubs, flowers, or gardens without permission from the property owner.
3. The contractor is responsible for contacting property owners and coordinating all work done on or in private property with the property owners.

630.3.4 Removing Private Sidewalk and Driveways

1. Remove the concrete, asphalt, and gravel only in the locations where utility work is being performed, prior to excavation operations or as required to install public sidewalk. Obtain approval of the engineer for limits of removal.
2. When adjacent panels of sidewalk, driveway, steps, or asphalt which are not identified for removal, are discovered to be cracked, chipped, or otherwise damaged, notify the engineer prior to commencing breaking or removal of the adjacent sidewalk or pavement. The engineer will make note of the type and extent of the pre-existing damage to ensure that the severity of the damage does not increase during the sidewalk or pavement replacement process. If adjacent panels or pavement are found to be damaged following the construction process, which were not previously approved by the engineer, repair or replace the damaged panel at the contractor's expense.

630.4 Basis of Payment

1. The owner will measure landscaping and restoration on private property once for each individual property acceptably completed. Payment for landscaping and restoration on private property is full compensation for coordinating with property owners; for removing and storing existing landscaping materials; and for restoring landscaping materials to existing state.
2. The owner will measure landscaping and restoration on private property only at properties the engineer approves. The owner will not measure landscaping and restoration on private property at sites where the engineer determines restoration is limited to concrete driveways, sidewalks, steps, pedestrian curb, asphalt driveways, gravel driveways, and lawn restoration only.
3. The owner will measure and pay separately for the following work constructed on private property:
   A. Driveway, sidewalk, step, and pedestrian curb removal as specified in 610.3.
   B. Fence, retaining wall, paver, decorative stone, sign, bench, or other miscellaneous structure removal or removal and replacement, at locations identified on the plans, as specified in 610.3.
   C. Concrete driveways, sidewalks, steps, and pedestrian curb as specified in 619.3.
   D. Asphalt driveways as specified in 622.3.
   E. Gravel driveways as specified in 624.3.
   F. Lawn restoration as specified in 627.3.