



STANDARD CONSTRUCTION SPECIFICATIONS

2021 EDITION

Rev 1.3 – 01/10/25

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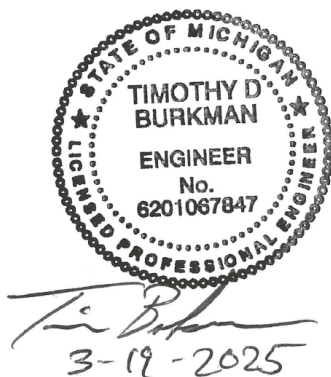
March 19, 2025

The Standard Construction Specifications ("Redbook") 2021 Edition, Revision 1.3-01/10/25 is hereby issued by the City of Grand Rapids. The issuance of these Standard Construction Specifications is to ensure the use of uniform, adequate, and acceptable construction methods and materials. These specifications are adopted as standard requirements to apply to work and materials advertised for bid or permitted after March 19, 2025.

Physical copies of the current edition of the standards are available for purchase through the Engineering Department and an electronic copy is available on the City's website.

If any deficiencies or the need for additional revisions or clarifications are discovered when using these specifications, please email Redbook@grand-rapids.mi.us. The Engineering Department will collect those comments, and as appropriate, incorporate those items into future revisions.

Tim Burkman, P.E.
City Engineer



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OFFICE OF THE CITY ENGINEER

Grand Rapids, Michigan

INVITATION TO BID

The City of Grand Rapids is seeking bids for _____.

Encrypted Bids will be accepted on the Bid Express site until 11:00 a.m., local time, on _____.

At that time bids will be publicly opened and read aloud.

Bids will be on the basis of unit prices as listed on the Bid Form and must be submitted using the e-bidding system. All forms, information, and specifications are available for download free of charge here _____. Hard copies may be examined and copies obtained at the Engineering Department, 5th Floor of City Hall, 300 Monroe Avenue NW, Grand Rapids, Michigan, 49503, (616) 456-3060. A non-refundable charge of \$____.00 will be charged for each hard copy set of project documents. A hardcopy of the Grand Rapids Construction Specifications may be obtained for an additional charge of \$20.00 or may be accessed electronically on the City's web page.

This work consists of _____.

A Pre-bid meeting will be held on _____, at _____ at the City of Grand Rapids Engineering Department, 5th Floor South Conference Room, 300 Monroe Avenue NW, Grand Rapids, MI 49503. Bidders and subcontractors are requested to attend the pre-bid meeting.

The City's Mission Statement and Sustainability Vision Statement, defines the purpose of the Equal Business Opportunity (EBO) – Construction Policy and Administrative Guidelines (1) provide equitable access to do business with the City; (2) encourage involvement in the City's Sustainability Vision Statement themes; and (3) enhance the growth, development and participation of small and emerging businesses to perform on City construction contracts. The EBO – Construction Policy and Administrative Guidelines include bid discount provisions. A contractor's bid may be discounted when the contractor can demonstrate and substantiate their involvement in practices that further the City's Mission Statement and Sustainability Vision Statement. Section 5 of the Administrative Guidelines for the EBO – Construction Policy describes the City's bid discount provisions and has been expanded to include additional discount point opportunities by employing graduates from construction entry programs.

Bidders and subcontractors must comply with the City of Grand Rapids prequalification and certification requirements. The successful bidder for the above project may not discriminate against any employee or job applicant in any matter related to employment because of actual or perceived color, race, religion or creed, sex, gender identity or expression, sexual orientation, national origin, genotype, age, marital status, familial status, medical condition, disability, height, weight, or source of lawful income and the successful bidder will be required to insert that provision in all subcontracts relating to the project. The successful bidder will be required to have a policy regarding Drug Free Work Place and certify to the City that this policy is in place.

A certified check or bid bond for a sum not less than five percent (5%) of the amount of the Bid will be required with each bid. No bid may be withdrawn for a period of 45 calendar days after the date and time for receiving bids.

The City reserves the right to accept or reject any and all Bids; to reject the Bid of a Bidder who is not, in the opinion of the Engineer or City, in a position to perform the contract; to waive informalities, irregularities and technicalities; to reject any and all non-conforming, non-responsive, unbalanced [unreasonable unit price(s)] or conditional Bids; or to advertise for new Bids. The City also reserves the right to award the Contract in the City's best interest, and therefore, may select a Bidder other than the lowest.

Tim Burkman, P.E., City Engineer

INFORMATION FOR BIDDERS

- IB-1.01 Receipt of Bids - Encrypted Bids will be received by the Office of the City Engineer, Grand Rapids, Michigan in the electronic bidding system until _____, at _____ local time, at which time they will be publicly opened and read by the City Engineer or their duly authorized representative.
- IB-1.02 Specifications - Except as may be provided in "Special Provisions" all work shall be done in accordance with the Standard Construction Specifications of the City of Grand Rapids and supplemental specifications, which are on file in the Office of the City Engineer.
- IB-1.03 Completion Date - Unless the completion date is indicated on the Bid Form, the bidder must state the number of calendar days from date of contract within which they will complete the work. Space is provided for this on Sheet 1 of the Bid Form.
- IB-1.04 Unit Price or Lump Sum Bids - Each bidder must submit a unit price for each item so indicated on the Bid Form. When a lump sum bid is requested for a project, only a lump sum bid should be provided. Alternate Bids are to be submitted only if requested on the Bid Form. Unsolicited Alternate Bids for any item listed on the Bid Form will not be considered and should not be submitted. Failure to comply with these requirements may be sufficient reason for rejecting the bid.
- IB-1.05 Bid Submissions - Each bid must be submitted as an electronic submission in the electronic bidding platform. Hard copy submissions will not be accepted.
- IB-1.06 The Bid:
- IB-1.06.01 Authority of the City Manager - It is provided that the City Manager or their duly authorized agent shall advertise for bids and that they shall be received, opened and tabulated by the Engineer, acting for and on behalf of the City Manager. After examining the bids, the Engineer shall report the same together with their recommendation to the City Manager. The City Manager shall then examine them, together with such report, and submit them with their own recommendation, to the City Commission.
- IB-1.06.02 Contents of Bid Form - Bidders will be supplied with Bid Forms which will state the location and description of the work planned, the approximate quantities of the work to be performed and materials to be furnished, the amount of the Bid Security and the date, time and place of submitting and opening bids.
- IB-1.06.03 Copies of Bidding Documents – Copies of the Bidding Documents for use in preparing bids may be obtained from the City of Grand Rapids electronic bidding system or at the Office of the City Engineer, 5th Floor, City Hall, 300 Monroe Ave NW, Grand Rapids, MI 49503.
- | <u>Non-Refundable Fee</u> | |
|--|-----------|
| Complete Set of Project Drawings and Specifications (hard copy) | \$____.00 |
| Complete Set of Project Drawings and Specifications (electronically) | FREE |
| Grand Rapids Standard Construction Specifications (hardcopy) | \$20.00 |
| Grand Rapids Standard Construction Specifications (electronically) | FREE |
- The Contractor to whom a contract is awarded will be furnished, without cost to them, up to 6 copies of the Project Specifications and up to 6 sets of the Project Drawings, together with all Addenda thereto. Additional copies of Project Specifications and Drawings may be obtained from the City at the cost stated above.
- IB-1.06.04 Interpretation of Estimates - The Engineer's estimate of quantities shown on the Bid Form shall be used for the comparison of bids upon which the award of the contract will be made. These quantities are not guaranteed and the furnishing of this information creates no liability on the part of the City.
- IB-1.06.05 Examination of Site by Bidder - Before submitting Bids, the bidder shall examine the site of

the proposed work as well as all the Bidding Documents. The bidder hereby agrees to accept full responsibility for their conclusions relative to the nature and probable difficulties of the work. Information made available by the City to the bidder regarding underground conditions, such as test borings, is offered as information only, and shall not be construed as relieving the bidder of their obligations to make such supplementary or independent investigations as may be necessary or advisable.

The bidder hereby waives all claims for any damages which they may suffer by reason of the inadequacy or incompleteness of such underground information which the City has been able to obtain and furnish.

The bidder shall also inform themselves of all the requirements of Federal, State and Local laws and regulations which may affect the execution of the work.

IB-1.06.06 Interpretations – All questions about the meaning or intent of the Bidding Documents shall be submitted to the Engineer in writing. Replies will be issued by Addenda, mailed, faxed, electronically or otherwise delivered to all parties, recorded by the City as having received the Bidding Documents. Questions received less than 5 business days prior to the date for opening of Bids will not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

IB-1.06.07 Bid Security - Bids on projects for which the Engineer's Estimate is \$50,000 or more may not be considered unless there is enclosed a certified check or certificate of deposit payable to the order of the City of Grand Rapids in the sum of 5% of the bid amount or a bid bond issued by an approved Surety Company. No Bid Security will be required on projects for which the Engineer's Estimate is less than \$50,000. The Bid Security of the three lowest Bidders will be retained by the City Manager until the contract has been awarded and the checks of all other Bidders will be returned at once. In the event that the award of contract is not made within 45 calendar days after opening of bids, the Bidder may withdraw the Bid Security without penalty.

IB-1.06.08 Delivery of Bids - The Bid shall be submitted electronically in the Engineering Department's electronic bidding system. All Bids must be received by the City Engineer, acting for and on behalf of the City Manager, prior to the time and at the place indicated in the Invitation to Bid.

IB-1.06.09 Number of Bids Allowed - Each Bidder shall submit only one bid for a particular project unless alternate bids are requested.

IB-1.06.10 Public Opening of Bids - The Bids will be opened publicly and read aloud at the time and place specified in the Invitation to Bid. Only the total amount of each bid will be read. After checking all bids, the unit prices of the bids will be made available for public inspection.

IB-1.06.11 Equal Business Opportunity - Construction Policy - In keeping with the City's Mission Statement and Sustainability Vision Statement, the purpose of the Equal Business Opportunity (EBO) – Construction Policy and Administrative Guidelines is to (1) provide equitable access to do business with the City; (2) encourage involvement in the City's Sustainability Vision Statement themes; and (3) enhance the growth, development and participation of small and emerging businesses to perform on City construction contracts.

The EBO – Construction Policy and Administrative Guidelines include bid discount provisions. A contractor's bid may be discounted when the contractor can demonstrate and substantiate their involvement in practices that further the City's Mission Statement and Sustainability Vision Statement. Section 5 of the Administrative Guidelines for the EBO – Construction Policy describes the City's bid discount provisions. This section was expanded to include additional discount point opportunities by employing graduates from construction entry programs.

Pursuant to Section 5 of the Administrative Guidelines for the EBO – Construction Policy, the City's Office of Diversity and Inclusion will maintain a list of Micro-Local Business Enterprise (Micro-LBE) firms that may be utilized under the bid discount provisions. It is the responsibility of the Contractor to make certain that any Micro-LBE firm which the Bidder proposes for use as a subcontractor is certified by the City as a Micro-LBE firm at the time of any particular bid solicitation. Bids which are received which list Micro-LBE firm who are not certified as Micro-LBE firm with the City may be rejected. The City's EBO – Construction Policy and Administrative

Guidelines are on file at the City's Office of Diversity and Inclusion for reference.

- IB-1.06.12 Prequalification of Bidders and Subcontractors - Bidders on projects for which the Engineer's Estimate is \$10,000 or more and subcontractors whose portion of the work is \$10,000 or more, must be prequalified with the Engineering Department of the City of Grand Rapids and capable of performing the various items of work on which they bid.

The current City Commission Policy, Procedures for Prequalification of Bidders and Subcontractors and list of Prequalified Bidders and Subcontractors are on file at the Engineering Department for reference.

- IB-1.06.13 Disqualification of Bidders - In accordance with the City Code of Grand Rapids, Michigan, no Bidder shall be permitted to submit a bid for any work for the City if said Bidder is in arrears to the City upon debt or contract, or who is in default upon any form of security or other obligation given to the City, or who shall in other respects be disqualified according to the provisions of this Code or the Grand Rapids City Charter.

- IB-1.06.14 Use of Apprentices - If apprentices are used on the project, they are required to be registered in a recognized apprenticeship program, [i.e. one that is certified by the Office of Apprenticeship (OA, formally BAT), U.S. Department of Labor].

- IB-1.07 Preparation and Submission of Bids:

- IB-1.07.01 Preparation of Bids - The Bid Form shall be prepared in the electronic bidding system. The bidder shall specify a unit price for each item on the Bid Form, and shall show the products of the respective quantities and unit prices in the column provided for that purpose, and the total sum for which he/she will perform the proposed work. Any Bid which does not contain a bid price for each item may be deemed incomplete and may not be considered, except when a lump sum bid is requested. Unsolicited alternate bids for any item will not be considered and should not be submitted, and if submitted, may cause the bid to be rejected.

When there is no completion date or progress schedule incorporated in the Bid Form, each Bidder is required to write such information in the space provided on the Bid Form.

The Bid Form must be signed and the complete address of the Bidder given. If the Bidder is a corporation, the authorization for the person signing must be given unless previously on file with the City Clerk and the City Comptroller. If the Bidder is a partnership, the names of the parties must be given as well as the firm or trade name. If the Bidder is an individual, the name of the individual must be given as well as the firm or trade name. If the bid is submitted as a joint venture, the name of the individuals, corporation or partnerships which make up the joint venture must be given.

- IB-1.07.02 Consideration of Bids - The Bidder must complete the appropriate forms in the Bid Form indicating the subcontractor(s) including, as appropriate, any Micro-Local Business Enterprise firms, and supplier(s) that the Bidder is intending to use on the project. Also, the Bidder will be required to certify that their firm has a Drug Free Work Place Policy by completing the Certification Regarding Drug Free Work Place form as part of the Bid Form. Failure to complete all of the forms and other entries required in the Bid Form may be cause for the rejection of the Bid.

Bids received will be compared on the basis of the summation of the products of the estimated quantities of items listed by the Engineer (designee) on the Bid Form and the unit prices bid. Bidders may not change the estimated quantities on the Bid Form. Where a discrepancy occurs, the unit prices as written in the Bid Form shall govern, and any errors found in said products, or in addition, will be corrected. Further, any discrepancies on the subcontractor form will be corrected as deemed appropriate by the City Engineer.

The City reserves the right to accept or reject any and all Bids; to reject the Bid of a Bidder who is not, in the opinion of the Engineer or City, in a position to perform the contract; to waive informalities, irregularities and technicalities; to reject any and all nonconforming, non-responsive, unbalanced [unreasonable unit price(s)] or conditional Bids; or to advertise for new Bids. The City also reserves the right to award the Contract in the City's best interest, and therefore, may select a Bidder other than the lowest.

- IB-1.07.03 Pre-Bid Meeting - A pre-bid meeting will be held on _____, at _____, at the City of Grand Rapids Engineering Department 5th Floor, South Conference Room, 300 Monroe Ave. NW, Grand Rapids, MI, 49503. Bidders and subcontractors are requested to attend the pre-bid meeting.
- IB-1.08 Execution of Contract
- IB-1.08.01 Execution of Contract - The Low Bidder will be determined by a tabulation of bids within three (3) business days of the bid opening. The Low Bidder or other Bidder(s) (hereafter called the Bidder), if requested by the City, shall furnish all necessary information, forms and documents required by the bid documents to the City within seven (7) calendar days or less as stated hereafter from the bid opening to enable the City to proceed with the award of the contract. Such items shall include applicable insurance, wage forms and federal/state forms. The Micro-Local Business Enterprise Affidavit Form shall be submitted within one (1) business day after the bid opening as required under the specifications for Micro-Local Business Enterprise requirements. The Bidder shall furnish all necessary sureties, in a form acceptable to the City, within twelve (12) calendar days of the bid opening. In the event the Bidder or the Bidder's proposed subcontractor(s) or supplier(s) are not in compliance with the City's Equal Opportunity and Non-Discrimination policies and related guidelines at the time of bid opening, the Bidder will make a request to the City's Office of Diversity and Inclusion within two (2) business days of the bid opening for the application form(s) for said compliance, including those for the proposed subcontractor(s)/supplier(s), and comply with the time frame required for the submittal of the same.
- The Contract will be transmitted to the Bidder at the email address given on the Bid Form or on file with the Engineering Department within two (2) business days after acceptance of the Bid by the City (Award of Contract by the City Commission). The Bidder shall enter into the Contract with the City within seven (7) calendar days of the Award of Contract.
- If the Bidder and the Bidder's proposed subcontractor(s) and supplier(s) are in compliance with the City's Equal Opportunity and Non-Discrimination policies and guidelines at the time of bid opening and the Bidder has complied with all the bid requirements and has submitted the necessary information, forms, documents, insurance and sureties acceptable to the City within the allotted time frames noted herein and in the event the City fails to award the Contract and to have the same ready for execution by the Bidder within fourteen (14) calendar days of the bid opening, then the total number of days by which the City fails to meet the aforesaid fourteen (14) day deadline will be added to the date of completion. However, if the Bidder or the Bidder's proposed subcontractor(s) or supplier(s) are not in compliance in accordance with the requirements of this Information for Bidders at the time of bid, then the aforesaid fourteen (14) calendar day time period is hereby extended to a twenty-eight (28) calendar day time period. Failure by the Bidder to furnish the necessary information, forms, documents, insurance and sureties within the allotted time frames or to enter into the Contract with the City within the allotted time frame as noted herein, for which failure the City is not obligated to meet either the fourteen (14) or twenty-eight (28) day deadline noted above, shall not be reason to extend the date of completion of the Contract.
- On certain projects, as the City deems appropriate, it will be necessary to expedite the schedules referenced herein to expedite the start of work. In such cases, the time frames for submittal of the necessary information, forms, documents, insurance, sureties, etc., and the projected date for the award of the Contract and having the same ready for execution by the Bidder will be so noted in the special provisions and such time frames will take precedent over the time frames noted herein.
- IB-1.08.02 Subcontracts - All contractors will be required to provide the City with copies of executed subcontracts for all subcontracted work in excess of \$3,000. Said subcontracts may utilize and/or modify the sample form supplied by the Engineering Department.
- Unless specifically approved by the Engineer, the Prime Contractor shall utilize the subcontractors listed in the Bid Form.
- IB-1.08.03 Contract Bond Requirements - The successful Bidder shall furnish satisfactory performance and payment/lien bonds, each in an amount equal to the total contract price, on all projects for which the contract amount is \$50,000 or more. On a project-by-project basis, performance and payment/lien bonds may be required on projects for which the contract price is less than \$50,000.

Such bonds shall conform to the regulations of the City and the requirements specified by the laws of Michigan.

- IB-1.08.04 Contract Insurance Requirements - The successful Bidder shall furnish Insurance of the several types and in the amounts described in the General Conditions and Special Provisions as applicable.
- IB-1.08.05 Failure to Execute Contract - Failure on the part of the successful Bidder to execute a contract and file satisfactory bonds and insurance, as specified herein, may be considered cause for the annulment for the award and forfeiture of the Bid Security to the City.
- IB-1.08.06 Compliance with Laws, Ordinances, and Regulations – The successful Bidder, as Contractor, shall keep themselves fully informed of and shall at all times comply with all local, state and federal laws, rules and regulations applicable to the Contract and the work to be done thereunder.
- IB-1.09 Miscellaneous:
- IB-1.09.01 Contractor Performance Review - In bidding the project, the Bidder shall note that the Engineering Department has instituted contractor performance review procedures to evaluate Contractor and, as applicable, subcontractor, performance during the project period, upon completion of the project and/or upon completion of the warranty period.

Name of Bidder:

BID FORM

Grand Rapids, Michigan

Bids to be received _____

at _____ Local Time

TO THE CITY OF GRAND RAPIDS:

The undersigned as bidder proposes to do all the work of:

and to furnish all parts, labor, materials, supplies, equipment and other facilities and things necessary and proper for and incidental to the proper performance and completion of the work specified in the Contract Documents, including the drawings and specifications and as required by the City Manager and City Engineer to begin construction within seven (7) calendar days after a Contract is executed (unless otherwise indicated in the Special Provisions) and to complete the work by the date(s) listed below, and for the unit prices stated in the Bid Form. Addenda, if any have been issued, are to be acknowledged on the form provided at the place where bids are received, and a signed copy attached to the bid.

Substantial Completion Date: _____

Final Completion Date: _____

LIST SUBCONTRACTORS*:

[illegible]

UNLESS APPROVED BY THE ENGINEER, THE CONTRACTOR SHALL UTILIZE THE SUBCONTRACTORS LISTED ON THIS BID FORM.

THIS COMPLETED SUBCONTRACTOR LIST MUST BE SUBMITTED WITH THE BID DOCUMENTS.

AS APPLICABLE, COMPLETE THIS FORM BY IDENTIFYING MICRO-LBE SUBCONTRACTOR(S) THAT WILL BE UTILIZED AS A SUBCONTRACTOR TO A SUBCONTRACTOR:

[illegible]

UNLESS APPROVED BY THE ENGINEER, THE SUBCONTRACTOR SHALL UTILIZE THE MICRO-LBE SUBCONTRACTORS LISTED ON THIS BID FORM.

THIS COMPLETED SECOND TIER SUBCONTRACTOR LIST MUST BE SUBMITTED WITH THE BID DOCUMENTS.

CERTIFICATION REGARDING DRUG FREE WORK PLACE

I, as authorized representative for _____, certify that our company and its principals believe in the concept of a drug free* workplace in support of a safe, healthy and more productive work environment, either on or off company premises. I further affirm that our firm has a written policy in place in this regard and that this policy is made available to current and prospective employees. The policy requires that company or contract employees remain Drug Free while performing all company-related job duties, either on or off company premises, or on job sites.

Print Name and title of Authorized Representative

Name of Firm

Signature of Authorized Representative

Date _____

*(Drug Free is defined as free from the use, manufacture, sale, possession or distribution of illegal drugs or the improper or abusive use of legal drugs or alcohol while performing company related job duties.)

(Effective January 23, 2007)

THE UNDERSIGNED, AS BIDDER, AGREES to furnish sureties, insurance and all necessary information, forms and documents acceptable to the City in accordance with and within the time frame outlined in the Information for Bidders and to enter into a contract within the time frames as required in the Information for Bidders and Special Provisions as applicable, and upon failure or refusal to do so agrees to forfeit the Bid Security herewith enclosed to the City as liquidated damages and not as a penalty.

THE UNDERSIGNED, AS BIDDER, AGREES to commence the work within seven (7) calendar days after signing the contract (unless otherwise indicated in the Special Provisions) and complete the same on or before the completion date(s) stated on this Bid Form. If the work is not completed on or before the date(s) stated or time specified, the City Manager is, because of the difficulty in estimating damages, authorized to retain out of the money which may be due or become due the sum of \$ _____.00 for each calendar day by which the Bidder, as Contractor, shall fail to achieve substantial completion of the work; and the sum of \$ _____.00 for each calendar day by which the Bidder, as Contractor, shall fail to achieve final completion of the work, said sum to constitute liquidated damages and not a penalty.

The undersigned, as bidder, certifies that the bidder has read and understands the City of Grand Rapids' current Equal Business Opportunity – Construction Policy and Administrative Guidelines.

By signing this bid, the bidder certifies to having carefully reviewed it and believes that all information provided is accurate, truthful, and not misleading. The bidder agrees that if the City finds that any information provided is materially false or misleading, the City may impose sanctions against the bidder and anyone who assisted in providing the false or misleading information. The severity of sanctions will depend on the degree of culpability of the bidder and the extent to which the City relied on the false or misleading information.

In any event, if the City relies on the false or misleading information to award a contract, the City may impose a monetary sanction of up to 10% of the contract price in addition to other possible sanctions.

Signature of Bidder:

(Print Name):

Name of Bidder:

Address of Bidder:

Daytime Telephone No.:

Email Address:

MICRO-LOCAL BUSINESS ENTERPRISE (MICRO-LBE)

AFFIDAVIT

STATE OF MICHIGAN)
)
COUNTY OF KENT)

_____, being first duly sworn, deposes and says:

- 1) That they is _____ of _____.
(owner, officer) (name of Micro-LBE company)
- 2) That the firm (company) name in paragraph one (1) is a City of Grand Rapids certified Micro-Local Business Enterprise (Micro-LBE).
- 3) That the primary nature of the business engaged in by the firm listed in paragraph one (1) is _____

- 4) That on _____, _____ submitted a quote
(date) (name of company)
to participate in the project known as:

- 5) That said quote was submitted to _____ in the amount of
_____ dollars.
(amount of quote)
- 6) That the affiant's (company's) quote was submitted to provide (perform) the following services or work:

- 7) That the affiant (company) has the knowledge and expertise to provide the services or perform the work described in paragraph six (6).
- 8) That the affiant has been notified by the General Contractor _____
_____ that affiant's quote has been accepted.

- 9) That the notification referred to in paragraph eight (8) was received on _____
by _____.
- 10) That the affiant (company) proposes to actually perform the services or do the work for which they have quoted.
- 11) That the affiant (company) has not and or will not, subcontract or assign the work upon which they (it) has quoted without written permission from the owner of the project or the owner's representative, and the City of Grand Rapids' Office of Equity and Engagement representative.
- 12) The affiant (company) certifies that affiant (company) has read and understands the City of Grand Rapids' current Equal Business Opportunity – Construction Policy and Administrative Guidelines.
- 13) By signing this affidavit, the affiant (company) certifies to having carefully reviewed the affidavit and believes that all information provided is accurate, truthful, and not misleading. The affiant (company) agrees that if the City finds that any information provided is materially false or misleading, the City may impose sanctions against the affiant (company) and anyone who assisted in providing the false or misleading information. The severity of sanctions will depend on the degree of culpability of the affiant (company) and the extent to which the City relied on the false or misleading information.

(Signature)

(Name)

(Title)

On this _____ day of _____, 20____ before me, a Notary Public, appeared _____, to me known to be the same person described and who, being duly sworn, did execute the foregoing Affidavit and did state that they were properly authorized by _____ to execute the said affidavit and who has acknowledged the same to be their free act and deed.

Notary Public, Kent County, MI

My Commission Expires: _____

City of Grand Rapids, Michigan
Office of City Engineer

SUBCONTRACTS

THIS AGREEMENT, is made this _____ day of _____, 20____, by
and between _____ Principal Contractor,
party of the first part, and _____ Subcontractor, party
of the second part.

WITNESSETH, that the party of the second part, for and in consideration of the payment or
payments hereinafter specified, hereby agrees to furnish all necessary machinery, tools, apparatus,
and other means of construction, do all the work, furnish all the material except as herein otherwise
specified, and to complete, in strict accordance with the contract between the City of Grand Rapids and
the Principal Contractor, dated _____, 20____, for the _____

_____, the work as described herein.

IN CONSIDERATION WHEREOF, said party of the first part agrees to pay said party of the
second part for all work done at the following prices:

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL

The current Grand Rapids Standard Specifications at the time the contract was awarded, the Drawings, and all of the general, supplemental and special provisions that are a part of the aforementioned contract between Grand Rapids and _____.

These Specifications are hereby made a part of this Subcontract.

Particular attention is called to the following contract provisions:

- A. It is specifically understood and agreed that the party of the second part shall present satisfactory evidence to the party of the first part, prior to the beginning of the work, that Workers' Compensation Insurance has been obtained and is in full force and effect covering all employees performing work hereunder, and that the same will be kept in full force and effect until the work herein contracted to be done has been fully completed.
- B. Should the contract documents include provisions or conditions indicating that the project is funded in whole or in part by any government agencies other than the City of Grand Rapids, the requirements of those agencies, as stipulated in the Contract, shall be binding on the parties to this Subcontract.

The Subcontractor hereby agrees to include all applicable parts of the above-described specifications in any lower-tier subcontracts which they may enter into together with a clause requiring this insertion in any further subcontracts that may in turn, be made.

IN WITNESS WHEREOF, the parties hereto have set their hands the day and year first above written.

WITNESSED:

Principal Contractor

By: _____
Title:

Sub-Contractor

By: _____
Title:

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____
as Principal, hereinafter called the Bidder, and _____

as Surety, are held and firmly bound unto the CITY OF GRAND RAPIDS, MICHIGAN, hereinafter called the Obligee, in the penal sum of _____ (\$_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

WHEREAS, the bidder has submitted the accompanying bid, dated the _____ day of _____, 20_____.

NOW, THEREFORE, the conditions of the obligation are such that if the bid be accepted as to any or all of the items of material and workmanship proposed to be furnished thereby, or as to any portion of the same, and if the said bidder will within ten (10) days after notice of the award of contract enter into contract with the Obligee to furnish all work and materials at the prices offered by said bid and will furnish bond with good and sufficient surety or sureties as may be required for the faithful and proper fulfillment of said contract and such other and further bonds as may be required under the ordinances of the Obligee, or statutes of the State of Michigan, then this obligation shall be void. And the surety hereby binds itself and its successors to pay the Obligee, in case the bidder fails to enter into such contract and give such bonds within ten (10) days after such notice of award of contract to pay to the Obligee the damages which Obligee may suffer by reason of such failure not exceeding the penalty of this bond.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed, and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of: _____ L.S.

_____ L.S.

_____ Surety

NOTE: If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended, <https://fiscal.treasury.gov/surety-bonds/circular-570.html>) and must be authorized to transact business in the State of Michigan.

**CERTIFICATION OF FINAL PAYMENT TO SUBCONTRACTORS
FOR**

LIST SUBCONTRACTORS (INCLUDING Micro-LBE SUBCONTRACTORS) USED FOR THE PROJECT:

I, _____ (Owner, Officer of Prime Contractor), as an owner or responsible officer of _____ (Name of Firm), do hereby certify by my signature below that the above named subcontractors have been fully utilized in the completion of Title _____ and that each subcontractor has been paid in full, or will be paid in full, upon receipt of final payment.

SIGNATURE (Owner/Officer of Prime Contractor)

THIS CERTIFICATION MUST BE SUBMITTED WITH THE FINAL PAYMENT REQUEST TO THE CITY DEPARTMENT AND MUST LIST EACH SUBCONTRACTOR USED.

TO BE USED FOR SECOND TIER SUBCONTRACTORS

CITY OF GRAND RAPIDS, MICHIGAN
OFFICE OF CITY ENGINEER

**AS APPLICABLE, COMPLETE THIS FORM BY IDENTIFYING Micro-LBE SUBCONTRACTOR(S)
THAT WERE UTILIZED AS A SUBCONTRACTOR TO A SUBCONTRACTOR:**

FOR

Title

<u>Micro-LBE SUBCONTRACTOR</u>	<u>TYPE OF WORK</u>	<u>FINAL AMOUNT PAID TO Micro-LBE SUBCONTRACTOR</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

I, _____ (Owner, Officer of Prime Contractor), as
an owner or responsible officer of _____ (Name of
Firm), do hereby certify by my signature below that the above named subcontractors have been
fully utilized in the completion of Title and that each subcontractor has been paid in full, or will be
paid in full, upon receipt of final payment.

DATE

SIGNATURE (Owner/Officer of Prime Contractor)

THIS CERTIFICATION MUST BE SUBMITTED WITH THE FINAL PAYMENT REQUEST TO THE
CITY DEPARTMENT AND MUST LIST EACH Micro-LBE SUBCONTRACTOR USED BY A
SUBCONTRACTOR.

CONTRACT

THIS AGREEMENT made on the _____ day of _____, _____ by and between the City of Grand Rapids, Kent County, Michigan, party of the first part, hereinafter called the "City", and

(A _____ Corporation)

party of the second part, hereinafter called the "Contractor."

WITNESSETH, that the City and the Contractor, for the considerations hereinafter mentioned, agree as follows:

ARTICLE I - THE CONTRACT

The following shall be deemed to be part of this Contract:

- a) Information for Bidders
- b) The proposal, including Addenda
- c) The Agreement
- d) Performance and Lien Bonds are (required) (not required)
- e) All Provisions required by law to be inserted in this Contract whether actually inserted or not
- f) The Standard Construction Specifications
- g) Supplemental and Special Provisions as listed below

SPECIAL PROVISIONS FOR _____: Reference Table of Contents for specification details.

- h) Project drawings and standard details as listed below:

Drawings for _____
(_____) Sheets (*No. of Sheets in drawings*)

ARTICLE II - SCOPE OF THE WORK - SUBJECT MATTER

The Contractor hereby agrees to furnish all of the materials and all of the equipment and labor necessary to perform all of the work shown on the drawings and described in the specifications for the project entitled:

all in accordance with the requirements and provisions of the Contract. The Contractor likewise agrees to do all incidental and appurtenant work in connection therewith.

ARTICLE III - TIME OF COMPLETION

The work to be performed under this Contract shall be commenced within seven (7) calendar days after the award of this Contract or as specified in the Special Provisions as provided or as approved by the City Manager or their authorized representative. Substantial completion Date(s), other Interim Completion Dates, and the Final Completion Date shall be as provided on the Bid Form and/or in the Special Provisions as provided. Should the Contractor be obstructed or delayed in the prosecution or completion of their work by any act, neglect or default of the City then the time herein fixed for completion of the work shall be extended for a period equivalent to the time lost by reason of such delay for the causes herein mentioned. The duration of such extension shall be determined by the City Manager or their authorized representative.

ARTICLE IV - LIQUIDATED DAMAGES

Should the work under this Agreement not be finished within the time specified, the City is hereby authorized to deduct out of the money which may be due or become due to the Contractor under the Agreement, as damages for the non-completion of the work aforesaid, within the time stipulated for its completion, the sum(s) as provided in the Bid Form and/or the Special Provisions for each calendar day by which the Contractor shall fail to achieve completion of the work or any part thereof in accordance with the provisions, and such liquidated damages shall not be considered as a penalty.

ARTICLE V - THE CONTRACT SUM

The City agrees to pay and the Contractor agrees to accept the sum of ____ Dollars (\$____), the amount named in the Proposal, as full compensation for all labor, supervision, equipment, materials, and incidental expense required in executing all of the work contemplated in this Contract, including also all loss or damage arising out of the nature of the work or from the action of the elements or from any unforeseen obstruction or difficulties which may be encountered in the prosecution of the same or from other causes of every description connected with the work.

It is further agreed that, only after approval by the City in writing, the sum named may be increased or decreased in accordance with the units of work actually completed at the Contract unit prices which may include addition of items or work not included in the proposal items.

ARTICLE VI - CITY CHARTER TO BE GOVERNING DOCUMENT

The City Charter of the City shall be the governing document in all contractual relations with the City of Grand Rapids. In the prosecution of the work under this Contract, eight (8) hours shall constitute a day's labor as provided by Section 22 of Title XVIII of the Charter of the City. The City retains the right to determine finally all questions as to the proper performance under this Contract or any unfinished portion thereof, and in case of improper, dilatory or imperfect performance thereof, to suspend the work at any time and to order the partial or entire reconstruction of the same. The City likewise retains full power to determine all questions arising under this Contract according to the true intent and meaning thereof, all in accordance with Section II of Title XVIII of the City Charter.

ARTICLE VII - COMPLIANCE WITH LAWS, ORDINANCES AND REGULATIONS

The Contractor shall keep himself fully informed of and shall at all times comply with all local, state and federal laws, rules and regulations applicable to this Contract and the work to be done hereunder.

ARTICLE VIII - EQUAL EMPLOYMENT OPPORTUNITY

The Contractor shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to hire, tenure, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of race, creed, color, religion, national origin, age, sex, height, weight or marital status. Breach of this covenant may be regarded as a material breach of the contract (Act 453, P.A. 1976). The Contractor further agrees to require similar provisions from any subcontractors.

The Contractor further agrees to review or examine with the City relevant employment data and other information pertaining to its hiring practices. The Contractor further agrees that they shall require similar covenants from all subcontractors under this Contract.

ARTICLE IX - BOND OF CONTRACTOR

The Contractor shall provide sufficient security by bond to guarantee the faithful performance of the work, including the guarantee provided in Division 1, Section GC-1.12 of the Standard Construction Specifications of the City of Grand Rapids, and the payment by the Contractor of all subcontractors and payment for all labor performed and materials and supplies furnished.

IN WITNESS WHEREOF, the parties hereto have set their hands thereto as of the day and year first written above.

The parties agree that this Agreement, agreements ancillary to this Agreement, and related documents to be entered into in connection with this Agreement will be considered signed when the signature of a party is delivered by facsimile transmission or delivered by scanned image or such other electronic means including a signature entered into the City's Bidding or Purchasing Software. Such facsimile, scanned, or electronic signature shall be treated in all respects as having the same effect as an original, wet-ink signature.

_____(Seal)
_____, Mayor

_____(Seal)
_____, City Clerk

_____(Seal)
(A _____ Corporation)

By: _____(Seal)

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS That _____

_____ of the _____ of _____, County of _____ and State of _____
as principal _____ and
as sureties are held and firmly bound unto the City of Grand Rapids, in the penal sum of _____

Dollars, to be paid to the City of Grand Rapids, or its assigns, for which payment will and truly to be made, we bind ourselves, or and each of our heirs, executors and administrators, jointly and severally, firmly by these presents.

Sealed with our seals, and dated this _____ day of _____ A.D., 20_____.

The condition of the above obligation is such that if the above-named principal shall in all things stand to, abide by, and will and truly keep and perform the covenant, conditions and agreements in the foregoing contract contained, including the guarantee requirements, to be performed on its/their part, at the time, and in the manner and form therein specified, subject to the changes therein provided for, then this obligation to be void, otherwise of force and virtue.

_____(Seal)

By: _____(Seal)

_____(Seal)

By: _____(Seal)

_____(Seal)

By: _____(Seal)

Bond, sureties, and contract approved and ordered executed by the Commission of the City of Grand Rapids at a session held _____, 20_____.

Attest: _____

Clerk

NOTE: If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended, http://www.fiscal.treasury.gov/fsreports/ref/suretyBnd/c570_a-z.htm) and must be authorized to transact business in the State of Michigan.

PAYMENT/LIEN BOND

KNOW ALL MEN BY THESE PRESENTS That _____

_____ and

_____, as principal _____ and

_____ as sureties, all of the

State of Michigan, are held and firmly bound unto the City of Grand Rapids in the sum of

_____ Dollars,

lawful money of the United States of America, to be paid to the City of Grand Rapids, or to their

certain attorneys, or assigns to which payment will and truly to be made, we bind ourselves, our

heirs, executors and administrators, jointly and severally, firmly by these presents. Signed with our

hands, sealed with our seals and dated the ____ day of _____, A.D., 20____.

WHEREAS, the above bounded _____

_____ have become the Contractor with the City of Grand Rapids, in the County of Kent and State of Michigan, for the _____

_____ project in said City.

NOW, THEREFORE, the conditions of this obligation are such, if _____

principal Contractor, shall pay any and all subcontractors and pay any and all parties performing labor or furnishing materials or supplies in the performance or construction of said work (provided that the principal Contractor shall not be required to make any payment to a subcontractor of sums due from the subcontractor to parties performing labor or furnishing materials or supplies except upon receipt of the written orders of said party to pay the sum due to them to subcontractors), then this obligation to be void, otherwise in full force and virtue.

_____(Seal)

By: _____(Seal)

_____(Seal)

By: _____(Seal)

_____(Seal)

By: _____(Seal)

NOTE: If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended,

http://www.fiscal.treasury.gov/fsreports/ref/suretyBnd/c570_a-z.htm) and must be authorized to transact business in the State of Michigan.

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DIVISION 1 – GENERAL PROJECT REQUIREMENTS

SECTION 1.1 GENERAL CONDITIONS

SECTION 1.2 GENERAL REQUIREMENTS

SECTION 1.3 MOBILIZATION

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DIVISION 1 – GENERAL PROJECT REQUIREMENTS

SECTION 1.1

GENERAL CONDITIONS

- 1.01 Definitions.** Whenever the words hereinafter defined, or any pronouns, used in their stead, occur in the Contract, they shall have the meanings herein given.
- 1.01.01 Addenda.** Written or graphic instruments issued prior to the opening of bids which clarify, correct or change the Bidding Documents or the Contract.
- 1.01.02 Applicable Law.** All laws, ordinances, codes, rules, regulations and orders applicable to the Project or the Project Site.
- 1.01.02 Approved.** Wherever in the Specifications or upon the Drawings the words **as ordered, as directed, as required, as permitted**, or words of like import are used, it shall be interpreted that the order, direction, requirement of permission of the Engineer is intended; and similarly, the words **approved, acceptable, or satisfactory**, or words of like import shall mean approved by, or acceptable or satisfactory to the Engineer.
- 1.01.03 Bid.** The written offer of the Bidder on the Bid Form furnished by the City for the work proposed.
- 1.01.04 Bidder.** The individual, partnership or corporation formally submitting a bid for the work contemplated, or any portion thereof, acting directly or through an authorized representative.
- 1.01.05 Bidding Documents.** The Invitation to Bid, the Information for Bidders, and those items defined herein as the Contract, upon which the Bidder is to base their Bid for the Work under this Contract.
- 1.01.06 Bid Security.** The security designated in the Information for Bidders and furnished by the Bidder as a guarantee of good faith to enter into a Contract for the work proposed.
- 1.01.07 Change Order.** A document signed by Contractor and Engineer authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the time of the Contract, issued on or after the effective date of the Contract.
- 1.01.08 City.** The corporation of the City of Grand Rapids, Michigan.
- 1.01.09 City Manager.** The person holding the position or acting in the capacity of the City Manager, appointed by the City Commission or their duly authorized representative.
- 1.01.10 Commission.** The duly elected Commissioners of the City of Grand Rapids, acting as a corporate body, or any officer duly authorized to act for the Commission in any matter pertaining to the Contract.
- 1.01.11 Contract.** The agreement covering the performance of the Work, Addenda (which pertain to the Contract), Contractors Bid (including documentation accompanying the bid and any post bid documentation) when attached as an exhibit to the Contract, the Bonds, these General Conditions, the Supplementary Conditions, the Standard and Special Provisions, and the Drawings, together with all Change Orders.

- 1.01.12 Contract Bonds.** The statutory bonds, executed by the Contractor and the Surety, guaranteeing performance of the Contract and the payment of all lawful indebtedness pertaining thereto.
- 1.01.13 Contract Price.** The moneys payable to Contractor for completion of the Work in accordance with the Contract as stated on the Contract Form.
- 1.01.14 Contract Unit Price.** The unit price for a pay item.
- 1.01.15 Contractor.** The individual, partnership or corporation undertaking the execution of work under the terms of the Contract and acting directly or through agents or employees.
- 1.01.16 Contractor's Prequalification.** The classification and rating based on the Experience and Financial Statement of the Bidder in accordance with City Commission Policy for prequalification of Contractors and Subcontractors.
- 1.01.17 Defective.** An adjective which, when modifying the word work, refers to work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract, or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract, or has been damaged prior to Engineer's recommendation of final payment.
- 1.01.18 Director of Public Service.** The person holding the position or acting in the capacity of the Director of Public Service or their duly authorized representative.
- 1.01.19 Drawings.** The Drawings which show the scope, extent and character of the Work to be furnished and performed by Contractor and which have been prepared or approved by Engineer and are referred to in the Contract. Shop drawings are not Drawings as so defined.
- 1.01.20 Engineer.** The person holding the position or acting in the capacity of the City Engineer or their duly authorized representative.
- 1.01.21 Final Completion.** The time at which the Work has been deemed to be totally completed and final payment has been authorized by the Engineer.
- 1.01.22 Inspector.** The authorized representative of the Engineer, assigned to make detailed inspections of any or all portions of the work or the materials therefor.
- 1.01.23 Laboratory.** The materials testing laboratory will be the laboratory which may be designated by the Engineer to inspect and determine the suitability of materials.
- 1.01.24 Pay Item.** An item of work in the Contract.
- 1.01.25 Progress Clause.** That part of the Contract pertaining to the order of proceeding with the various items of the Work to be done and the rate of progress for completing said items of work.
- 1.01.26 Risk Manager.** The person holding the position or acting in the capacity of the Risk Manager for the City of Grand Rapids, or their duly authorized representative.
- 1.01.27 Shop Drawings.** All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

- 1.01.28 Special Provisions.** Special requirements, regulations, or directions prepared to cover work on a particular project not satisfactorily provided by the Standard or Supplemental Specifications.
- 1.01.29 Standard Specifications.** All requirements contained in the latest edition of the City of Grand Rapids Standard Construction Specifications, including Standard Details therein.
- 1.01.30 Subcontractor.** The individual, partnership or corporation undertaking the execution of part of the work under the terms of the contract by virtue of an agreement with the Contractor.
- 1.01.31 Substantial Completion.** The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, it is sufficiently complete, in accordance with the Contract, so that the Work (or specified part) can be utilized for the purposes for which it is intended.
- 1.01.32 Supplemental Specifications.** Detailed specifications which are supplemental to or supersede any part of the Standard Specifications.
- 1.01.33 Supplementary Conditions.** Project-specific written modifications to these General Conditions.
- 1.01.34 Surety.** The corporate body which is bound with and for the contractor for the performance of the Contract and for the payment of all lawful indebtedness pertaining thereto.
- 1.01.35 Traffic Safety Supervisor.** The person holding the position or acting in the capacity of the Traffic Safety Director for the City of Grand Rapids, or their duly authorized representative.
- 1.01.36 Work.** The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract. Work includes and is the result of performing or furnishing labor and furnishing or incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract.
- 1.01.37 AASHTO.** The American Association of State Highway and Transportation Officials.
- 1.01.38 AED.** Associated Equipment Distributors.
- 1.01.39 ANSI.** American National Standard Institute.
- 1.01.40 ASTM.** The American Society for Testing Materials.
- 1.01.41 AWPA.** American Wood Preservers Association.
- 1.01.42 AWWA.** The American Water Works Association.
- 1.01.43 City Ordinance.** City of Grand Rapids Code of Ordinances
- 1.01.44 EEI.** Edison Electric Institute.
- 1.01.45 Green Infrastructure Guidance.** City of Grand Rapids Green Infrastructure Guidance.

- 1.01.46 Green Infrastructure Standards.** City of Grand Rapids Green Infrastructure Standards.
- 1.01.47 IES.** Illuminating Engineering Society.
- 1.01.48 MDOT.** The Michigan Department of Transportation.
- 1.01.49 Michigan Building Code**
- 1.01.50 MIOSHA.** Michigan Occupational Safety and Health Act
- 1.01.51 National Fire Protection Association**
- 1.01.52 NEC.** National Electric Code.
- 1.01.53 NEMA.** National Electrical Manufacturers Association.
- 1.01.54 Stormwater Standards Manual.** City of Grand Rapids Stormwater Standards Manual.
- 1.02 The City Charter.** The City Charter shall be the governing document in all contractual relations with the City of Grand Rapids. Any apparent discrepancy in the text of any other Contract document, or in construction drawings or sketches, shall be interpreted, construed, or set aside in favor of the specific provision or provisions of the City Charter.
- 1.03 Insurance Requirements.**
 - (a) Indemnity – General.** Upon execution of the Contract, the Contractor shall agree to assume all liability for and protect, indemnify and save the City, Engineer, Engineer's Subconsultants and their agents, officers and employees harmless from and against all actions, claims, demands, judgments, losses, expense of suits or actions and attorney fees for injuries to, or death of, any person or persons and loss or damage to the property of any person, or persons, whomsoever, including the parties thereto, and their agents, contractors, subcontractors, officers and employees, arising in connection with or as a direct or indirect result of entering into and performance of the contract, whether or not due to or arising out of the acts of any party thereto or its agents, contractor, subcontractors, officers and employees, or by or in consequence of any negligence or carelessness in connection with the same or on account of liability or obligation imposed directly or indirectly upon the City by reason of any law of the State of Michigan or the United States, now existing or which shall hereinafter be enacted, imposing any liability or obligations, or providing for compensation to any person or persons on account of or arising from the death of, or injuries to employees. Said Contractor shall pay, settle, compromise, and procure the discharge of any and all such claims and all such losses, damages, and expenses.
 - (b) Requirements.** Prior to commencing work under the Contract, the Contractor as successful bidder shall file with the City a certificate of insurance acceptable to the City as proof that the Contractor has secured the types and amounts of insurance as stated herein or as stated in any Special Provisions applicable to the Contract. The City reserves the right, in its sole discretion, to require the Contractor to file with the City certified copies of any policies of required insurance either prior to the execution of the Contract or at any time thereafter.

The insurance required to be purchased and maintained by the Contractor shall contain a cross liability or severability of interest clause or endorsement. Insurance covering specified additional insureds shall be primary insurance, and all other insurance carried by

the additional insureds shall be excess insurance. Insurance contain an AM Best Rating of A-; VII or higher.

The certificate, policies, or other proofs of insurance filed with the City must provide for giving the City written notice of any cancellation or material change in coverage prior to the expiration date of the insurance. In addition, if the stated expiration date for any of the required policies of insurance precedes the stated Contract completion date, the applicable certificate, policy, or other proof of such insurance filed with the City must provide for giving the City thirty (30) days prior written notice of an intent not to renew any such required insurance coverage.

The furnishing by the Contractor of any insurance policies and insurance certificates required and their acceptance or approval by the City shall not release the Contractor from the obligation to provide sufficient coverage as set forth herein and shall not waive liability of the Contractor to indemnify the City against all damage as aforesaid.

For each Contract to which these Standard Provisions apply, the following types and amounts of insurance shall be provided by the Contractor, unless any Special Provisions applicable to the Contract provide for different insurance requirements. The Contractor may comply with these or any Special Provisions by providing insurance with separate limits for bodily injury and property damage and/or by providing umbrella insurance which provides substantially equivalent coverage to that required by the applicable specifications. THE CITY RESERVES THE ABSOLUTE RIGHT TO MAKE THE FINAL DETERMINATION AS TO WHETHER ANY INSURANCE PROVIDED BY THE CONTRACTOR COMPLIES WITH THESE STANDARD SPECIFICATIONS OR ANY APPLICABLE SPECIAL PROVISIONS.

In addition, the City reserves the absolute right to modify or waive at any time, by mutual agreement with the Contractor, any applicable insurance requirements when, in the sole discretion of the City's Risk Manager or any other authorized representative of the City Manager, it is in the City's best interests to do so.

(b1) Contractor's General Liability Insurance. The Contractor shall secure and maintain during the life of the Contract, Commercial General Liability insurance in an amount not less than One Million Dollars (\$1,000,000) Combined Single Limits (CSL) per occurrence; Two Million Dollars (\$2,000,000) General Aggregate; Two Million Dollars (\$2,000,000) Products Completed Operations Aggregate. Coverage shall include, but not limited to, the following: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent; (E) Explosion, Collapse, and Underground

In addition to the foregoing, the Contractor, if required in the bid or special provisions, will be required to provide umbrella coverage in an amount of One Million Dollars (\$1,000,000) to Five Million Dollars (\$5,000,000) as determined necessary by the City's Risk Manager based on an analysis of the risks involved in the particular work to be performed.

The City and the City's Consultant (if applicable) shall be listed as additional insureds to the General Liability Policy. With respect to workers' compensation and employers' liability, comprehensive automobile liability, commercial general liability, and umbrella liability insurance, Contractor shall require its insurance carriers to waive all rights of subrogation against City, Engineer, Engineer's Subconsultants and their respective officers, directors, partners, employees, agents and, when required, CSX Transportation, Inc. (CSXT).

(b2) Contractor's Motor Vehicle Insurance. The Contractor shall secure and maintain during the life of the contract, Contractor's Motor Vehicle Insurance, including Michigan No-Fault Coverages, with limits of liability not less than One Million Dollars (\$1,000,000) per occurrence combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

(b3) Owners and Contractors Protective Liability Insurance- The Contractor shall secure and pay the premiums for, and maintain during the entire life of the contract, a separate Owners and Contractors Protective Liability Insurance Policy with limits of liability not less than One Million Dollars (\$1,000,000) per occurrence and aggregate. The City of Grand Rapids shall be "Named Insured" on said coverage. Only the City of Grand Rapids shall be a named insured on such policy, except that, if there are any named additional insureds, then the policy limits shall be increased by an additional One Million Dollars (\$1,000,000) CSL for each named additional insured.

(b4) Worker's Compensation Insurance, including Employers' Liability Coverage. The Contractor agrees that it and all of its Subcontractors will comply with all applicable Workers' Compensation laws and will provide proof of such insurance coverage. This insurance shall protect Contractor against all claims under applicable state workers' compensation laws.

(c) Builders Risk Insurance. When required in the Special Provisions, the Contractor shall purchase and maintain during the term of construction Builder's Risk/Installation Floater Property insurance in the amount of the Contract price. Policy shall be on an All Risk form and cover all property under a Replacement Cost basis. Coverage shall include, but may not be limited to: Fire, lightening, removal, wind, hail, aircraft, vehicles, explosion, riot, smoke, vandalism, malicious mischief, collapse, theft, and water damage. Policy shall name City of Grand Rapids as Loss Payee.

(d) Notification of Cancellation. A guarantee that should any policy be cancelled, change in, or non-renewal before the expiration date thereof, notice shall be delivered to the City, shall be endorsed on each policy and shall be noted on each certificate.

If any of the above coverages expire during the term of the contract, the Contractor shall deliver renewal certificates, endorsements, and/or policies to City of Grand Rapids at least ten (10) days prior to the expiration date.

(e) If the work is located in the City of Kentwood, City of Walker, Township of Cascade, or Township of Grand Rapids, the Contractor shall furnish to that unit of government an Owner's Protective or Contingent Liability policy written in the name of that unit of government in the amount of the Owner's and Contractor's Protective Liability Insurance limits specified in paragraph b3) Owner's and Contractor's Protective Liability Insurance.

1.04 Non-Discrimination Requirements. The Contractor shall not discriminate against any employee or applicant for employment, to be employed in the performance of their contract, with respect to their hire, tenure, terms, conditions or privileges of employment because actual or perceived color, race, religion or creed, sex, gender identity or expression, sexual orientation, national origin, genotype, age, marital status, familial status, medical condition, disability, height, weight, or source of lawful income in accordance with federal state, and local law and ordinance. Breach of this Contract may be regarded as material breach of Contract as provided for in Act 453, of the Public Acts of 1976. The Contractor further agrees to require similar provision from any subcontractors and suppliers.

- 1.05 Preconstruction Meeting.** The Contractor shall, upon award of the Contract, arrange for a Preconstruction Meeting with the Engineer. At the Preconstruction Meeting the Contractor shall present to the Engineer a proposed work schedule for their approval. The meeting shall also serve to coordinate the Contractor's work with the utility companies.
- 1.06 Time.** In the performance of the work under City Contracts, time shall be deemed to be of the essence.
- 1.07 Permits and Licenses.** The Contractor shall procure all permits and licenses and pay all charges and fees necessary to the due and lawful prosecution of the work. Costs for these items shall be included in the price bid for other items of work.
- 1.08 Sanitary Provisions.** The Contractor shall comply with all rules and regulations of the State and local health officials and must take such precautions as are necessary to avoid creating unsanitary conditions.
- 1.09 Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material.** If, during the course of construction, any asbestos, PCBs, petroleum, hazardous waste or radioactive materials are uncovered or revealed at the site which were not shown or indicated on the Drawings or in the Special Provisions to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site, the Contractor shall cease operations affecting the find and shall notify the Engineer, who shall notify the necessary parties. No further disturbance of the materials shall ensue until the Contractor has been notified by the Engineer that they may proceed.

Any additional work or contract time associated with removal and disposal of any such hazardous materials, if encountered, shall be included in a Change Order. The contract price and contract time shall be adjusted in accordance with the provisions stated in these General Requirements. City reserves the right to negotiate such additional work under a separate contract.

1.10 Contractor Responsibilities.

- 1.10.01 Safety and Protection.** The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
- (a) the public and all persons on the Work site or who may be affected by the Work;
 - (b) all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
 - (c) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The Contractor shall notify owners of adjacent property and of underground facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in

this paragraph caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by the Contractor. The Contractor's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and accepted.

- 1.10.02 Safety Representative.** The Contractor shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.
- 1.10.03 Hazard Communication Programs.** The Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.
- 1.10.04 Emergencies.** In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the City or the Engineer, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Engineer prompt written notice if the Contractor believes that any significant changes in the Work or variations from the Contract have been caused thereby. If the Engineer determines that a change in the Contract is required because of the action taken by the Contractor in response to such an emergency, a Change Order will be issued to document the consequences of such action.
- 1.10.05 Supervision and Superintendence.** The Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall be responsible to see that the complete Work complies accurately with the Contract.

The Contractor shall keep on the Work at all times during its progress a competent superintendent who will cooperate fully with the Engineer at all times and who shall not be replaced without written notice to the Engineer except under extraordinary circumstances. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

- 1.10.06 Labor, Materials, and Equipment.** The Contractor shall provide competent, suitably qualified personnel to perform the Work as required by the Contract. The Contractor shall at all times maintain good discipline and order at the site.

The Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the Work. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of the City. If required by the Engineer, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used,

cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract.

1.10.07 Claim Resolution. Contractor shall promptly address any oral, verbal or written damage claims received from residents, business owners, property owners, pedestrians, motorists, and/or any other person(s). The Contractor shall notify the Engineer every two weeks in writing as to the status of the resolution of the claim. Any work to be performed as a result of a claim's resolution shall be completed by the Contractor within 45 days of the claim resolution, or by the date mutually agreed to by the Contractor and the claimant.

1.11 Completion/Substantial Completion. When the Contractor considers the Work complete, they shall notify the Engineer. If the Engineer agrees and the Contractor has furnished the City with all required records, operating and/or maintenance manuals, guarantees, bonds and other such documents required by the Contract or applicable permits, law, etc., the Engineer will notify the Contractor that the Work is complete and accepted.

Should the Engineer not consider the Work complete, they shall notify the Contractor of the incomplete or defective work and the Contractor shall promptly remedy the deficiencies.

Should the Contractor consider that all or a portion of the Work is Substantially Complete as defined herein and as more fully described below, they shall declare so in writing and request the Engineer to concur in writing.

Within two weeks thereafter, the Engineer shall make an inspection of the Work or a portion thereof, to determine the status of completion. If the Engineer does not consider the Work or a portion thereof substantially complete, the Engineer shall notify the Contractor in writing, giving reasons therefor. If the Engineer considers the Work or a portion thereof substantially complete, the Engineer shall prepare a Notice of Substantial Completion which will fix the date of Substantial Completion and the responsibilities between the City and the Contractor for operation, utilities, and maintenance. The notice shall include a tentative list of items to be completed or corrected before final acceptance.

Substantial Completion includes, but is not limited to the following examples: the treated water main is completed, including testing and disinfection, and can be put into service in accordance with the City's standard operating procedures; and all valves, branch piping, distribution mains, appurtenances and connections to existing water mains have been installed and operational; the sanitary sewer system has been installed and tested for infiltration and exfiltration; the storm sewers and catch basin leads have been installed to adequately collect and transport stormwater runoff; all final grading and pavement restoration including bituminous leveling course, drive approaches, sidewalks, curbs and gutter, have been completed. Substantial Completion for equipment requires the successful start-up of said equipment or the successful start-up of the facility in which the equipment operates, and the Engineer accepts the equipment for the City's beneficial use.

1.12 Guarantee. The Contractor shall guarantee the completed work for one year, shall promptly repair, replace, restore, or rebuild, as the Engineer may determine, any finished work in which defects of materials or workmanship may appear or to which damage may occur (or has occurred) because of such defects during the one-year period following Final Completion except where other periods of maintenance and guarantee are provided or at a point of substantial completion as agreed to in writing by the Contractor and Engineer, and as provided below.

The date of substantial completion for general construction may be upon final payment for the work performed or as otherwise agreed in writing between the Engineer and the Contractor after a written request from the Contractor to the Engineer.

The date of substantial completion for equipment may be the date of successful start-up of said equipment or the successful start-up of the facility in which the equipment operates, and the Engineer accepts the equipment for the City's beneficial use, whichever event occurs last, or as otherwise agreed in writing between the Engineer and the Contractor after a written request from the Contractor to the Engineer.

All subcontractors', manufacturers', or suppliers' warranties and guarantees, expressed or implied, with respect to any material or equipment used in or incorporated as a part of the Work shall be obtained by the Contractor as agent for the City, and all such warranties and guarantees shall inure to the benefit of the City without the necessity of separate transfer or assignment thereof; **Provided:** that if approved by the Engineer, the Contractor shall require such subcontractors, manufacturers, or suppliers to execute such warranties and guarantees in writing to the City.

Notice by the Engineer to the Contractor to repair, replace, rebuild or restore such defective or damaged work shall be timely if given not later than ten (10) days subsequent to the expiration of the stipulated one-year period or other periods provided herein.

- 1.13 Assignments.** The Contractor shall not assign, transfer, convey, or otherwise dispose of this Contract or their right to execute it or their right, title, or interest to it or any part thereof, or assign any of the moneys due or to become due under this contract, without the prior written consent of the Engineer.
- 1.14 Estoppel (No waiver of legal rights by City).** The City or any officer, agent or employee thereof, shall not be estopped, bound or precluded by any determination, return, decision, approval, order, letter, payment or certificate made or given by the City Manager, or other officer, employee or agent of the municipality at any time, either before or after the final completion and acceptance of the Work and payment therefor from: (1) showing the true and correct amount, classification, quality and character of the work done and materials furnished by the Contractor or any other person under this contract, or from showing at any time that any determination, return, decision, approval, order, letter, payment or certificate is untrue and incorrect, or improperly made in any particular, or that the completed Work or incorporated materials or any part thereof, do not in fact conform to the specifications, and (2) from demanding and recovering from the Contractor any overpayments made to them, or such damages as it may sustain by reason of their failure to perform each and every part of this Contract in strict accordance with its terms, or both.
- 1.15 Unlawful Provisions.** All unlawful provisions shall be deemed stricken from the Contract and shall be of no effect. Upon the application of either party, the unlawful parts shall be considered stricken without affecting the binding force of the remainder of the Contract.
- 1.16 Patents.** The Contractor shall pay all royalties and license fees and shall hold and save the City, its officers, agents, servants and employees harmless from liability of any nature and kind, including costs and expenses for or on account of any patented or unpatented invention, process, article or appliance manufactured or used in the performance of the Contract, including its use by the City. In this respect, the Contractor shall defend all suits or claims for infringement of any patent or license rights.
- 1.17 Subcontracting.**
- 1.17.01 Permission.** The Contractor shall not subcontract or assign any portion of the Contract without the written consent of the Engineer. Such consent shall not relieve the Contractor from full responsibility for the performance of the Work. The authority thus exercised by the Engineer shall be construed as having been delegated to them by the City Manager and they is acting on behalf of the City Manager.
- 1.17.02 Subcontractors to Prequalify.** Approval of the subcontracting of any portion of the Contract will not be granted unless and until the subcontractor is prequalified for

work of the type and magnitude proposed. The current City Commission Policy and Procedures for Prequalification of Bidders and Subcontractors, and a list of prequalified Bidders and Subcontractors are on file at the City Engineer's Office for reference.

- 1.17.03 Subcontracts.** All Contractors will be required to provide the City with copies of executed Subcontracts for all subcontracted work in excess of \$3,000. Said Subcontracts shall be executed on forms supplied by the City Engineer's Office.

Unless approved by the Engineer, the Contractor shall utilize the Subcontractors listed in the Bid Form.

- 1.17.04 Prompt Payment.** For progress payments, the prime contractor agrees to pay each subcontractor under the prime contract for satisfactory performance of its sub-contract work within a reasonable time from the completion of such work but not later than fifteen (15) calendar days from payment by the City for such work. The term "satisfactory performance" is defined as sub-contracted work completed by the subcontractor and accepted by the prime contractor.

Final payment by the prime contractor to each subcontractor for sub-contracted work under the prime contract shall occur not later than fifteen (15) calendar days from final payment to the prime contractor by the City. Final payment to the subcontractor shall be made only for work that is satisfactorily completed. The term "satisfactorily completed" is defined for the purpose of this prompt payment clause as when:

1. Prime contractor finds that the subcontractor's work is completed in accordance with the contract plans and specifications;
2. All required paperwork, as applicable, including but not limited to material certifications, payrolls, payment certifications, etc., have been received and approved by prime contractor; and,
3. The City has inspected and approved the subcontracted work and determined such work to be acceptable.

This prompt payment provision shall be a requirement and does not confer third-party beneficiary rights or other direct rights to a subcontractor against the City.

- 1.17.05 Payment Certification.** The prime contractor shall provide to the City closeout documentation certifying total dollars paid to subcontractors on the project pursuant to the bid and contract documents. Further, the prime contractor shall require, as part of the closeout documents, the same information from its subcontractors when the subcontractor utilized Micro-Local Business Enterprise (MLBE) firms as the subcontractor's subcontractor. The City reserves the right to withhold final payment to a prime contractor until the requirements of this provision have been satisfied.

- 1.18 Authority of the Engineer.** The Engineer shall decide all questions which may arise as to the quality and acceptability of materials furnished and work completed; all questions which may arise as to the interpretation of the Drawings and specifications; and all questions as to the satisfactory and acceptable fulfillment of the terms of the Contract. The City reserves the right to make minor technical changes in the Work, when such changes would provide a better completed project, in the judgment of the Engineer, and would not incur additional expense for the Contractor. The authority thus exercised by the Engineer shall be construed as having been delegated to them by the City Manager and that they are acting on behalf of the City Manager.

The Engineer shall not supervise, direct or have control of the Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto.

- 1.19 Coordination of Parts of the Contract.** It is the intent of the Contract to describe a functionally complete Project. All Work, materials or equipment that may reasonably be inferred from the Contract or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for.

1.19.01 Pay Items. The listing of Pay Items in the Bid Form and the Contract is intended to define the complete Work for the purposes of receiving competitive bids, and for determining the amounts of partial and final payments to the Contractor. The Pay Items describe the work to be done for each unit price bid. Additional descriptions of some pay items are included in those Divisions of these Standard Specifications and in Special Provisions included with some contracts, which specify and describe the Work in detail. The cost of work which is required to provide a complete project, but which is not described either in the wording of the Pay Items or in the additional descriptions of Pay Items, shall be considered to have been included in the prices bid for the Pay Items listed in the Bid Form, and will not be paid for separately.

- 1.20 Access.** The Engineer and their representatives shall be allowed access to all parts of the Work at all times and shall be furnished such information and assistance by the Contractor as may be required to make a complete and detailed inspection. Such inspection may include mill, plant or shop inspection of materials and workmanship.

Scales and weighing equipment may be inspected at any time by the City. Claims by the Contractor for delays or inconvenience due to these operations will not be considered.

- 1.21 Authority and Duties of Inspectors.** Inspectors shall not supervise, direct, or have control of the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. Inspectors are not authorized to revoke, alter, enlarge or relax any of the specifications nor to change the Drawings in any particular. The Inspectors are not authorized to increase or decrease any Contract item nor to add new items to the Contract. The Inspector will inform the Engineer as to the progress of the work and the quality of the completed work, and the quality of the materials being used. No payments will be made for materials or work found to be defective by the Inspector. No additional payments will be made to the Contractor for efforts required to uncover defective work which was covered after the Inspector informed the Contractor of the defect. In no instance shall any action or omission on the part of the Inspector relieve the Contractor of the responsibility for completing the Work in accordance with the Contract.

- 1.22 Final Inspection.** The Engineer shall make inspection of the completed Work, or such portions thereof which are eligible for acceptance upon notification by the Contractor that the Work is complete or substantially complete. If the completed Work is not acceptable to the Engineer at the time of such inspection, they shall inform the Contractor orally or in writing as to the particular defects to be remedied before final payment can be made.

- 1.23 Partial Payments.**

1.23.01 Completed Work. Projects will fall into one of the following three classifications:

- a) Projects less than \$30,000.** Partial payments will be made monthly or as may be otherwise agreed by the Contractor and the Engineer. Such payments shall be made on the basis of 90% of the amount earned. Partial payments shall only be made if the following provisions apply: that the Work is progressing satisfactorily, the time for completion has not expired, and that not less than \$500 has been earned during the month.

When, in the opinion of the Engineer, the project has been substantially completed, the Engineer may reduce the retained amount to an amount sufficient to pay for

the Work yet to be done provided that the Contractor has filed with the City the written consent of the Surety to such reduction and, that the Contractor has furnished an affidavit that all their indebtedness by reason of the Contract has been paid.

- b) Projects with a maximum of three payments.** For certain projects the Engineer may state in the Special Provisions that a maximum of three payments will be made. The Special Provisions shall also describe how the payments will relate to the progress schedule, i.e., at which major points in work the Contractor can expect to receive payments. In these cases the first two payments will be made on a basis of 90% of the amount earned. Partial payments shall only be made if the following provisions apply: that the Work is progressing in accordance with the Contract, that the time for completion has not expired, and that not less than \$500 has been earned since the last payment.

When, in the opinion of the Engineer, the project has been substantially completed, the Engineer may reduce the retained amount to an amount sufficient to pay for the Work yet to be done; provided, that the Contractor has filed with the City the written consent of the Surety to such reduction and, that the Contractor has furnished an affidavit that all their indebtedness by reason of the Contract has been paid.

- c) All other projects.** For all projects not as described in paragraph a.) or b.) above, partial payments will be made monthly or as may otherwise be agreed by the Contractor and Engineer and on the basis of the amount earned however, payments for work done, which exceed 95% of the final Contract amount, shall be made only after the Contractor has filed with the City the written consent of the Surety and has furnished an affidavit that all their indebtedness, by reason of the Contract, has been paid.

Partial payments shall only be made if the following provisions apply: that the Work is progressing satisfactorily in accordance with the Contract, that the time for completion has not expired, and that not less than \$500 has been earned during the month.

- 1.23.02 Accepting Payment.** By accepting payments, the Contractor declares that they have not, during the period of the time for which they are accepting payment, performed any work, furnished any materials, sustained any loss, damage, or delay, or otherwise done anything for which the Contractor shall ask, demand, sue for, or claim compensation from the City of Grand Rapids in addition to the regular items as set forth in the Contract executed between the Contractor and the City of Grand Rapids and the extra work as agreed to in writing between the Contractor and the City of Grand Rapids except as the Contractor has filed a written claim with the Engineer prior to the Contractor's acceptance of said payment.

- 1.23.03 Delivered Materials.** Generally no allowance will be made in any payment for materials furnished and delivered until such materials have been permanently incorporated into the Work. In the case of non-perishable or indestructible materials which are properly stored and protected to the satisfaction of the Engineer, and are not scheduled to be incorporated into the Work for 30 days or more, the Engineer may make an allowance in the estimate not to exceed the invoice price of such items. However, Contractor shall be responsible for any such materials which are lost or stolen even though they have been included in progress payments.

- 1.24 Acceptance and Final Payment.** When the Work has been completed and the Engineer has ascertained that each and every part of the Work has been performed in accordance with the

Contract or such modifications thereof as have been approved, the same will be accepted and the Engineer will make a final estimate as soon as practicable, but not more than one month after acceptance, for the completed Work, and the total amount due the Contractor, less the total amount of all previous payments will be paid.

Final payment will not be made until the Contractor has filed with the City the consent of the Surety to payment of the final estimate and satisfactory evidence by affidavit or otherwise that all their indebtedness by reason of the Contract has been fully paid or satisfactorily secured. In case such evidence is not furnished, the Engineer may retain out of any amount due said Contractor sums sufficient to cover all lienable claims unpaid.

The acceptance of the final payment by the Contractor, or by anyone claiming by or through them of the final payment, whether such payment be made pursuant to any judgment of any court or otherwise, shall constitute and operate as a release of the City from any and all claims of and liability to the Contractor for anything theretofore done or furnished for or relating to or arising out of the Contract, and the Work done thereunder, and for any prior act, neglect or default on the part of the City or any of its officers, agents, or employees, excepting only a claim against the City for the amount deducted or retained in accordance with the terms and provisions of this Contract.

1.25 Authorized Extras and Changes in Work.

1.25.01 Increased or Decreased Quantities of Contract Items. The City reserves the right under the Contract to make such changes from time to time in the character of the Work and the length of the project as may be necessary or desirable. When said changes are made in original Contract items, and if such a change amounts to Twenty-Five Percent (25%) or more in any one Contract item, or in two or more closely related items, a new unit price may be negotiated for each of the items thus increased or decreased, or as otherwise specified in the Special Provisions.

1.25.02 Construction Items Not in Original Contract. The amount to be paid to the Contractor for work and materials not included in a specific Contract item shall be determined by one or more of the following methods, the City reserving the right to select the method or methods at the time the change in the Work is ordered.

- (a) **By an acceptable lump sum bid.** All lump sum bids shall be itemized and all quantities and unit prices shall be given, as well as the total amount.
- (b) **By unit prices.** The payment for such items(s) of work shall be made on the basis of the actual quantity completed at the unit prices(s) for such items(s) in the original Bid or fixed by subsequent agreement.
- (c) **By force account.** The Engineer may order such work, including any required off-site work, to be done by force account. The compensation as herein provided shall be accepted by the Contractor as payment in full for extra work done by force account, and the general expense, overhead, miscellaneous costs, unforeseen costs, and the use of small tools and equipment.

For approved subcontract work, the Contractor will be paid an amount equal to six percent (6%) of the total administrative costs incurred in connection with the subcontract work. When it becomes necessary for the Contractor to hire a firm to perform a specialized type of work or a service for which the Contractor or Subcontractors are not qualified to do, payment will be made at the invoice costs. Prior approval by the Engineer is required. The Contractor will be paid an amount equal to six percent (6%) of the invoice costs as reimbursement for administrative costs. The aforesaid six percent (6%) administrative cost shall

be a one-time cost paid by the City to the Contractor, and no additional costs therefore shall be paid to any intermediate tier of Subcontractors.

For all labor and for all craft forepersons directly engaged in the specified work, the Contractor will be paid the actual rate of wages and the number of hours paid computed to the nearest half hour, plus twenty-six percent (26%) of the sum thereof, which includes a one percent (1%) allowance for the Single Business Tax.

For materials, the Contractor will receive the actual cost of such materials and supplies delivered to the site of the work, including freight charges as shown by original receipted bills, plus twenty percent (20%) of the sum thereof. If a change in the amount or type of the force account work results in a surplus of the materials and/or supplies ordered and delivered to the project site, the City will reimburse the Contractor for the costs incurred in returning the surplus materials and/or supplies to the supplier.

For any machinery and equipment owned by the Contractor, which it may be deemed necessary or desirable to use on force account work, the Contractor shall be paid an ownership expense price as approved by the Engineer and which will be reviewed annually.

When it is necessary for the Contractor to rent equipment in the performance of the force account work, the Contractor shall be allowed the actual rental price paid, if reasonable, for each and every unit of time (i.e., hourly, daily, weekly, monthly) that such equipment is used on the work, to which the sum of twenty percent (20%) will be added. The Contractor will be required to furnish receipted bills to cover such rental costs.

Bond premium, workers' compensation insurance, personal injury public liability insurance, property damage public liability insurance, unemployment compensation, and federal social security shall be paid for at actual cost to which the sum of twenty percent (20%) will be added except that twenty-six (26%) percent will be added to the taxable fringe benefits. The Contractor shall furnish satisfactory evidence of the amounts paid for each of these required costs as related to the force account work.

The Contractor shall furnish to the Engineer itemized reports of the costs of all force account work. The reports shall be furnished as often as required by the Engineer and shall include a certified copy of the weekly payroll and copies of the bills for the materials used and freight charge paid on the same. Discount for prompt payment or penalty for late payment will not be considered in determining the net amount of the bill. The net amount of the bill shall be charged to the force account work. When materials used are not specifically purchased for use on extra work but are taken from the Contractor's stock, the Contractor shall submit certification of the quantity, price and freight of such materials in lieu of the original bills and invoices.

The Contractor shall prepare itemized statements on acceptable City forms that include, but is not necessarily limited to, the following information:

- Name, class, dates, number of hours worked each day, total hours computed to the nearest half hour, rate, and extension for each laborer and foreperson engaged;

- Designation, number of hours computed to the nearest half hour worked each day, total hours, rental rate, and extension for each unit of equipment engaged;
 - Quantities of materials, prices, and extensions. Freight on materials.
- As often as the Engineer requires, the Contractor and the Engineer shall compare records of force account work and bring them into agreement.

1.25.03 Deleting Items. The Engineer shall have the right at any time to delete the performance or completion of any Contract item and shall promptly execute the standard City forms as evidence of such action. A fair and equitable amount, representing all costs incurred on such items prior to such deletion, shall be agreed upon in writing and paid to the Contractor.

1.25.04 Equivalent Materials and Equipment. Whenever any material or equipment is defined by describing a proprietary product, or manufacturer's name, the term "or approved equal," if not inserted, shall be implied. The specified material or equipment shall be understood to indicate a standard of quality. The Engineer will consider alternate products upon request of the Contractor and may allow such substitution, when in the opinion of the Engineer equal products are being offered. Said approval shall be in writing.

1.26 Defective Materials and Work. All materials which do not meet the requirements of the specifications at the times they are to be used shall be rejected, unless otherwise authorized as acceptable by the Engineer and approved by the City.

All completed work that may be found to be defective before the final acceptance of the completed work shall be corrected and replaced immediately in conformance with the Specifications.

The Contractor shall be responsible for any and all damages that the Work may sustain prior to its acceptance, and shall rebuild, repair, restore and make good at their own expense, all injuries and damages to any portion of the Work by the action of the elements or from any cause whatsoever prior to its acceptance.

1.27 Temporary Suspension of Work. The Engineer shall have the authority to suspend the work wholly or in part, for such period or periods as they may deem necessary, due to unsuitable weather or such other conditions as are considered unfavorable. The Contractor shall not suspend the Work or remove therefrom equipment or materials without permission from the Engineer.

Upon suspension, the Work shall be put in proper and satisfactory condition, carefully covered and adequately protected. In all cases of suspension of construction operations, the Work shall not again be resumed until permitted by written order of the Engineer. In the event that the Work is temporarily suspended, no claims for additional compensation will be approved, and extensions of the contract completion date will only be allowed if approved in writing by the Engineer.

The Engineer shall not supervise, direct, control, or have authority over or be responsible for the Contractor's means, methods, techniques, and sequences of construction, or safety precautions and programs incident thereto.

1.28 Extension of Time. If the Contractor finds that it will be impossible for them to complete the Work on or before the completion date fixed by the Contract, they shall, at least ten days prior to said date, make written request to the Engineer for an extension of time for completion of the Work. They shall set forth fully therein the reasons which they believe would justify the Engineer in granting their request and shall also set forth a revised completion date which will provide sufficient additional time for the completion of the Work.

Upon receipt of such written request from the Contractor, if the Engineer finds that the Work was delayed by conditions beyond control of the Contractor, or that the quantities of work done or to be done are sufficiently in excess of the estimated quantities to warrant additional time, they will, with or without notice to the Surety, grant an extension of time, in writing, to such date as appears to them to be reasonable and proper. This date shall thereafter be as binding upon the Contractor and Surety as if it appeared in the Contract originally.

When such extension of time, or any part thereof, is granted for the purpose of completing the work of one or more of the original Contract items which, in the judgment of the Engineer could have been completed prior to the original completion date, and when the completion of such original Contract items required additional expense of inspection, engineering or other services, the City reserves the right to deduct such expense from any moneys to be paid the Contractor for the said original Contract items which were completed after the original completion date.

Payments due the Contractor will be paid only if the Contract completion date is not in default at the time payments are due, except for those items of work which were completed before the Contract completion date.

Immediately following the Contract Completion date, the Contractor's right to proceed with the Work under the Contract may be considered forfeited, and the City may proceed immediately to terminate the Contract as provided in the General Conditions under Termination of Contract. Under these circumstances the City is not required to give the Contractor the ten (10) day written notice of such forfeiture.

Permitting the Contractor or the Surety to continue and finish the Work, or any part thereof, after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the City of any of its rights under the Contract.

- 1.29 Termination of Contract.** If the Contractor shall be prosecuting the Work with a work force, equipment or materials insufficient to complete the Work by the date set for completion; or shall discontinue the performance of the Work; or shall neglect or refuse to remove such materials or to replace any such work as shall have been rejected as defective and unsuitable; or shall, for any reason, not complete the Work in accordance with the Contract; the Engineer may give the Contractor and Surety written notice, specifying the delay, neglect or default, and the action to be taken by the Contractor; and if the Contractor or Surety, within a period of ten (10) days after such notice, shall not proceed satisfactorily in accordance therewith; then the City may terminate the Contract. The City may then complete the Work with its own forces, may enter into another contract to finish the Work, may appropriate and use any and all materials on the site which may be suitable, or may use such other methods as in its judgment may be required for the proper completion of the Work.

If the Contractor commits any act of bankruptcy, becomes insolvent, or is declared bankrupt; if the Contractor follows any final judgment against them to remain unsatisfied for a period of five days; or, if the Contractor shall make an assignment for the benefit of their creditors; then in such case, the City shall have full power and authority to proceed in any of the ways aforesaid, forthwith upon the delivery by the Engineer to the Contractor and Surety of written notice stating the reasons for the Engineer's said action.

In case the City takes over the uncompleted work under any provisions of this section, all additional costs damages, and charges for completing the work shall be deducted from moneys due or to become due the Contractor; and if the total of such damages, costs and charges exceeds the balance of the Contract price which would have been payable to the Contractor had they completed the Work, then the Contractor and Surety shall, on demand, pay to the City the amount of such excess.

The City has the right to terminate the Contract in whole or in part for the City's convenience and without cause. Notification of termination by the City for convenience shall be delivered to the Contractor, specifying the extent of termination and the effective date. Upon receipt of such notice, the Contractor shall immediately, in accordance with direction from the City, proceed with performance of the following regardless of delay in determining or adjusting amounts due under this Section:

- (a) cease operations as specified in the notice and deliver to the City the originals or legible copies of all Drawings, Specifications, reports and other data, records and materials in the Contractor's custody and control pertaining to the portion of the Work for which the Contractor was terminated;
- (b) enter into no additional subcontracts, except as necessary to complete continuing Work and approved by the City;
- (c) terminate, on favorable and negotiable terms, all subcontracts to the extent they relate to the Work terminated;
- (d) complete the performance of Work not terminated; and
- (e) take actions that may be necessary or that the City may direct, for the protection and preservation of the terminated Work and of materials, and equipment in transit or stored.

Upon such termination, the City shall pay the Contractor, as its sole remedy, including a reasonable allowance for overhead and profit, for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination, for items properly and timely fabricated off the Project Site, delivered and stored in accordance with the City's instructions, and for out-of-pocket costs incurred in complying with the above, such as reasonable demobilization costs, protection and preservation costs, negotiated settlements with subcontractors or suppliers, claims resolution, restocking charges, shutdown costs, etc. The Contractor shall waive all other claims against the City based on the termination except to the extent the Contractor has filed a written claim with the Engineer that has not been previously resolved. In addition to payment(s) related to the City's termination for convenience, the City will bring current all payments due and payable to the Contractor for Work properly completed up to the effective date of termination. In any recovery by the Contractor, the City shall be credited for payments previously made to the Contractor for the terminated portion of the Work. Any termination for cause by the City that is determined to have been wrongful will be deemed a termination for convenience and handled in accordance with this section.

- 1.30 Cooperation by Contractor.** The Contractor shall conduct their operation so as to interfere as little as possible with those of other Contractors, Utilities, or any public authority on or near the work shown on the Drawings or in the other documents comprising the Contract.

The Contractor shall adjust their schedule when necessary and cooperate with other Contractors to the best interest of the City, as determined by the Engineer.

No claims for extra compensation or adjustments in the Contract price will be made on account of delay or failure of others to complete work units as scheduled.

The Contractor agrees to make no claim for monetary damages for delay in the performance of the Contract occasioned by any act or omission to act of the City or any of its representatives, or because of any injunction which may be brought against the City or its representatives, and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of the Work.

- 1.31 Other Remedies.** The previous provisions outlined shall be in addition to any and all other legal remedies permissible under law.
- 1.32 Utility Work Within the Public Right-of-Way.** Any Contractor representing a private party or private utility company, or any private utility company working within the public right-of-way within the City of Grand Rapids, or outside the City of Grand Rapids where the City of Grand Rapids has sanitary sewers or watermain which are an extension of the Grand Rapids system, shall comply with the construction methods and materials requirements as set forth in this book or in accordance with any other requirements on file in the Grand Rapids City Engineer's Office. For work within the City of Grand Rapids the Contractor shall also comply with all Land Use (LUDS) Permit requirements.
- 1.33 MDOT Standard Specifications for Construction.** Pay Items from the current Michigan Department of Transportation Standard Specifications for Construction when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction unless otherwise modified by the City's Standard Construction Specifications or project Special Provisions.

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DIVISION 1 – GENERAL PROJECT REQUIREMENTS

SECTION 1.2

GENERAL REQUIREMENTS

1.01 General Requirements

1.01.01 The General Requirements contained in Division 1 of these Standard Specifications apply to the Work described in the other Divisions. The costs of work specified in this Division shall be considered to have been included in the prices bid for other Pay Items listed in the Bid Form and will not be paid for separately.

1.01.02 When the description of the work is referenced to the Bid Form it shall refer specifically to the listing of Pay Items in the Bid Form and the Contract.

1.01.03 Public Safety and Convenience. The Contractor shall at all times conduct their work so as to create the least possible obstruction to both vehicular and pedestrian traffic and to ensure the safety and convenience of the general public including the residents along the street. Unless otherwise specified, streets shall remain open to local and emergency traffic during construction operations.

Complete protection of persons and property shall be provided by the Contractor. To this end, the Contractor shall provide and maintain adequate barricades, signs, lights, temporary pavement marking, and flags to warn and guide the public, and shall provide flag persons and watch persons as required. If no separate pay item is provided, the cost of maintaining traffic as referenced in this Division and [Section 8.1](#) shall be considered to be included in the prices bid for other items of work.

1.02 Protection and Restoration of Property.

1.02.01 Contractor to Restore Property. The Contractor shall restore, at their own expense, any public or private property damaged or injured as a result of any act or omission on their part or on the part of their employees or agents, to a condition similar and equal to that existing before such damage or injury was done.

1.02.02 Clean-Up. All cleanup shall be completed, and site restored in accordance with LUDS permit (if required), before final acceptance of the Work. The Contractor shall clean the street surface, walks, gutters, fences, lawns, private property, right-of-way, and structures, leaving them in as good a condition as originally found, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site.

1.02.03 Railroad Crossing Protection. Whenever a line of pipe or any other structure shall cross any railroad or lie close to any railroad track, all of the precautionary construction measures required by the railroad officials shall be performed by the Contractor.

1.02.04 Public Easement. The easements shown on the Drawings for this project have been secured by the City of Grand Rapids or other governmental units involved for the construction, maintenance or repair of the utility shown on the Drawings. When additional access rights have been acquired, they shall be described in the Special Provisions.

These easements do not grant the City or the Contractor the unrestricted use of the properties adjacent thereto, nor do they grant the City or other governmental units or the Contractor the right to disturb trees or landscaping or structures outside the easement areas.

- 1.02.05 Notification to "Miss Dig".** The Contractor shall notify the Utility Communications Systems (Miss Dig - 800-482-7171) a minimum of three (3) working days hours prior to commencing any excavating, blasting, or drilling.
- 1.02.06 Soil Erosion and Sedimentation Control.** When a LUDS permit is required for the Project, the Contractor shall not proceed until Authorization to Proceed has been received from the Development Center.
- 1.03 Monuments.** United States public land survey monuments, City street monuments, and land property corner irons shall not be disturbed by construction operations, except as authorized by the Engineer.
- U.S. Government monuments, (i.e., section corners, quarter section corners, and center section points) which require removal and replacement shall not be disturbed by the Contractor. If encountered, the County Surveyor will be notified by the Engineer and the County Surveyor will witness, remove and replace such monuments at no cost to the Contractor.
- City street monuments, if encountered, shall not be disturbed by the Contractor. The Engineer will arrange for City forces to witness, remove and replace these at no cost to the Contractor.
- Property corner irons, if encountered, shall be witnessed, removed and replaced by a Registered Land Surveyor, licensed in Michigan. The cost of this work shall be born entirely by the Contractor and shall be included in the prices bid for other items of work on the project.
- Any monuments of any type disturbed by the Contractor without proper notifications as required will be replaced in a manner acceptable to the Engineer at the Contractor's sole cost.
- 1.04 City Datum.** The 0.00 (zero elevation) of City Datum is 588.79 feet above mean sea level as determined by the United States Geological Survey (USGS).
- 1.05 Water.** If the Contractor desires to use City water for construction, they shall obtain the required permit from the City Water Department. A hydrant connection will then be issued to them by the City Water Department. The Contractor must deposit the required fee as charged by the City Water Department for the use of the hydrant connection. It will be refunded to the Contractor upon the return of the connection. The use of privately owned hydrant connections is prohibited. When connections are made to hydrants, the Contractor shall promptly notify the City Fire Department.
- 1.06 Contractor's Office.**
- 1.06.01 Place of Office.** The Contractor shall maintain an office at or near the site of the Work, or at some regularly appointed place of business within the Grand Rapids metropolitan area. They shall keep on file in this office copies of the Contract. The date of delivery of written notices from the City left at this office shall constitute and become the date of Contractor's notification.
- 1.06.02 Office for Engineer.** The Contractor shall furnish and maintain an office for the exclusive use of the Engineer in making field tests or as a field office, for use at concrete batching plants, asphalt plants, or other large projects, if so ordered by the Engineer. The building shall be suitably heated and lighted, and where feasible, a telephone shall be installed as directed.

1.07 Contractor's Employees. The Contractor shall employ only competent and trained employees for work on the project.

1.08 Blasting. Where blasting is necessary, the Contractor shall obtain the required permits and licenses from the City Fire Department and the State Fire Marshall at their own expense. The work shall be done in compliance with the City Ordinance, and with due regard to the safety of workers, the public, and public and private property.

The Engineer reserves the right to reject any proposed blasting procedures. However, the Engineer will not supervise, direct, control or have authority over or be responsible for the Contractor's means, methods, techniques, sequences or procedures of construction, including blasting, or the safety precautions and programs incident thereto.

1.09 Progress Schedule. The Contractor shall be responsible to perform and complete the Work in accordance the Project Progress Clause and [Section 1.1](#).

1.10 Maintaining Traffic. The Contractor shall be responsible to conduct the Work in a manner which will ensure the safety and convenience of the public, including vehicular and pedestrian traffic in and around the site of the project. Specific provisions and Pay Items for Maintaining Traffic are specified in [Section 8.1](#).

1.11 Shop Drawings. When called for in the Standard Specifications or Special Provisions, the Contractor shall submit shop drawings for equipment and material items to be incorporated into the Work.

The Contractor shall stamp each submittal indicating that they accept full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that they have reviewed or coordinated each submittal with the requirements of the Contract.

Each submittal shall include a statement prepared by the originator of the Drawings and data, certifying compliance with the Contract, except for deviations which are specifically identified.

All deviations from the Contract shall be identified on submittals.

The Contractor shall accept full responsibility for the completeness of each submission, and, in the case of a resubmission, shall verify that all exceptions previously noted by the Engineer have been taken into account. In the event that more than one resubmission is required because of failure of the Contractor to account for exceptions previously noted, the Contractor shall reimburse the City for the charges for review of the additional resubmissions when such reimbursement is required by the Engineer.

The Engineer's review of the Drawings and data submitted by the Contractor will cover only general conformity to the Drawings and Specifications, external connections, and dimensions which affect the layout. The Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or items shown. The Engineer's review of submittals shall not relieve the Contractor from responsibility for errors, omissions, deviation, or responsibility for compliance with the Contract Documents.

Four copies (or one reproducible copy) of each Drawing and necessary data shall be submitted to the Engineer. The Engineer will not accept submittals from anyone but the Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal.

- 1.12 Specified Products Index.** A materials inclusion in the Specified Products Index is not to be construed as City acceptance, warranty, or guarantee that the material provided by the Contractor meets the requirements of the contract. If the Contractor chooses to obtain materials from the Specified Products Index, the Contractor must ensure the supplier provides materials that meet the contract requirements.

If the City approves the use of materials from the Specified Products Index, the Contractor is responsible for removal and replacement of nonconforming materials, even after final acceptance, unless the Contractor can prove all of the following:

1. The Contractor provided notice to the Engineer in writing, at least 7 days prior to: materials being delivered to the site and materials being ready for sampling, testing or inspection by the City.
2. The Contractor provided the City a reasonable time to sample, test, or inspect the material prior to incorporation into the work.
3. The Contractor did not know, and had no reason to know through reasonable inquiry, that substandard materials had been supplied.
4. The materials provided matched the material described in the Specified Products Index.
5. The material described in the Specified Products Index conform to the requirements in the specification.

The Contractor must notify the Engineer if the Contractor has, or by reasonable inquiry should have, reason to believe that a material supplier, producer, or manufacturer's circumstances have changed so that the quality of the materials certified for use on the project or materials in the Specified Products Index might not meet the contract requirements.

- 1.13 Source of Steel and Iron.** The Contractor must provide steel and iron materials, for permanent incorporation into the work, that were produced only in the United States. A waiver may be granted for steel and iron materials if they are not produced in sufficient and reasonably available quantities that are of satisfactory quality. Steel and iron materials include steel, steel products, and products that include steel components.

The Contractor must ensure that the manufacturing processes, including the application of coatings, for these materials and products occur in the United States. The application of coatings includes processes that protect or enhance the value of the material to which the coating is applied.

The Contractor may provide a minimal amount of foreign steel materials on the project, if the total invoice cost of the foreign steel materials permanently incorporated in the project does not exceed 0.1 percent of the original contract amount or \$2,500, whichever is greater. The City defines the total invoice cost as the total value of the foreign steel materials delivered to the project.

The Contractor must submit written certification of compliance with the requirements of this subsection to the Engineer.

- 1.14 Project Record Drawings.** The Contractor shall maintain a set of project record drawings on the project site solely for the purpose of recording as-built information and shall record actual revisions to the work concurrently with the construction progress.

The Contractor shall store project record drawings in the Contractor's field office apart from documents used for construction and shall maintain drawings in a clean, dry, legible condition and in good order. Project record drawings shall be available for review by the Engineer at all times and shall not be used for construction purposes.

The Contractor shall record actual revisions to the work on the project record drawings concurrently with the construction progress and shall not conceal any work until the required information is

recorded. The Contractor shall legibly mark, with notes or graphic representations, the following to record actual construction:

1. Depths of various elements in relation to an approved datum.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Field changes of dimension and detail.
4. Changes made by Change Order.
5. Details not on original Drawings.

The Contractor shall provide the Engineer with completed set of project record drawings within 5 days of substantial completion of each phase or other approved time frame by engineer. If project record drawings are not complete, the Engineer will return drawings to Contractor for revision. If project record drawings are not in a clean, dry, legible condition and in good order, the Engineer may require the Contractor to transfer all marks to a set of clean drawings provided by the Engineer.

Final payment will not be made until Contractor has furnished Engineer a complete set of project record drawings in good condition.

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DIVISION 1 – GENERAL PROJECT REQUIREMENTS

SECTION 1.3

MOBILIZATION

- a. **Description.** This work consists of coordinating, scheduling, obtaining, and assembling at construction site all equipment, materials, permits, supplies, manpower, and other essential and incidentals necessary to perform Work defined in the Contract. The Contractor shall be paid mobilization in accordance with Michigan Department of Transportation (MDOT), Standards Specifications for Construction, Section 110.
- b. **Materials.** None specified.
- c. **Construction.** None specified.
- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Price for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, including excavation and backfilling, for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
	None	

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
1.3.101	Mobilization, Max (dollar)	Lump Sum

The City will pay the Contractor for **Mobilization, Max (dollar)** in accordance with Table 110-1 of Section 110 of the Michigan Department of Transportation Standard Specification for Construction.

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DIVISION 2 - EARTHWORK

- SECTION 2.1 CLEARING, GRUBBING, REMOVING TREES
- SECTION 2.2 SOIL EROSION AND SEDIMENTATION CONTROL
- SECTION 2.3 REMOVING PAVEMENTS, STRUCTURES AND MATERIALS
- SECTION 2.4 EXCAVATION, EMBANKMENT AND GRADING
- SECTION 2.5 EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES
- SECTION 2.6 CONTAMINATED SOIL AND GROUNDWATER PROCEDURES
- SECTION 2.7 BORE AND JACK

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DIVISION 2 - EARTHWORK

SECTION 2.1

CLEARING, GRUBBING, REMOVING TREES

a. Description.

1. **Clearing.** This work shall consist of cutting and disposing of all trees, shrubs, and other vegetation occurring within the right-of-way or within such other limits as may be defined on the Drawings or specifications which interfere with excavation, embankment, clear vision, or are otherwise objectionable.
2. **Grubbing.** This work shall consist of removing from the ground and disposing of all stumps, roots, logs, and other timber more than 3 inches in diameter, together with all brush, matted roots, and debris which occur within the right-of-way or within such other limits as may be defined on the Drawings or specifications.
3. **Removing Trees and Stumps.** This work shall consist of removing individual trees and stumps where called for on the Drawings or in the Bid Form or as approved by the Engineer. The materials, equipment, construction methods, and measurement and payment shall be specified under Division 2 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, or any special provisions.

b. Materials.

1. The granular material used for fill after tree or stump removal shall be Granular Material Class III as specified in the current MDOT Standard Specifications for Construction.

c. Construction.

1. No Clearing, Grubbing, or Tree or Stub Removal shall occur without an Authorization to Proceed with Earth Change from the City in accordance with [Section 2.2](#) Soil Erosion and Sedimentation.
2. **Clearing.**
 - A. All trees, stumps, brush and other vegetation occurring within the areas affected by grading, excavation, or embankment for cuts, fills, special ditches, borrow pits, and clear vision areas which are not designated on the Drawings or by the Engineer to be saved, and all such material occurring outside these areas which is shown on the Drawings to be removed, shall be cut off at a height not more than 3 feet above the ground; provided, however, that in any areas where clearing is required, but grubbing is not required, such material shall be cut off level with the ground.
 - B. All shrubs and other vegetation within the areas affected by grading, excavation, or embankment which are designated on the Drawings or by the Engineer to be saved, and all such material occurring outside these areas which is not designated on the Drawings or by the Engineer to be removed, shall be carefully protected from damage or injury during all construction.
3. **Grubbing.** All stumps, roots, logs and other timber more than 3 inches in diameter and all brush, matted roots and debris not suitable for road foundation, occurring within the limits for cuts and for fills, shall be pulled or otherwise removed to a depth of at least one foot below the ground.
4. **Clean-up.** All brush, limbs, tops, stumps, roots, logs, and debris resulting from clearing, grubbing, and removing trees, shall be removed from the site, or otherwise disposed of according to applicable laws and regulations.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Price for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, including excavation and backfilling, for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
	None	

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
2.1.101	Tree, Rem, 6 inch to 18 inch	Each
2.1.102	Tree, Rem, 19 inch to 36 inch	Each
2.1.103	Tree, Rem, 37 inch or Larger	Each
2.1.104	Stump, Rem 6 inch to 18 inch	Each
2.1.105	Stump, Rem 19 inch to 36 inch	Each
2.1.106	Stump, Rem 37 inch or Larger	Each

1. **Clearing and Grubbing.** All clearing, grubbing, removing and disposal of trees, brush, stumps, roots, logs and other vegetable matters shall be considered included in the price bid for **Roadway Grading** - [Section 2.4](#).
2. If the contract does not include a separate item to remove trees or remove stumps, all work specified in this section which is within the area affected by roadway grading shall be included in such work. When trees or stumps outside these areas are required to be removed which are not shown on the Drawings to be removed, they will be paid for as extra work.

DIVISION 2 - EARTHWORK

SECTION 2.2

SOIL EROSION AND SEDIMENTATION CONTROL

a. Description.

1. **General.** Soil Erosion and Sedimentation Control (SESC) shall be in accordance with [Division 1](#) of the City of Grand Rapids Standard Construction Specifications, and all revisions thereto, except as modified herein, Chapters 32 and 67 of the Grand Rapids City Code of Ordinances; City of Grand Rapids Administrative Policy 06-01; and Part 91 of the Natural Resources and Environmental Protection Act, 1994 PA 451.
2. The Contractor shall act as the agent for the City of Grand Rapids with regard to all the duties and responsibilities in providing soil erosion and sedimentation controls for this project, and shall comply with all Federal, State and local laws and regulations regarding soil erosion and sedimentation control at the construction site until the project construction is completed, the site has been permanently stabilized and the project is accepted by the City Engineer. The Contractor shall indemnify the City of Grand Rapids, its officers, employees and agents, and shall be solely responsible for any penalty, fine, or financial loss attributable to any violations of any Federal, State and local laws and regulations regarding soil erosion and sedimentation control that may occur during the construction until the project is accepted by the City Engineer.

b. Materials. None Specified.

c. Construction.

1. The Contractor shall complete the Land Use Development Services (LUDS) application form, which includes an Authorization to Proceed with Earth Change. The application can be found in the bid documents or on the City's website. The Contractor, as Agent for the City, shall complete the application form, and shall prepare a soil erosion and sedimentation control plan utilizing the "Keying System" found in chapter 6 of the publication from the State of Michigan, Department of Management and Budget entitled **Soil Erosion and Sedimentation Control Guidebook 2021 Michigan Department of Transportation Best Management Practices**. A PDF copy on a CD may be obtained from The City of Grand Rapids, Environmental Services Department (ESD), 3rd Floor, 1120 Monroe Avenue NW, or a PDF copy may be obtained from the State of Michigan at:

<https://www.michigan.gov/-/media/Project/Websites/MDOT/Programs/Highway-Programs/Environmental-Efforts/Stormwater-Management/Stormwater-Design-Professionals/SESC-Manual.pdf>

2. A base drawing of the project can be obtained from the City Engineer, the drawing may use to prepare the soil erosion and sedimentation control plan in applying for a LUDS permit. It is the Contractor's responsibility to ensure that the plan has sufficient information to be acceptable to the Environmental Services Department (ESD) of the City of Grand Rapids. The Contractor shall submit a comprehensive and completed application, SESC plan, including project phasing if applicable, and pay the associated application and authorization fees to the ESD, 1120 Monroe Avenue NW to obtain the LUDS permit. The authorization shall be issued by the ESD, signed by the Contractor and all authorization fees paid prior to beginning construction.
3. The Contractor shall properly maintain and operate the soil erosion and sedimentation controls in accordance with the plan submitted for the authorization, inspect the construction activity at least once per week and within 24 hours after every precipitation event that results in a discharge from the site, and take any needed corrective actions. All catch basins in the Contractor's work area and those on adjacent streets affected by Contractor's vehicular tracking of soil and other materials shall be protected from sedimentation. All roadways within

- the Contractor's work and influence area shall be swept clean by the Contractor. Any soil tracked within the project limits shall be swept at least once daily. Any soil tracked outside the project limits shall be swept immediately. Waiting until the end of the work day to sweep the public right-of-way outside the project limits is not an acceptable practice.
4. When the Project includes a earth change greater than 5 acres, prior to commencing work and after receiving the LUDS permit, the Contractor shall coordinate with the Engineer's office to submit an application for Notice of coverage (NOC) from the Michigan Department of Environment, Great Lakes, and Energy (EGLE).
 5. When the item **Storm Water Operator's Inspection** is provided in the bid form, the Contractor shall employ the services of a Construction Site Storm Water Operator who has been certified by the Michigan Department of Environment, Great Lakes and Energy (EGLE) to inspect all soil erosion and sedimentation controls for proper installation and maintenance. The certification shall be done in accordance with requirements of R323.1251 et seq. of the Michigan Administrative Code. The Contractor's certified Construction Site Storm Water Operator shall inspect the construction site at least once per week and within 24 hours after every precipitation event that results in a discharge from the site, and shall prepare a report of each inspection and any necessary corrective actions. The report shall be submitted to the ESD, 456-4088 (facsimile) or stormwater@grcity.us (email) within 24 hours of conducting the inspection. The reports shall be maintained by the certified Construction Site Stormwater Operator as a log of the inspections and shall be available for inspection by the Engineer, EGLE and the public. The Contractor is responsible for properly maintaining and operating the soil erosion and sedimentation control measures and shall promptly take all necessary corrective actions as reported by the Construction Site Stormwater Operator or as directed by the Engineer or ESD. The Contractor shall retain a copy of the log on file for a period of 3 years from the date of the latest inspection or corrective action. The Contractor shall also furnish a copy of this log to the Engineer upon completion of the project.
 6. **Dust Control.** During the construction, maintain adequate dust control measures to prevent detriment to the safety, health, welfare, or comfort of any person or cause damage to any property, residence or business.
 - A. Sweep streets a minimum of once per day and as required by the Engineer with a street sweeping machine. Apply dust palliative to all dirt roads and drives to control dust. Apply water to paved roads, as required, to remove and control dust. If directed by the engineer, the contractor shall apply dust control within 2 hours of being notified to do so. Special efforts shall be used to control dust near local businesses. Trucks hauling soil shall be tarped/covered at all times while traveling in the project area.
 7. **Area Limitations.** Conduct work to minimize soil erosion. Limit the area of earth disturbance to in accordance with approved LUDS permit application.
 8. **Time Limitations.** Bring grading sections to final earth grade as soon as possible. Complete topsoil placement and stabilize slopes, channels, ditches, and other disturbed areas within 5 calendar days after final earth grade with permanent soil erosion control measures. Permanently restore and place topsoil on slopes and ditches within 150 feet of lakes, streams, or wetlands within 24 hours of achieving final earth grade using permanent soil erosion control measures.
- d. **Measurement and Payment.** The completed work shall be paid for at the Contract Unit Price for the following contract items, Pay Item (City Standard) which shall include all materials, equipment, labor and fees required to complete this work.
- Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.2.001	Soil Erosion and Sedimentation Control, _____	Lump Sum
2.2.002	Soil Erosion and Sedimentation Control Plan _____	Lump Sum
2.2.003	Storm Water Operator's Inspection _____	Each
2.2.004	Dust Control _____	Lump Sum

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Soil Erosion and Sedimentation Control, Install, Soil Erosion and Sedimentation Control, Maintain and Soil Erosion and Sedimentation Control, Remove** shall be paid for properly installing, maintaining and operating, and removing the soil erosion and sedimentation control measures according to the soil erosion and sedimentation control plan, making all corrective actions needed during the course of the project; and sweeping all roadways as often as necessary within the Contractor's work and influence areas.
2. The City will pay the Contractor for **Soil Erosion and Sedimentation Control, Maintain** in accordance with payment schedule for Mobilization.
3. **Soil Erosion and Sedimentation Control Plan** shall be for developing the soil erosion and sedimentation control plan; submission of an authorization application including related authorization fees.
4. **Storm Water Operator's Inspections** shall be for the inspection of the entire construction activity made by a certified storm water operator as required in this special specification; preparing a report upon each inspection and submitting it to the ESD; and keeping the appropriate log as noted above.
5. The Contractor shall only be paid for soil erosion and sedimentation control work under the items included in the bid form. If any of the above items are not included in the bid form, then all necessary work for soil erosion and sedimentation control related work noted above shall be considered to be included in the other items that are in the bid form and no additional payment shall be made to the Contractor, with the exception of the item **Storm Water Operator's Inspections**. If that item is not included in the bid form, then the Contractor shall not be required to furnish a Storm Water Operator for that project, but he/she shall be required to perform all other soil erosion and sedimentation control work covered by this Section.
6. The Contractor shall be solely responsible for any penalty, fine, or financial loss attributed to the City for any of the Contractor's means, methods and techniques or those of the Contractor's agents, which directly or indirectly cause/result in the project being declared in noncompliance with the soil erosion and sedimentation control plan, any soil erosion control permit, and/or any National Pollution Discharge Elimination System (NPDES) permit issued in connection with this project. The Contractor shall pay all re-inspection fees associated with any Notice of Violation or Corrective Action Order, or any civil penalties from a Civil Infraction Ticket issued by ESD, in addition to any criminal penalties for noncompliance with the soil erosion and sedimentation control regulations of the City of Grand Rapids, the State of Michigan, or the Federal Environmental Protection Agency.
7. Failure to perform the rules and procedures specified in this Section, City of Grand Rapids SESC Ordinances, and Part 91 and the administrative rules of the Natural Resources and Environmental Protection Act, 1994 PA 451, will result in the Contractor not being allowed to bid on future City projects for a period of two years and/or doubling of the size of the surety that would otherwise be normally required.
8. **Dust Control** shall be payment in full for furnishing all labor, equipment, and material and all other work required for a complete job. The City will pay the Contractor for **Dust Control** in accordance with payment schedule for Mobilization.

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DIVISION 2 - EARTHWORK

SECTION 2.3

REMOVING PAVEMENTS, STRUCTURES AND MATERIALS

a. Description.

1. This work shall consist of removing, to the extent shown on the Drawings or specified herein, bridges, retaining walls, culverts, old pavement surface and base course, curb and gutter, driveway returns, straight curb, areaways, sidewalk (including sidewalk grinding), masonry, fence poles, signs, guard rail, manholes, catch basins, inlets, sewers, water mains, and other structures which are not suitable to be left in the roadway or are otherwise objectionable, disposing of the resulting materials and backfilling the resulting trenches, holes and pits.
2. All walls, piers, foundations and similar masonry structures shall be removed entirely, or to an elevation at least two feet below subgrade within the area of the roadbed, or to provide two feet clearance from proposed new structures, and elsewhere to an elevation at least one foot below the finished surface.

b. Materials.

1. Backfill shall meet the requirements for Granular Materials Class II as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, unless noted otherwise on the Drawings or the Bid Form.

c. Construction.

1. **Drop-Hammer Prohibited.** The use of a drop-ball, drop-hammer, pile-driver, or any such equipment will not be permitted for the purpose of breaking up any structure in the streets or alleys unless done under controlled conditions as approved by the Engineer.
2. **Sawing Concrete.** When a limited portion of a concrete pavement or other concrete structure is to be removed, the boundary of such portion shall first be sawed to a depth of not less than 3 inches with an approved masonry saw. When the sawing has been completed, the concrete which is to be removed shall be broken out in such a manner as will leave the sides of the opening as nearly vertical and smooth as is feasible. When sawcutting is to be full depth, and called out on the Drawings, it will be paid for separately.
3. **Grinding.** Contractor shall own or lease commercial equipment that the City considers sufficient to provide services as specified. Equipment noise must be minimal so it does not disturb the public and the public will not need to wear hearing protection if located 10 feet or further from the operation of the equipment. Per OSHA, hearing protection is required for individuals exposed to noise over 75 dB, as such the City requires that the equipment to perform the work must not exceed the 75 dB at 10 feet. Noise control shall be in accordance with Federal, State, and City regulations.
4. **Salvage.** All materials resulting from the work under this Section shall be removed from the site and disposed of by the Contractor in accordance with applicable laws and regulations unless otherwise shown on the Drawings or indicated in the Bid Form or Special Provisions.
5. **Backfilling.** Unless otherwise specified, all trenches, holes, and pits resulting from the breaking down or removal of any structures shall be filled with granular material Class II as specified in the current MDOT Standard Specifications for Construction, unless otherwise approved by the Engineer.

6. Removal.

A. Pavement Removal.

- (1) **Pavt, Rem, Full Depth** shall consist of removing all of the pavement and disposing of the resulting materials, when called for on the Drawings, listed on the Bid Form, or when required by the Engineer, be it HMA on concrete, HMA on brick on concrete, brick on concrete, or concrete.
- (2) **Coldmill HMA Pavt __ inch** shall consist of removing the existing HMA pavement to the depth shown on the Drawings, listed on the Bid Form, or as approved by the Engineer.
 - (a) Prior to removal of the HMA pavement, all of the manhole castings shall be removed, the openings plated and temporarily filled with HMA pavement or other material as approved by the Engineer. These temporary patches in the manhole areas shall be adequately maintained for traffic by the Contractor during the construction period until the final adjustment to the manhole castings has been made. All work necessary to remove the casting and maintain the patches including all necessary HMA materials will be considered to have been included in the price bid for other items of work for removing the existing HMA pavement or the items for adjusting the manhole castings.
 - (b) The Contractor shall use power-operated machines of the cold-milling type to remove the HMA surface. Any equipment used shall be capable of accurately removing the HMA surface in one or more passes to the grade shown on the Drawings or as established by the Engineer. The equipment shall also have an effective means for removing excess material from the surface and preventing any dust resulting from the operation from escaping into the air.
 - (c) There may be some concrete patches under the HMA pavement. These patches shall be removed to the same depth as the HMA pavement. No extra compensation will be allowed for removal of such concrete.
- (3) **Conc Pavt Base, Rem** shall consist of removing concrete pavement base and disposing of the resulting material when called for on the Drawings, listed on the Bid Form, or when required by the Engineer. This item will be used in areas where the existing pavement is HMA on concrete or HMA on brick on concrete and the existing HMA pavement or HMA and brick pavement is removed and paid for under separate items, leaving the removal of the concrete base to be paid for separately under the item **Conc Pavt Base, Rem**.
- (4) **Conc Pavt, Reinf, Rem** shall consist of removing reinforced concrete pavement when called for on the Drawings, listed on the Bid Form, or required by the Engineer regardless of whether it is the pavement base or riding surface course.
- (5) **Brick Pavt, Rem, Full Depth** shall consist of removing brick pavers where shown on the plans, removing the sand setting bed, removing the concrete base course, and remove any underlying layers of aggregate or soil regardless of the depth of the material being removed.
- (6) **Brick Pavt, Rem and Salv Brick Pavers, Full Depth** shall consist of carefully removing and salvaging the brick pavers where shown on the plans, removing the sand setting bed, removing the concrete base course, and remove any underlying layers of aggregate or soil regardless of the depth of the material being removed.
 - (a) After the brick have been removed, examine and separate pavers with chips or cracks from the rest of the pavers. Cracked pavers, previously cut pavers, and pavers with chipped surfaces shall not be salvaged and shall become the property of the Contractor. The Engineer shall have the final determination of the pavers to be salvaged.
 - (b) Salvaged brick pavers shall be carefully cleaned, stacked on pallets, temporarily stored and protected from theft or vandalism onsite within the road right-of-way, delivered to a location within the City of Grand Rapids as directed by the Engineer. Contractor shall coordinate delivery and shall provide a manifest proving the delivery of pavers prior to payment. No non-brick construction debris (concrete, HMA, etc.) will be accepted.

- B. **Conc Sidewalk, Grinding.** Shall consist of grinding raised joints or uneven cracks on sidewalk segments as indicated by the Drawings and or Engineer. No grinding will be performed on areaways or sidewalks with snowmelt systems. The City will work with the Contractor to identify these locations prior to grinding.
- (1) The surface area after grinding must be textured to meet ADA standards for pedestrian safety; which includes a slip resistant surface that does not become slippery when wet.
 - (2) Contractor shall own or lease commercial equipment that the City considers sufficient to provide services as specified. Commercial concrete grinding equipment is required.
 - (3) Equipment must be able to grind from 1/4 inch to 1-1/2 inches. Grinding equipment must be self-contained with integral debris/dust recovery system and designed to capture debris and dust by-products of the grinding operation to minimize the presence of air-borne dust and comply with OSHA standards for Crystalline Silica Standards for Construction. All grinding will be done dry without the use of water. Should the integral vacuum system fail to collect all debris, the Contractor shall sweep the sidewalks thoroughly after the grinding operation.
 - (4) Grass, landscape or irrigation systems damaged by the contractor shall be restored at the contractor's expense to conditions that are equal to or better than the existing conditions prior to commencement of work. Contractor will be responsible to prevent damage from vibration to adjacent structures and property.
- C. **Abandon and Fill Underground Utility.** Shall consist of filling the existing underground utilities, greater than 6 inches (basin connections, sewers, water mains, underdrains, etc.) which are to be abandoned with a flowable fill mix as specified in [Section 6.1](#). All utilities to be abandoned shall be cut at each end of the pipe and filled from one end until the fill material comes out the other end. All open ends of the pipe to be filled are to be plugged with concrete. Unless otherwise called out on the Drawings, plugging shall be included in the unit price for abandonment. The Contractor may remove the utility in lieu of filling if approved by the Engineer. However, the Contractor will only be paid the price bid for abandoning underground utilities.
- D. **Mh, Valve Chamber, or Catch Basin, Rem.** The Contractor shall break the existing structure down to a point at least three feet below the pavement elevation, clean out all rubble and sediment and complete the work by either of the following methods. The first method being to break up the concrete floor to allow it to drain and backfill the area with compacted MDOT granular material Class II. The second method is to backfill the structure area with pea stone and sealing the structure with a concrete cap as per the applicable standard detail. The remaining area above the concrete cap shall be filled with compacted MDOT Class II backfill. The contractor shall use a vibrator to aid in the compaction of the pea stone.
- (1) The entire structure may be removed and backfilled with compacted sand in lieu of either of the above-mentioned methods at the Contractor's option.
 - (2) Payment for the work of plugging or bulkheading abandoned pipes, conduits, or service connections encountered in excavation, up to and including 12 inches is included in payment for **Mh, Valve Chamber, or Catch Basin, Rem.**
- E. **Meter Pit, Rem.** This item is for removing abandoned meter pits in which the meter has already been removed or for removing active meter pits in which there is a meter in use in the meter pit. In active meter pits, the meter will need to be relocated into the building it serves before the meter pit can be removed. All work necessary to relocate the meter into the building shall be performed, measured and paid for under a separate item.
- (1) The work to remove a meter pit shall consist of removing the meter pit structure in its entirety, backfilling the hole with compacted sand and restoring the surface as necessary.
 - (2) Payment for the work of plugging or bulkheading abandoned pipes, conduits, or service connections encountered in excavation, up to 12 inches is included in payment for **Meter Pit, Rem.** This work shall only be done when specifically shown on the Drawings or required by the Engineer.
- F. **Areaways, Rem.** (For use on projects where building owner is responsible for removal of areaway only.) Areaway ceiling and walls shall be removed and filled with compacted

MDOT Class II backfill as specified in [Section 2.5](#). The floor of the areaway shall be broken up to provide drainage. Any existing utilities shall be adequately protected. The opening from the building into the areaway shall be filled in. All designs for the filling in of said openings must meet with the approval of the Engineer prior to construction. Relocation and/or protection of service utilities and constructing the necessary closure between the areaway and the basement of the adjacent building shall be the responsibility of the building's owner.

- G. **Removal of Signs.** Do not remove or obstruct regulatory signs until necessary to complete street reconstruction or without prior approval of the Engineer. Temporary regulatory signs shall be placed in accordance with the Michigan Manual on Uniform Traffic Control Devices (MMUTCD) once the permanent signs are removed and shall be maintained until the permanent signs are reinstalled. After approval from Engineer, the Contractor shall carefully remove all existing street signs and posts within the construction limits in a manner to prevent damage to all materials. Contractor shall store and protect salvaged items. Any items damaged in removal, storage, handling or transportation, through carelessness or improper procedures, shall be replaced by the Contractor in kind or with new items. Salvaged posts and signs shall be stockpiled at one location on the project for the City of Grand Rapids (City) to inspect and pick up. The Contractor shall contact the City Traffic Safety Division to inform the City when the salvaged materials are ready to be inspected and picked up and the location where the salvaged materials are stored. The City may elect to salvage all, a portion, or none of the post and sign materials. All post and sign materials not salvaged by the City will become the property of the Contractor.
- H. **Bulkheads, Rem.** Shall consist of removing all concrete, mortar and reinforcing, including any forms utilized for the placement of the bulkhead and disposing of the resulting material, where shown on the drawings, listed on the Bid Form, or required by the Engineer. The removal shall also include any concrete patching required for a smooth finish to the remaining pipe(s).
- I. **Cleaning Up.** When the removed structures and or materials were in or near the right-of-way of a public street or alley, or in a right-of-way acquired across private property, the Contractor shall remove all resulting debris from the street surface, walks, gutters, fences, lawns, private property, right-of-way, and adjacent structures. When the removed structures and or materials were in or near or over a public waterway, the Contractor shall remove all resulting debris from the bed of the stream and the adjacent structures and land. All areas and structures to be cleaned as herein specified shall be left in as good a condition as originally found, and all machinery, tools, surplus materials (except salvage), temporary buildings and other temporary structures shall be removed from the site before final payment will be made.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

1. When Pay Item(s) are not included in the bid form, the cost of removing pavement, sidewalk, or other structures for the purpose of constructing a sewer, water main, or other underground utility will not be paid for separately, but will be considered to be included in the unit prices bid for installing the underground utilities unless otherwise shown on the Drawings, or indicated in the Bid Form or Special Provisions.
2. Unless otherwise provided, this work will be measured in the original position of the structures to be removed. The contract unit price shall be payment in full for breaking down and removing,

including sawing where required, disposing of materials, and furnishing, placing, and compacting backfill.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.3.001	Saw Cut, Full Depth	Foot
2.3.002	Pavt, Rem, Full Depth	Square Yard
2.3.003	Conc Pavt Base, Rem	Square Yard
2.3.004	Conc Pavt, Reinf, Rem	Square Yard
2.3.005	Coldmill HMA Pavt __ inch	Square Yard
2.3.006	HMA Pavt, Rem, Full Depth, Outside Roadway	Square Yard
2.3.007	Brick Pavt, Rem, Full Depth	Square Yard
2.3.008	Brick Pavt, Rem and Salv Brick Pavers, Full Depth	Square Yard
2.3.009	Abandon and Fill Underground Utility, __ inch Dia.	Foot
2.3.010	Areaway, Rem	Cubic Yard
2.3.011	Meter Pit, Rem	Each
2.3.012	Mh, Valve Chamber, or Catch Basin, Rem	Each
2.3.013	Conc Curb and Gutter, Rem	Foot
2.3.014	Conc Alley and Approach, Rem	Square Foot
2.3.015	Conc Sidewalk, Driveway and Approach, Rem	Square Foot
2.3.016	Conc Sidewalk, Grinding, __ inch to __ inch	Foot
2.3.017	HMA Driveway, Rem	Square Foot
2.3.018	Abandon Valve Chamber and Place Valve Box, Det P-23A	Each
2.3.019	Sign, Remove and Salvage	Each
2.3.020	Bulkhead, Rem, 6 inch to 23 inch	Each
2.3.021	Bulkhead, Rem, 24 inch and Larger	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

3. **Areaway, Rem** will be measured by volume in cubic yards of backfill placed in the areaway. This price shall include the cost of removing roofs and walls.
4. **Abandon and Fill Underground Utility, __ inch Dia.** will be measured by length in linear feet of the utility filled and paid for at the Contract unit price per foot.
5. **Sawcutting.** The cost of sawcutting to a depth of 3 inches, as specified for removing limited portion of concrete pavement or other concrete structures, shall be included in the unit price bid for removal items. Sawcutting full depth when called for on the Drawings, stated in the Special Provisions, or required by the Engineer will be measured in lineal feet actually cut and paid for under the item **Saw Cut, Full Depth**. When sawcutting full depth is not specifically called for in the Drawings but is required for the removal of pavements and structures it shall be included in the unit price bid for those removal items.
6. **Conc Curb and Gutter, Rem** will be measured in linear feet and paid for at the Contract unit price per foot.
 - A. The units to be paid for shall be as specified and shall be based on a straight measurement along the joint of the curbing with the pavement with the measurement carried across the driveway and alley returns included in the straight measurement. No extra measurement or allowance will be made for the reason that the driveway and alley returns extend in from the face of the curb.
7. Removing straight curb or straight curb with separate gutter will be paid for under the item **Conc Curb and Gutter, Rem**.
8. **Conc Sidewalk, Driveway and Approach, Rem** and **Conc Alley and Approach, Rem** will be measured in area by square foot and paid for at the contract unit price per square foot.
9. **Conc Sidewalk, Grinding, __ inch to __ inch** will be measured in linear feet and paid for at the Contract unit price per foot, including grinding sidewalk deficiencies to meet ADA standards and clean up after grinding operation.
10. **Mh, Valve Chamber, or Catch Basin, Rem** will be measured as units and will be paid for at the contract unit price each, and include cost of maintaining and reconnecting live sewers,

- bulkheading abandoned pipe(s) where required, and of removing attached parts and connections.
11. **Sign, Rem and Salv** shall include the removal of signs, posts, and foundations including removing the sign from the support(s), stockpiling (by shape and size), storing and protection of the existing sign materials. This work shall also include coordination with the City and disposal of any materials the City elects not to salvage, and the notification of City Traffic Safety for permanent sign installation.
 12. **Bulkhead, Rem 6 inch to 23 inch** and **Bulkhead, Rem 24 inch and Larger** will be measured as units and include the cost of removing and disposing of materials and repairing any damage to the pipe remaining.
 13. **Bulkheads** required for the removal and/or abandoning of utilities and structures with a diameter including, but not greater than 12 inches are include in other related pay items. The Engineer will measure bulkheading abandoned pipe, conduits, or service connections, with a diameter greater than 12 inches as **Bulkhead, __ inch** in accordance with [Section 6.1](#) and **Bulkhead, reinf, Detail __** in accordance with [Section 7.1](#).
 14. Miscellaneous structures shown on the Drawings to be removed but which are not included in the Pay Item quantities will not be paid for separately; payment for such work will be considered as having been included in the contract unit prices bid for other Pay Items. When not shown on the Drawings to be removed and there is no contract item, the work of removal will be paid for as extra work.

DIVISION 2 - EARTHWORK

SECTION 2.4

EXCAVATION, EMBANKMENT AND GRADING

a. Description.

1. **Excavation, Embankment and Subgrade Undercutting.** This work shall consist of constructing earth grades by excavating soil or rock and placing embankment of fills; salvaging and stockpiling selected materials; providing, placing, and compacting embankment materials; trimming the earth grade; disposing of surplus or unsuitable material; and maintain the work in a finished condition until accepted by the Engineer. The materials equipment, construction methods and measurement and payment shall be as specified under Division 2 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, or any special provisions. Clearing, grubbing, and removal of trees shall be as specified in [Section 2.1](#).
2. **Roadway Grading.** This work shall consist of all the work necessary for shaping the street to conform to the established grades and cross sections shown on the Drawings and as may be indicated on the site by stakes set by the Engineer. It shall include all the area of the pavement, curb and gutter, parkway, sidewalks, entrances to driveways and alleys, intersecting streets, and such adjacent property as may be necessary to construct needed side slopes.

b. Materials.

1. **Embankment.** Material used for embankment shall be Granular Material Class II or Class III as specified in the current MDOT Standards Specifications for Construction as shown in the Bid Form or approved by the Engineer. If no specific reference is made on the Drawings or in the Bid Form regarding the type of material to be used for embankment, Class II material shall be used. Class II may be substituted for Class III at the Contractor's option. Sound earth may be used for embankments when specifically shown on the Drawings or specified in the Bid Form.

c. Construction.

1. **Preparation of Roadway Foundation, Rock Excavation, Peat Excavation, Swamp Backfill, Subgrade Undercutting, Subgrade Manipulation and Earth Excavation, Roadway Embankment** shall be as specified by the current MDOT Standard Specifications for Construction.
2. **Pre-Grading of Plats or Other Developments within the City of Grand Rapids.** Prior to the initiation of any plat pre-grading work not under contract to the City of Grand Rapids, the Consulting Engineer will be required to submit to the Office of the City Engineer for review and approval, the grading Drawings, specifications regarding "cut" and "fill" in public rights-of-way, and method of construction of the same. Upon completion of the pre-grading work and prior to the initiation of the construction of utility and improvement work in public rights-of-way, the Consulting Engineer will be required to submit test results indicating the compliance with the work as noted above and state in writing under the signature of a Registered Professional Engineer that the work was done in such a manner that it is suitable for roadway construction and installation of various underground utilities, and that the private lots have been graded in accordance with the previously approved grading Drawings.

3. **Roadway Grading.** As required to achieve proposed cross section, **Roadway Grading** includes, but is not limited to, the following work.
- A. Removing miscellaneous structures and materials.
 - B. Removing trees less than 6 inch in diameter.
 - C. Removing rocks or boulders less than 0.5 cubic yard in volume.
 - D. Removing landscaping items within the right of way, including plants, edging, landscaping blocks, and other miscellaneous landscaping items.
 - E. Sawing existing pavement when not called out separately in the drawings or included in the bid form.
 - F. Topsoil stripping.
 - G. Grading to Heavy Line and compacting subgrade shown on typical sections.
 - H. Compacting of existing subbase or aggregate base left in place during utility or road reconstruction and meeting the proposed cross-section.
 - I. Final grading to plan alignment and grades.
 - J. Maintaining driveway access.
 - K. Maintaining a lane for emergency and local traffic along and parallel to the street. Maintaining a sidewalk per Maintaining Traffic, Pavement Marking and Detector Loops, [Section 8.1](#) and project Special Provisions.
 - L. Protecting and maintaining existing gates and fences.
 - M. Protecting and maintaining existing retaining walls.
 - N. Temporarily holding and protecting utility poles as needed for construction of roadway and underground utilities.
 - O. Temporarily holding and protecting light poles as needed for construction of roadway and underground utilities.
 - P. Miscellaneous items identified in the Drawings as included in **Roadway Grading**.
4. **Salvageable Material.** The Engineer reserves the right to require the Contractor to haul any surplus earth for filling any low street, alley, or sidewalk space to an established grade, provided that the location is not more than 2000 feet from the limits of the Project. This shall be considered included in the price bid for **Roadway Grading**.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment and material for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.4.001	Roadway Grading	Station

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
2.4.101	Excavation, Earth	Cubic Yard
2.4.102	Excavation, Rock	Cubic Yard
2.4.103	Excavation, Peat	Cubic Yard
2.4.104	Backfill, Swamp	Cubic Yard
2.4.105	Subgrade Undercutting, Type __	Cubic Yard
2.4.106	Embankment, LM	Cubic Yard
2.4.107	Embankment, CIP	Cubic Yard

1. **Roadway Grading.** Will be measured along the proposed centerline alignment in stations. Work along side streets shall be included in **Roadway Grading** for the other mainline streets and avenues. **Roadway Grading** includes work on both sides of the roadway and at driveways and intersections. The price shall include all labor, equipment, and materials required to complete the work as described. Pavement, curb and gutter, and sidewalk removal and other items specifically excluded in this Section will be paid for separately when included on the Bid Form.
 - A. In the event the existing Subbase material located between the Heavy Line and Aggregate Base, as shown on the Drawings, meets the requirements of MDOT Class II sand, and grading to the Heavy Line is not completed, the Subbase shall not be measured and paid separately in accordance with [Section 3.1](#), but shall be considered included in **Roadway Grading**. No deduction of payment for **Roadway Grading** will be made or credit will be given by the Contractor to the City for not grading to the Heavy Line in these areas.
 - B. When grading to the Heavy Line is completed by the Contractor, the subbase Pay Item shall be measured and paid for both existing material meeting MDOT Class II requirements utilized from onsite as well as MDOT Class II material furnished from off site.
2. **Excavation, Earth.** The City will pay for removal of masonry and concrete structures in accordance with [Section 2.3](#).

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DIVISION 2 – EARTHWORK

SECTION 2.5

EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES

- a. **Description.** The work shall consist of excavating and backfilling for storm sewers, sanitary sewers, water mains, conduits, and all other underground utilities.

b. **Materials.**

1. **Backfill and Bedding.**

- A. Backfill shall meet the requirements for Granular Materials Class II as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
- B. Bedding shall meet the requirements for MDOT Class II except that 100 percent of the materials shall pass a 3/8 inch sieve.
- C. Gravel shall only be used for bedding when shown on the Drawings, listed in the Bid Form, specified in the Special Provisions, or when approved by the Engineer. Gravel for bedding shall be shall conform to the following grading requirements:

Table 2.5-1 Grading Requirements for Gravel	
Standard Sieve	Sieve Analysis, Total % Passing (a)
1 ½ in	100
1 in	95 – 100
½ in	30 – 60
No. 4	15 – 30
No. 200	0 – 30
a. Crushed material, minimum 80 percent	

2. **Water.** The water used to obtain the desired moisture content of backfill material shall be taken from the City's water mains, as specified in [Section 6.1](#), unless otherwise specified.

c. **Construction.**

1. **Excavation.**

- A. Excavation of the trench shall normally begin at the outlet end for sewers unless otherwise permitted by the Engineer and as may be agreed upon for other utilities. The excavation shall be true to line and grade as is required and shall be of sufficient width to provide ample working space and to permit ramming and compacting of bedding backfill around the utility, including also sufficient space for bracing and supporting sides of trenches and for pumping and draining of ground water and/or sewage.
- B. **Width of Trench.** In addition to the provisions of the preceding paragraph, the maximum bottom width of trench shall be 36 inches for pipe, 8 inches to 12 inches inclusive in diameter. For larger sizes of pipe, the maximum width of trench shall be not more than 2 feet greater than the inside diameter of the pipe, except as otherwise specified or directed. The above limiting restrictions on trench width apply from outside bottom of pipe to 12 inches above outside top of pipe.

- C. **Unstable Foundation.** When the bottom uncovered at the proposed grade is soft and in the opinion of the Engineer cannot support the pipe or utility, a further depth shall be excavated and refilled to the proposed grade with approved materials compacted in 12 inch layers as specified in this Section, or other approved means shall be employed to assure a firm foundation for the utility, with extra compensation allowed therefore. The volume of unstable foundation removed and replaced with approved materials for which payment will be allowed shall be determined in cubic yards unless otherwise specified on the Drawing or in the Bid Form, said volume to be computed by assuming that the cross-section area of the unstable foundation takes the form of a trapezoid as shown on Standard [Detail S-15](#).
2. **Tunneling** shall be done only where shown in Drawings, or as approved by the Engineer.
 3. **Extent of Open Trench.** The excavation shall at all times be finished to grade for a safe distance in advance of the completed structures, but unless otherwise specifically approved or permitted by the Engineer, not more than 50 feet of trench shall be open at one time. The excavated earth along the line of the trench shall be controlled by the use made of the street or right-of-way by the public and shall always be confined to approved limits. ADA compliant Pedestrian crossings shall be erected and maintained by the Contractor where designated by the Engineer. Excavation or use of land outside the street right of way or easement shown on the Drawing will not be permitted, unless approval is granted by the Engineer, or, as specified on the Drawing or in the Special Provisions, and unless specific approval is given by the Engineer.
 4. **Fire Hydrants and Water Main Valves** shall be kept accessible for immediate use at all times, unless otherwise approved by the Engineer. Upon approval, the Contractor shall notify the Grand Rapids Water Department and Fire Department of any hydrants or valves to be taken out of service.
 5. **Existing Underground Structures and Utilities.** The Contractor shall provide and install adequate supports and protection for all sewer and water pipes or other underground structures and utilities extending into or crossing the trench. Where gas mains, telecommunication cable or conduits, electric cable or conduits, or any other public or private infrastructure, extend into or across the trench, the Contractor shall notify the owner of the utility at once and provide such supports and protection as may be required by the them.
 - A. Should any such gas main, telecommunication cable or conduits, electric cable or conduits, or any other public or private infrastructure require raising or lowering or moving to another location due to direct conflict, such changes will be made by the owner without additional expense to the Contractor.
 - B. Where sewers, water mains, cables or conduits and all other underground structures and utilities are within the influence of the Contractor's trench opening, the Contractor shall so carry on their work at all times as not to cause damage to the structures or utilities.
 - C. Where crossing underneath transmission water mains (24 inch and larger), a structural support plan is required at all times a transmission water main joint or more than 5 feet of transmission main is exposed below the spring line of the pipe, unless otherwise approved by the Engineer. Structural support plan shall be signed and sealed by a professional engineer and allow no more than 0.01' of deflection of the transmission watermain.
 - D. Where utilities such as underground irrigation, snowmelt systems, private communications and/or electrical systems are within the influence of the Contractor's trench opening, the Contractor shall so carry on their work at all times as not to cause damage to the structures or utilities, except in the case of emergency repairs.
 - (1) Systems known to exist have been indicated on the Drawings. This information is being furnished to the Contractor for their convenience and shall be considered general information only. Prior to excavation the Contractor shall be responsible for making field investigations and making their own determinations as to the nature and amount such systems that shall be encountered.
 - (2) The Contractor shall be responsible for the protection, or, if required for the proposed work and approved by the Engineer, the removal and replacement, of any systems disturbed by their operations and for contacting and coordinating any necessary work

- with the appropriate owners of such systems. The cost for such work shall be considered to be included with the restoration items or other major items of work.
- E. Where gas, electrical, or telephone, water or sewage service connections to occupied buildings must be temporarily disconnected, the Contractor shall give at least 24 hours notice to the affected building occupants of the time and duration of the anticipated cut-off.
 - F. When pipes, conduits or sewers are removed from the trench leaving "dead" ends in the ground, such ends shall be fully plugged or bulkheaded with brick and mortar by the Contractor in accordance with [Section 2.3.c.6.C](#).
 - G. Removal and replacement of existing street lighting, storm, sanitary or water main structures, necessary for the proposed utility construction, shall be included in the unit cost of installing the utility, and no extra compensation will be allowed unless an item is shown on the Bid Form for said removal and replacement.
 - H. The Contractor shall not abandon any unidentified pipes, conduit, mains, etc. without the approval of the Engineer. If approval is not given, the Contractor shall restore such pipes, conduits, water mains, etc., to service. The cost of restoration shall be the responsibility of the Contractor.
 - I. The removal of abandoned underground utilities, both public and private (such as street lighting, telephone or electrical conduits; gas mains, water mains, sewer, etc.) necessary to install new utilities shall be considered to be part of installing the new utility and will not be paid for separately, unless called out specifically on the Bid Form.
6. **Disposal of Water.** The Contractor shall remove, by pumping, bailing or otherwise, any water which may accumulate or be intercepted or be found in the trenches and in any other excavations made under this contract. The Contractor shall provide all temporary construction necessary to keep the trenches entirely clear of water while the structures and their appurtenances are being constructed. The Contractor shall at all times have sufficient pumping equipment on the job ready for immediate use. If groundwater is contaminated as defined in [Section 2.6.c.4](#), Contractor shall proceed in accordance with [Section 2.6.c.4](#).
- A. **Discharge to Storm Sewer.** The Contractor shall discharge water from dewatering operations to separate storm sewer whenever possible. The Contractor shall provide the Engineer notification prior to proposed dewatering operations and discharge. The Engineer will be responsible to provide any necessary notification to EGLE and the City of Grand Rapids ESD stormwater Engineer of proposed discharge to the storm sewer system.
 - B. **Discharge to Sanitary Sewer.** Prior to groundwater discharge to a Sanitary or Combined Sewer, the Contractor shall obtain discharge authorization from the City of Grand Rapids Industrial Pretreatment Program (IPP) Supervisor. For authorization, the Contractor shall complete the following:
 - (1) Contact the IPP Supervisor and inform them of the Project and Project location.
 - (2) Submit the required IPP checklist, including characterization of the waste stream for all parameters listed in the checklist
 - (3) Submit completed IPP discharge authorization permit application.
 - (a) The Contractor shall be responsible for any fees based on the current fee schedule in the current water sewer rate study.
 - (b) Application shall be submitted 30 days prior to planned dewatering.
 - (4) Obtain IPP discharge authorization permit authorization.
 - C. **Dewatering Flow Rates.** Flow rates shall not result in a total flow rate which exceeds 50 percent of the capacity of the receiving sewer, or which will cause backups of the receiving sewer, including separate storm sewers, combined sewers and sanitary sewers. The city hydraulic engineer shall determine the allowable total flow rate for dewatering activities.
 - D. The Contractor shall pay special attention to the water quality of the discharge and incorporate necessary measures to reduce suspended solids (i.e., stone, straw, or geotextile filters). The Contractor shall temporarily suspend the discharge of dewatering water to storm sewers, sanitary sewers or combined sewers if necessary, to prevent basement backups, local flooding or combined sewer overflows.
 - E. Dewatering methods used by the Contractor shall provide adequate protection against damage to properties in the area. The potential for settlement of structures located in the

area shall be assessed prior to initiating the dewatering operation and specific measures shall be incorporated to avoid settlement where necessary. The Contractor shall be solely responsible for any claims, suits, and causes of actions for environmental damage or system damage caused to public or private property resulting from their dewatering activities.

- (1) The contractor shall maintain compliance with all local limits, City Code, Chapter 27 and 32 of the General Ordinances of the City of Grand Rapids (Chapter 27 and 32) and the Discharge Authorization requirements. The Contractor shall not discharge solids to the sanitary or combined sewer. The Contractor shall provide all necessary pretreatment controls to maintain compliance with Chapter 27 and 32, and the Discharge Authorization requirements. The pumping rate shall be controlled to meet Discharge Authorization limits. There shall be no sanitary sewer or stormwater sewer backups caused by this discharge alone or in conjunction with other discharges. In the event of a suspected backup or pending backup, the discharge shall be halted immediately. The contractor shall be responsible for damages and reparations for any and all claims resulting from backups related to this discharge.
 - (2) In the event that problems are experienced that are due to this discharge alone or in conjunction with other discharges or in the event any changes in Local, State, or Federal regulations occur, the City Manager or his designee may revoke this permission at any time.
- F. No additional payment will be made to the Contractor for this work. It will be considered as included in the prices bid for other items of work. However, if the groundwater is found to be contaminated, and if pretreatment is required prior to discharge, then the pretreatment will be considered as extra work and paid for separately in accordance with [Section 2.6](#).
7. **Bracing, Sheet piling, and Shelving.** The Contractor shall brace or slope back the sides of all excavations in accordance with current MIOSHA and OSHA regulations. The Contractor shall be responsible for the design, installation and maintenance of all excavation safety measures.
- A. Unless otherwise specified in the Bid Form, the costs incurred in the installation of bracing, sheet piling, and shelving shall be included in the unit price bid for the work being performed.
8. **Bedding and Backfill**
- A. **General Requirements.** Bedding and backfill shall not be placed until the material has been approved by the Engineer. Bedding material shall be placed under and around the utility to a minimum depth of at least one foot above the top of the utility. Bedding shall be placed in layers not more than 6 inches in thickness and each layer thoroughly compacted without damaging or displacing the utility. Unless otherwise specified on the Drawings, on the Bid Form, or in the Special Provisions, backfill shall be of material as specified in this Section. The backfill shall be placed in layers not more than 12 inches thick, each layer being fully compacted using vibrators or other mechanical means as approved by the Engineer. Flooding of trenches as a method of compaction will be not permitted. However, additional water may be required to reach desired moisture content of the backfill material. The backfill shall test at 95 percent of maximum unit weight as measured by the current Modified Proctor Test, ASTM Specification D1557.
- B. **Clay or other Hard Bottom.** When the soil encountered at the proposed utility grade is clay or other hard material, the Contractor shall excavate such hard material to a depth of 6 inches below the bottom of the pipe or conduit and replace such material with material as specified in this Section. Cost of such work shall be included in the price for the utility unless payment is specifically provided for in a contract item prior to bidding.
- C. **Special Requirements.** In certain instances, the Engineer may choose to use the existing material excavated from the trench as backfill for the area of the trench above 1 foot above the top of the utility. When the conditions allowing this choice are known prior to bidding, the Drawings, Bid Form or Special Provisions shall so note that the general requirements regarding the material used for backfill in Paragraph (A) above relative to the area above

one foot above the top of the utility to not apply. Material shall be placed as specified in Paragraph (A), above.

- (1) When the conditions are unknown prior to bidding and the decision is made by the Engineer in the field, a suitable reduction in price for eliminating the required granular backfill as specified in Paragraph (A) above shall be negotiated. Material shall be placed as specified in Paragraph (A), above.
- D. Excavated rock, boulders of more than one cubic foot, broken concrete, masonry, frozen material, tree roots or other vegetable or organic matter, debris, and refuse shall not be used for backfill.
9. **PVC Solid Wall, PVC Corrugated Pipe, Truss Pipe Installation.** The construction methods used for PVC solid wall and truss pipe shall be as specified in ASTM D2321, Underground Installation of Flexible Thermoplastic Sewer Pipe, the applicable sections of this Section, and the Manufacturer's recommendations.
10. **Disposal of Excess Excavated Material.** All excavated material in excess of that needed for backfill shall be disposed of by the Contractor at the Contractor's cost. The Engineer reserves the right to direct the Contractor to haul any excess material for filling any low street, alley, or sidewalk space to an established grade, provided that such haul shall not be more than 2000 feet outside the Project.
11. **Rock Excavation.**
 - A. In accordance with [Section 2.4](#).
 - B. **Pipe Clearance in Rock.** When rock is encountered in the excavation, it shall be removed to the depth shown on the Drawings or 6 inches below the bottom of the utility when no underdrain is required. If an underdrain is required, additional excavation shall be made to the depth and width required for the underdrain. The width of rock excavation shall be two (2) feet greater than the inside diameter of the utility unless otherwise specified.
12. **Removal of Surface Features.** When not provided for on the Bid Form, the costs of removing pavement, curb and gutter, sidewalk, trees, brush, or other structures necessitated by the excavation for placing utilities shall be included in the unit price bid for the utilities.
13. **Prolonged Trench Maintenance.** When conditions are such that the final restoration must be prolonged, the Contractor shall maintain all roadways, driveways and sidewalks in condition suitable for their convenient and safe use until such time as they are permanently restored.
 - A. This will include the use of HMA material as may be necessary and approved by the Engineer as a temporary surface in areas which ultimately receive either a HMA or concrete surface. The costs of such temporary materials shall be included in the unit prices bid for installing the utilities unless otherwise shown on the Drawings or indicated in the Special Provisions.
14. **Removing Abandoned Utilities.** The cost of removal of all abandoned underground utilities (such as street light conduits, gas mains, water mains, etc.) necessary to install new underground utility lines shall be included in the unit price bid for installation of the utility.
15. **Holding Utility and Street Lighting Poles.** The Contractor shall be responsible for holding any utility or street lighting pole which are locate adjacent to the proposed underground utility or utilities that the Contractor is constructing and they shall provide all necessary materials, labor, and equipment necessary for holding the pole, for adequate compaction of backfill near the pole, and for any temporary or permanent guys and anchors. Any damage to underground and/or overhead utilities shall be the responsibility of the Contractor and shall be repaired or replaced by the Contractor at their expense. All work associated with holding these poles shall be included in the major items of work for placing the utility or utilities.
16. **Cleaning-Up.** The Contractor shall remove surplus excavated materials and materials for construction as the work progresses, and shall render the street suitable, safe, and convenient for traffic. Before final acceptance of the work, the Contractor shall remove all temporary traffic control, clean the street surface, walks, gutters, fences, lawns, private property, right of way, and structures, leaving them in as good condition as originally found or better, and shall remove all machinery, tools, surplus materials, temporary buildings and other temporary structures from the site of the work. Furthermore, the sewers, manholes, inlets, etc. shall be cleared of all scaffolding, centering, rubbish, dirt, dams or other obstructions.

- d. **Measurement and Payment.** Payment for the work covered in this section shall be included in the unit price of the utility work being accomplished, except for rock excavation in accordance with [Section 2.4](#) and removal of unsuitable soil in accordance with this Section. The completed work as measured for **Unsuitable Soil, Rem and Replacement with __** will be paid for at the unit price for the following contract items, Pay Items (City Standard). The price for these items shall be payment in full for furnishing all labor, equipment and materials, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.5.001	Unsuitable Soil, Rem and Replacement, with __	Cubic Yard
Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Unsuitable Soil, Rem and Replacement, with __** will be measured in cubic yards as specified in this Section for Unstable Foundation per Standard [Detail S-15](#) and paid for at the unit price listed in the Bid Form.

DIVISION 2 – EARTHWORK

SECTION 2.6

CONTAMINATED SOIL AND GROUNDWATER PROCEDURES

a. Description.

This work consists of all labor, equipment, and materials necessary to handle, transport, and dispose of potentially contaminated or contaminated soil and groundwater.

1. **Governing Standards.** Except as modified or supplemented herein, the handling of potentially contaminated or contaminated soil and groundwater shall be governed by state and federal waste management regulations, by the provisions of Federal Regulation 29 CFR Part 1910.120, and regulations of the Occupational Safety and Health Administration (OSHA).
2. **Definitions of Terms.**
 - A. **Potentially Contaminated Area.** Potentially contaminated areas.
 - B. **Clean Area.** A designated area where the possibility of contact with hazardous materials has been removed. Personnel working in this area are not required to meet health and safety training requirements in accordance with Federal Regulation 29 CFR Part 1910.120.
 - C. **Exclusion Zone.** A designated area where contact with hazardous material is expected. Personnel working in area must meet health and safety training requirements in accordance with Federal Regulation 29 CFR Part 1910.120.
 - D. **Contaminated Material.** Soils or other materials which contain chemical contaminants in excess of federal and state standards for unlimited (residential) land use. These soils may not be used as fill unless approved by the Engineer.
 - E. **Hazardous Material.** Soils or other materials which contain chemical contaminants in excess of federal and state standards for disposal in a non-hazardous solid waste landfill.
 - F. **Level C Protection.** Protection of personnel from hazardous conditions in accordance with Federal Regulation 29 CFR Part 1910.120.
 - G. **Fractionation Tanks.** Tanks used for temporary onsite storage of water removed from the trench during the excavation operation.

b. Materials. None Specified.

c. Construction.

1. **Performance Requirements.** The Contractor is responsible for complying with the requirements of Federal Regulation 29 CFR Part 1910.120, the Health and Safety training for his employees and providing his employees with adequate protective equipment.
 - A. The Contractor is responsible for the monitoring of City designated clean areas to ensure that the areas remain free from exposure to contaminated materials.
 - B. The Contractor is responsible for the monitoring of City designated exclusion zones to ensure proper compliance with Federal Regulations.
2. **Health and Safety Plan.** The Contractor shall prepare a Health and Safety Plan for this project and shall provide a copy to the Engineer if requested.
3. **Handling of Potentially Contaminated Soils.** The Engineer will determine which soils are uncontaminated and contaminated. The Engineer will monitor excavated soils and direct the Contractor to remove uncontaminated soils from the project site or to place the potentially contaminated soils in a designated Soil Stockpile Area, for review by the Engineer.
 - A. The existence of potentially contaminated soils will be determined by the Engineer during the trenching operations. The Engineer will identify potentially contaminated soils as they are excavated and will designate a soil stockpile area. The Contractor will load, transport, and unload the potentially contaminated soils at the designated soil stockpile area. The Contractor shall stockpile the materials in piles as required by the Engineer. Segregation of materials may be necessary to prevent cross contamination.

- B. All potentially contaminated soils stockpiled shall be placed on and covered by a 6-mil black PVC liner. Contractor shall avoid transporting contaminated soils or allowing runoff of storm water which may come in contact with potentially contaminated soil to clean areas. The Contractor shall monitor the integrity of the PVC liner and correct deficiencies.
- C. Engineer will obtain samples of the soil from the stockpile area and have necessary analytical tests performed to determine the required method of disposal. Sample collection, laboratory testing, and landfill approval typically require 4 to 5 days to complete. The Engineer will identify the type of disposal required and notify the Contractor. The following three disposal types for materials removed from the potentially contaminated area will apply:
 - (1) **Uncontaminated Soils.** If the soil is uncontaminated, the Contractor will load, transport, and dispose of the soils at an appropriate disposal area. This removal operation will begin within 48 hours of notification by the Engineer and be completed as expeditiously as possible to facilitate the ongoing use of the soil stockpile area.
 - (2) **Non-hazardous Contaminated Soils.** If the soil is contaminated and non-hazardous, the Contractor will load, transport, and dispose of contaminated soils at a non-hazardous solid waste landfill. This removal operation will begin within 48 hours of notification by the Engineer and be completed as expeditiously as possible to facilitate the ongoing use of the soil stockpile area.
 - (3) **Hazardous Contaminated Soils.** If the soil is contaminated and hazardous, as determined by the analytical test results, the soil will be loaded, transported, and disposed of at a hazardous waste disposal site by the hazardous waste contractor designated by the City.
- 4. **Excess Water Control/Handling Potentially Contaminated Groundwater.** Excavations shall be kept dry during construction. Water shall be removed by use of wells, well points, portable pumps, bailing, drains, underdrains, or other acceptable methods. Surface water shall be diverted from entering excavations by the construction and maintenance of channels, berms, etc. Sediment traps and other soil erosion control measures shall prevent soil particles from entering any sewer, watercourse, or similar conveyance.
 - A. Contractor shall provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the work. Dewatering shall be accomplished by means which will ensure dry excavations, preserve final lines and grades, not disturb or displace adjacent soil, and avoid contamination of any surface water or storm water. All pumping and drainage shall be done with no damage to property, pedestrians, vehicular traffic, or the work of other contractors and in accordance with all pertinent laws, ordinances, and regulations. Existing drainage facilities shall not be overloaded or obstructed.
 - B. If the groundwater is determined by the Engineer to be potentially contaminated (e.g., hydrocarbon sheen or chemical odor), the Contractor shall immediately cease dewatering operations and shall not resume dewatering until equipment appropriate to store the potentially contaminated groundwater is onsite and operational. Additionally, the Contractor shall manage the groundwater as contaminated until directed otherwise by the Engineer.
 - C. Potentially contaminated groundwater removed from the trench during the pipe laying operation shall be stored in fractionation tanks located on the project site. Each fractionation tank shall have a minimum capacity of 20,000 gallons.
 - D. Samples of the stored groundwater will be collected by the Engineer within 48 hours of initial storage in the fractionation tanks. Analytical tests will be performed on the samples to determine if the stored groundwater is contaminated. Laboratory testing of collected samples typically requires 24 to 72 hours to complete. Based on the results of these tests, the Engineer will identify the type of disposal required and notify the Contractor. The following types of disposal may be used:
 - (1) **Uncontaminated Groundwater.** If chemical concentrations in the stored groundwater are below federal and applicable state clean up criteria, the Contractor shall dispose of it by pumping in accordance with [Section 2.5](#).

- (2) **Non-hazardous Contaminated Groundwater.** If the stored groundwater is contaminated and non-hazardous, as determined by the Engineer, the stored water shall be disposed of as directed by the Engineer in one of three ways. Disposal will be based on the sampling results:

- (a) By discharge into the nearest available sanitary sewer in accordance with [Section 2.5.c.6.](#)
- (b) By pumping the stored water through a carbon treatment system and discharging to the nearest available sanitary sewer in accordance with [Section 2.5.c.6.](#) The carbon treatment system shall be operated at a minimum empty bed contact time of 15 minutes. The Contractor shall submit information regarding use, performance, and capacity of the carbon treatment system for review and approval in accordance with the General Requirements for Shop Drawings in [Section 1.2.](#)
- (c) By loading, transporting, and disposing at a licensed treatment facility, contingent upon City and Engineer approval.

- (3) **Hazardous Contaminated Groundwater.** If the stored groundwater is contaminated, hazardous, and not treatable by carbon filtration, it shall be loaded, transported, and disposed of at a hazardous waste disposal site by the hazardous waste contractor designated by the City.

- E. Fractionation tanks shall be emptied and made available for reuse within 72 hours of notification by the Engineer of the appropriate disposal method of the tank's contents. After each tank is emptied, it may require decontamination before reuse. The Engineer will notify the Contractor of this requirement.

5. **Available Disposal Facilities for Contaminated Wastes.**

- A. **Non-hazardous Solid Waste Landfills** per the Specified Product Index (SPI) ([SPI 2.6.A](#))
- B. **Non-hazardous Liquid Waste.** ([SPI 2.6.B](#))
- C. **Hazardous Wastes - Solid or Liquid.** Hazardous wastes, solid and liquid, shall be handled by a contractor designated by the City.
- D. **Fractionation Tank Vendors.** ([SPI 2.6.C](#))

- d. **Measurement and Payment.** The completed work as described will be paid for at the Contract Unit Price for the following contract item, Pay item (City Standard)

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.6.001	Contaminated Material, Storage, Handling and Disposal	Dollars

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Contaminated Material, Storage, Handling and Disposal** is an allowance established to pay for the handling, transporting, storage and disposal of non-hazardous and hazardous contaminated soil and groundwater. All work to be paid under this item shall be pre-approved in writing by the Engineer.

- A. Where the work is performed by a subcontractor or supplier, the Contractor will be paid for the amount invoiced plus an additional 6 percent of the invoiced cost as reimbursement for the Contractor's administrative costs. Where the Contractor will be performing the work with his own forces, the work will be paid for using predetermined, negotiated prices. If the Contractor and Engineer cannot agree upon prices, the work will be paid for by force account in accordance with section 109.05 of the MDOT Standard Specifications for Construction.

- B. The cost of the following work items will be paid for from the allowance:
 - (1) Loading, transporting and unloading potentially contaminated soils at the soil stockpile area.
 - (2) Labor, equipment and materials related to the use of a PVC liner.
 - (3) Loading, transporting and disposing of contaminated, non-hazardous soils at a non-hazardous solid waste landfill.
 - (4) Loading, transporting and disposing of contaminated, hazardous waste at a hazardous waste disposal site by the hazardous waste disposal contractor designated by the City.
 - (5) All work associated with the supply, use, decontamination, reuse, and removal from site of fractionation tanks.
 - (6) All costs associated with disposing of non-hazardous contaminated groundwater using a carbon treatment system.
 - (7) Loading, transporting and disposing of non-hazardous contaminated groundwater at a licensed treatment facility.
 - (8) Loading, transporting and disposing of hazardous contaminated groundwater at a hazardous waste disposal site by the hazardous waste disposal contractor designated by the City.
 - (9) Permit fees associated with disposing of non-hazardous contaminated groundwater by disposal to the nearest available sanitary sewer.
- C. The following work items will not be paid for separately, but are considered included in payment for the utility and/or grading work requiring the excavation or dewatering:
 - (1) Loading, transporting and disposing uncontaminated soils to a disposal area
 - (2) Crushed stone or gravel used to aid dewatering operations
 - (3) All costs associated with disposing of uncontaminated groundwater.
 - (4) All costs associated with disposing of non-hazardous contaminated groundwater by disposal to the nearest available sanitary sewer, excluding permit fees.

DIVISION 2 - EARTHWORK

SECTION 2.7

BORE AND JACK

- a. **Description.** The work shall consist of boring and jacking a casing pipe, or carrier pipe, as specified in the Bid Form, and shall include the furnishing of all labor, materials and equipment necessary to complete the work as specified herein.
- b. **Materials.**
1. **Steel Casing Pipe.**
 - A. Steel Casing Pipe shall be 35,000 psi minimum yield strength and shall conform to ASTM Designation A-139, Grade B or as indicated on the Drawings.
 - B. Steel casing pipe for carrier pipe less than 6 inches in diameter, the inside diameter of the casing pipe shall be at least 2 inches greater in diameter of the carrier pipe joints.
 - C. Steel casing pipe for carrier pipe 6 inches or greater in diameter, the inside diameter of the casing pipe shall be at least 4 inches greater than the largest outside diameter of the carrier pipe joints.
 - D. All steel casing pipe under Railroads shall have a specified minimum yield strength, SMYS, of at least 35,000 psi. Casing pipe shall have a minimum wall thickness as shown in the drawings (Cooper E-80 railroad loading). All casing pipe joints will be welded in accordance with AISC specifications, Section 1-7-2. All joints will be full penetration. The inside diameter of the casing pipe shall be such as to allow the carrier pipe to be removed subsequently without disturbing the casing or the roadbed.
 2. **Carrier Pipe** shall be as called for on the Bid Form.
 3. **Sand.**
 - A. Sand fill shall meet the requirement for Granular Materials Class II as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
 4. **Pea Stone.**
 - A. Peastone shall meet the requirement for Open-Graded Aggregate 34R as specified in the current MDOT Standard Specifications for Construction.
 5. **Flowable Fill.** In accordance with [Section 6.1](#).
- c. **Construction.** Excavation and backfill for bore pits and other open cut portions of the bore and jack operation shall be done in accordance with [Section 2.5](#).
1. Joints between adjacent sections of steel casing pipe shall be field welded.
 2. Casing pipe shall be placed on an elevation so that the carrier pipe will be at the proper elevation. Wood blocking, or other Engineer approved blocking, shall be used as necessary to install the carrier pipe at the proper elevation inside the casing pipe. Said blocking shall be securely fastened to the carrier pipe.
 3. The carrier pipe shall be joined to form a continuous run through the casing.
 4. The space between the carrier pipe and the casing pipe shall be filled with dry sand, pea stone, or flowable fill to sufficiently support carrier pipe material type and in accordance with any permit requirements.
 5. Both ends of the casing pipe shall be sealed with Grade 3500 concrete in accordance with [Section 6.1](#) or as indicated on the Drawings.
 6. In constructing the jacking pit, the Contractor will be required to tight-sheet the front and all sides of the pit as necessary to protect his operation and the adjacent property.
 7. **Railroad.** When bore and jack is in conjunction with placement of casings and utilities under a railroad, the Contractor shall comply with all requirements of the approved railroad permit.
 8. **Contamination.** If an area of contaminated ground or groundwater is encountered, cease all operations and notify the Engineer immediately. Contaminated material will be handled in

accordance with [Section 2.6](#). Bore and jack shall not resume until approved by the City, railroad (if applicable) and the Engineer.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material including excavation and backfill, necessary jacking pits, dewatering, complying with railroad requirements, including settlement monitoring, connections to pipes on both ends of the boring and jacking, restoration, and all other work necessary and incidental thereto for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
2.7.001	Bore and Jack ___ inch dia Steel Casing Pipe, Wall Thickness ___ inch, including ___ inch (carrier pipe).....	Foot
2.7.002	Obstruction Rem, Bore and Jack, Less than 18 inch	Each
2.7.003	Obstruction Rem, Bore and Jack, 18 inch to 36 inch	Each
2.7.004	Obstruction Rem, Bore and Jack, 36 inch or larger	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Bore and Jack ___ inch Dia Steel Casing Pipe, Wall Thickness ___ inch, including ___ inch (carrier pipe)** shall be measured in linear feet of the actual length of pipe bored and jacked into place. This length shall not exceed that shown on the Bid Form except if additional length is specifically authorized by the Engineer. No additional payment shall be made for the length beyond the Bid Form amount except as authorized by the Engineer.
2. **Obstruction Rem, Bore and Jack, (size)** will be paid for each obstruction of the specified size that is encountered that halts the forward progress of the bore and jack operation, such as concrete rubble, cobbles, etc. The size of each obstruction piece will be measured as the average of the maximum and minimum dimension of the piece removed. Payment includes all labor, materials and equipment necessary to remove the obstruction, including the removal and re-insertion of the auger. Only those obstructions which prohibit the advancement of the auger will be considered for payment. No separate payment will be made for obstructions that come through the cutting head regardless of the size.
3. Handling and disposal of contaminated material, if required, and restoration will be measured and paid for separately.

DIVISION 3 – BASES

SECTION 3.1 SUBBASES

SECTION 3.2 AGGREGATE BASE AND SURFACE COURSES

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DIVISION 3 - BASES

SECTION 3.1

SUBBASES

- a. **Description.** This work shall consist of constructing a subbase of sand material, constructed to the specified depth below the pavement shown on the Drawings or required by the Engineer and stabilized when necessary. The materials, equipment, construction methods, and measurement and payment shall be specified under Division 3 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, or any special provisions.
- b. **Materials.** The sand used for subbase shall be Granular Material Class II as specified in the current MDOT Standard Specifications for Construction.
- c. **Construction.** In accordance with Section 301 of the current MDOT Standard Specification for Construction.
- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, including excavation and backfilling, for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
	None	

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
3.1.101	Subbase, LM	Cubic Yard
3.1.102	Subbase, CIP	Cubic Yard

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DIVISION 3 – BASES

SECTION 3.2

AGGREGATE BASE AND SURFACE COURSES

- a. **Description.** This work shall consist of an aggregate roadway or aggregate base constructed on an existing aggregate surface or on a prepared subbase or subgrade. The materials, equipment, construction methods, and measurement and payment shall be as specified under Division 3 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, or any Special Provisions. Crushed, recycled concrete pavement meeting the gradation requirements of the specified aggregate may be used at the Contractor's option.
- b. **Materials.**
1. The aggregate used for base shall be Dense-Graded Aggregate 21AA as specified in Section 302 the current MDOT Standard Specifications for Construction.
 2. The aggregate used for surface courses shall be Dense-Graded Aggregate 21A, 21AA, 22A, or 23A as specified in Section 306 of the current MDOT Standard Specifications for Construction, as call out in the Drawings, or as directed by the Engineer.
 3. The aggregate used for temporary gravel pavement materials shall be any aggregate described in Division 3 of the MDOT Standard Specifications for Construction, or as approved by the Engineer.
- c. **Construction.** In accordance with Section 302 and 306 of the current MDOT Standard Specification for Construction.
- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
3.2.001	Temp Gravel Pavt	Ton

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
3.2.101	Aggregate Base, LM	Cubic Yard
3.2.102	Aggregate Base, __ inch	Square Yard
3.2.103	Aggregate Surface Cse, __ inch	Square Yard
3.2.104	Aggregate Surface Cse	Cubic Yard, Ton

1. **Temp Gravel Pavt** shall be payment in full for all labor, equipment, and material necessary to place and remove gravel pavement as directed by the Engineer. The Contractor shall only be paid for temporary gravel pavement when so required by the Engineer to place such materials.

The Contractor shall not be paid for **Temp Gravel Pavt** when used for the Contractor's convenience. Any temporary gravel necessary in the roadway over utility trenches to maintain local and emergency traffic is incidental to the utility being placed and shall not be paid for separately.

Any temporary gravel used in maintaining a lane for emergency and local traffic along and parallel to the street shall not be paid for separately under the item temporary gravel but is considered to be included in the item **Roadway Grading** per [Section 2.4](#). The Contractor shall only be paid one time for the placement of **Temp Gravel Pavt** in any one area.

The Contractor shall maintain temporary gravel for the remainder of the project.

DIVISION 4 – UTILITIES

SECTION 4.1 SANITARY SEWERS

SECTION 4.2 STORM SEWERS

SECTION 4.3 WATER MAINS

SECTION 4.4 FORCEMAINS AND FORCEMAIN STRUCTURES

SECTION 4.5 MANHOLES, CATCH BASINS AND SIMILAR STRUCTURES

SECTION 4.6 VALVE CHAMBERS, METER PITS AND SIMILAR STRUCTURES

SECTION 4.7 ELECTRICAL DISTRIBUTION

SECTION 4.8 STREET LIGHTING

SECTION 4.9 DUCTS AND COMMUNICATIONS

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DIVISION 4 - UTILITIES

SECTION 4.1

SANITARY SEWERS

- a. **Description.** The work shall consist of constructing sanitary sewer pipe of the specified sizes placed in a trench, and shall include furnishing and installing the pipe, excavation and backfill. The work also shall include connections to the sanitary sewer and sanitary sewer laterals to the abutting property.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [4.1 of the Specified Products Index \(SPI\)](#). Material shall be new and free of defect from manufacture or transport.
 1. **Sanitary Sewer Pipe.** Sewer pipe shall conform to one or all of the following current ASTM or other specifications as designated on the Drawings or in the Bid Form. Pipe furnished for a project shall be of the materials shown on the Drawings or specified in the Bid Form for that project. No changes in pipe material or size will be allowed between manholes.
 - A. **PVC Truss Pipe** (Composite Sewer Pipe) shall conform to current ASTM Specification D2680 as shown on the Drawings or specified in the Bid Form.
 - B. **PVC Solid-Wall Pipe** where approved, shall conform to current ASTM specification D3034, including appendixes, with a standard dimension ratio of 35 (SDR35).
 - (1) The use of PVC Solid Wall Pipe shall only be permitted by the City Engineer's office on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
 - C. **PVC Corrugated Pipe** with a smooth interior shall conform to current ASTM specification F949.
 - (1) The use of PVC Corrugated Pipe shall only be permitted by the City Engineer's office on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
 - D. **Ductile Iron Pipe** shall conform to the current ANSI A21.50, thickness Class 53 or as approved by the Engineer. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI A21.51 as shown on the Drawings or specified in the Bid Form.
 - (1) **Ceramic Epoxy Lining.** ([SPI 4.1.A](#)) When shown in the Drawings or specified in the Bid Form the ductile iron pipe shall include Ceramic Epoxy Lining. Lining shall be applied by a firm certified in ceramic lining of ductile iron pipe.
 - E. **Vitrified Clay Pipe** conforming to the current ASTM Specification C700 or for either standard or extra-strength pipe or to the current National Clay Pipe Institute's Specification ER 4-67, as shown in the Drawings or specified in the Bid Form.
 - (1) The use of Vitrified Clay Pipe shall only be permitted on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
 - F. **Concrete Pipe** conforming to the current ASTM Specification C76 Class I through V, as shown in the Drawings or specified in the Bid Form.
 - (1) The use of Concrete Pipe shall only be permitted by the City Engineer's Office on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
 2. **Sanitary Sewer Lateral Pipe** shall be PVC Truss, PVC Solid-Wall, Ductile Iron Pipe, or Vitrified Clay Pipe, unless otherwise specified.
 - A. **PVC Truss Pipe** (Composite Sewer Pipe) shall conform to the current ASTM specification D2680.
 - B. **PVC Solid-Wall Pipe** shall conform to the current ASTM Specification D3034 with a standard dimension ratio of 35 (SDR35). Extra Strength laterals in accordance with Standard [Detail S-17](#) shall be SDR23.5 for all depths.

- C. **Ductile Iron Pipe** shall conform to the current ANSI A21.50, thickness Class 53. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI Standard A 21.51.
- D. **Vitrified Clay Pipe** for depths up to 10 feet shall be standard strength pipe conforming to current ASTM specification C700. Depths over 10 feet shall be as shown on the Drawings or listed in the Bid Form.
 - (1) The use of Vitrified Clay Pipe shall only be permitted by the City Engineer's Office on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
- E. **Concrete Pipe** conforming to the current ASTM Specification C76 Class I through V, as shown in the Drawings or specified in the Bid Form. (Laterals 12 inches or larger in diameter)
 - (1) The use of Concrete Pipe shall only be permitted by the City Engineer's Office on a project by project basis and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
- F. **PE Pipe** conforming to the current ASTM F714.
 - (1) The use of HDPE Pipe shall only be permitted by the City Engineer's Office on a project by project basis for insertion renewal of existing laterals and said approval shall be prior to bids being received and the Drawings or Special Provisions shall so state.
- 3. **Sanitary Sewer Lateral Connections.**
 - A. **PVC Truss and PVC Solid Wall Pipe.** Lateral connections to truss and solid wall pipe shall be manufactured tees and wyes for sewer mains 15 inches or less in diameter.
 - B. **Clay.** Lateral connections to clay sewer pipe shall be per [Detail S-20](#) for sewers 12 inches or less in diameter.
 - C. **Concrete Pipe.** Lateral connections to concrete sewer pipe shall be per [Detail S-20](#) for sewers 12 inches or less in diameter.
 - D. **Flexible Connections for PVC Truss, Solid Wall greater than 15 inches Clay and Concrete Pipe greater than 12 inches in diameter.** ([SPI 4.1.B](#))
 - (1) Rubber sleeve lateral connection shall conform to ASTM F477.
- 4. **Sewer Joints.** Joints for Sewer and Sewer Laterals shall conform to the following specifications.
 - A. **PVC Truss Pipe and PVC Solid-Wall Pipe.** Joints shall be chemically welded or shall be of the elastomeric gasket seal type as specified in the current ASTM Specification D3212. Care shall be taken to ensure that all joints are pushed to the full "home" position and held tightly in the "home" position during any grade or line adjustments. If solvent is used, pipe shall be rotated during joint insertion to ensure a complete spread of joining cement. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers and adhesives shall be used as recommended by the pipe manufacturer. Installations of solvent weld joint pipe shall be installed in accordance with current ASTM specification F402, and all required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe. Swab-type applicators shall be used to apply primer and cement. Opened containers in the trench shall be protected from dirt, water and other contaminants.
 - B. **PVC Corrugated Pipe.** Joints shall be made with integrally formed bell and spigot gasketed connections. Contractor shall provide documentation showing no leakage when gasketed pipe joints are tested in accordance with ASTM D3212. Gaskets shall meet the requirements of ASTM F477.
 - C. **Vitrified Clay Pipe.** Joints shall conform to the current ASTM specification C425 Types I, II or III.
 - D. **Ductile Iron Pipe.** Joints shall be push-on type coupled in accordance with ANSI/AWWA C111/A 21.11.

- E. **Concrete Pipe.** Joints for concrete sanitary sewer pipe of 10 inch diameter and larger shall be of the round rubber gasket type, or Glipp Type, using a modified bell and spigot design. The spigot shall have an external groove accurately sized to receive the gasket, so that when the pipe is laid and the joint completed, the gasket shall be enclosed on all surfaces. Joints and gaskets shall conform to the current ASTM Specifications C443 except the taper on the conic surfaces of the inside of the bell and the outer surface of the spigot shall not be more than 2 degrees with respect to the longitudinal axis of the pipe. The durometer hardness of rubber gaskets shall be 45, plus or minus 5, and the gaskets shall have a circular cross section or be the Glipp Type. The Contractor shall furnish to the Engineer a detailed drawing showing the pipe and joint proposed to be furnished under these specifications.
- F. **PE Pipe. (Laterals Only)** Joints for PE laterals shall be heat fused in accordance with ASTM D2657 or mechanical joint in accordance ASTM D3212 with elastomeric seal meeting ASTM C1173.
- 5. **Pipe Test Certification.** Contractor shall make arrangements to furnish the Engineer with a satisfactory test report by an approved independent Testing Consultant to be hired by the City (or Developer for Private Development projects) covering all pipe delivered to the site. It shall, as a minimum, include the following information as may be applicable: ASTM specifications, breaking test data, absorption test data, test cylinder data and other information as may be required by the Engineer.
 - A. The Testing Consultant shall stamp all pipe covered by their test report and delivered to the job site.
 - B. Each lot shall be tested and if the representative sample fails, the entire lot, as defined by the Manufacturer, will be considered defective and rejected.
 - C. The cost of the above-described testing shall be paid for by the City. Any testing charges resulting from unsatisfactory pipe having been furnished shall be the responsibility of the Contractor. (The Testing Consultant and testing costs for a Private Development project shall be arranged and paid for by the Developer.)
 - D. The Engineer may, in cases where in their opinion the work is of such small quantity as to make the above requirement unnecessary, waive or alter these test requirements if so requested prior to delivery of pipe to a job site. (This provision does not apply to Private Development Projects) If testing is waived, at a minimum, in cases where the pipe manufacturer has an approved testing facility, certification test reports performed by the manufacturer shall be submitted for acceptance.

c. Construction.

- 1. **Excavation and Backfill.** Excavation and backfill for sewers shall be done in accordance with [Section 2.5](#).
- 2. **Handling.**
 - A. Ceramic lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.
- 3. **Laying Sewer Pipe.**
 - A. **General.** Alignment and depth of the pipe shall be as shown on the Drawings, unless otherwise approved by the Engineer. The construction shall begin at the outlet end and proceed toward the upper end. The pipe shall be carefully laid in the prepared trench to the line and grade as shown on the Drawings or as approved by the Engineer, with the spigot end downstream. The bottom of the trench shall be so shaped to permit a firm and even bearing along the barrel of the pipe. A sufficient sand cushion shall be provided in clay soil as specified in [Section 2.5](#), where approved by the Engineer. The pipe shall be fitted close and tight and with smooth inverts. All connections to existing manholes shall be of the flexible type (rubber boot) as specified in [Section 4.5](#).
 - (1) Whenever a force or pressure main is to be constructed in which sewage will be pumped under pressure, it shall be installed according to the Construction Methods as specified in [Section 4.4](#).

- (2) **Concrete Joints.** Wrap pipe joints, with a diameter greater than 24 inches, using geotextile fabric. Use geotextile at least 22 inches wide, centered on the joint.
- B. **Laser.** The Contractor shall use the laser beam method of maintaining line and grade for sewer construction. If requested by the Engineer, the Contractor shall submit evidence to the Engineer that a qualified operator will handle the laser beam equipment during the course of construction.
- (1) The Engineer shall place the line and grade stakes at each manhole, or more often, as determined appropriate. The Contractor shall check the line and grade at every point at which a stake has been placed.
- C. **Laterals.** The openings for house connections shall be tees or wyes (unless otherwise noted) placed at the locations shown on the Drawings or as approved by the Engineer, and the pipe shall be laid from the tee to the property line. These laterals shall be laid at right angles to the street line unless otherwise directed and shall be laid on a uniform line and grade from the sewer opening to the property line. Lateral shall be constructed at a minimum 1 percent grade from the main to the right of way or easement line. The depth of the lateral, below grade, at the right-of-way or easement line shall be set at 9.5 feet to the invert, unless otherwise shown on the Drawings and approved by the Engineer. The upper end of the lateral shall be closed with a stopper sealed in place by the same joint and material as used for the lateral. The location of the end of each lateral and of each stoppered opening in the sewer shall be marked by a 2 inch x 2 inch wooden stake which shall extend vertically from the sewer pipe to just below the ground, and which shall have at its lower end, a piece of lumber 1 inch x 2 inch x 6 inch securely nailed horizontally, and shall have at its upper end a securely fastened, heavy ferro-magnetic washer.
- (1) If the lateral being constructed is to be constructed all the way to the structure which it will serve, the final connection is to be made by a licensed plumber in possession of a valid connection permit. No lateral is to be constructed any closer than 3 feet to the structure it is to serve without the above requirements being met.
- (2) No sewer lateral may be connected into any newly constructed sanitary sewer until such time as said sewer has been approved and an "In-Service" letter has been written by the Engineer.
- (3) Approved premanufactured pipe-to-pipe adapters shall be utilized on all laterals where more than one type of pipe is used.
- (4) Sewer laterals shall be cored into concrete pipe and shall be fitted with a flexible connection.
- (5) Sewer laterals connecting to lined sanitary sewer shall be connected per details on the plan in accordance with [SPI 4.1.B](#).
- (6) All lateral connections to sewer mains and manholes shall be by gravity. No force main connections will be allowed.
- D. **Extra Strength Laterals.** Where the buried depth of the sanitary sewer main is greater than 13 feet below the established street grade, an extra strength lateral as per Standard [Detail S-17](#) shall be constructed at the location shown on the Drawings or profile, of the diameter and height specified, or as approved by the Engineer, for the purpose of providing a connection at the top of such riser for a house lateral.
- E. **Other Connections.** All other connections shall be made in tee or wye openings at the locations shown on the Drawings or as approved by the Engineer.
- F. **Cut-Ins.** When cutting into a sewer or manhole, the opening in the larger sewer shall be no larger than is necessary to connect the new sewer or lateral. Openings shall be circular. All broken or surplus material shall be removed from both sewers.
- (1) When the larger sewer is of reinforced concrete construction, the reinforcing steel shall be carefully cut off to the proper distance to avoid spalling the concrete. For connecting clay or concrete sewers greater than 24 inches, the sewer shall be neatly grouted into the receiving sewer as approved by the Engineer. For connecting clay or concrete sewers, 12 inches through 24 inches, the hole shall be cored in, and the connection between the new sewer and the sewer which was cut into shall be made with a flexible rubber boot, or manufactured lateral connection. Cut-ins for clay or concrete pipe 12

inches in diameter and less shall be made with a sewer saddle as shown in Standard [Detail S-20](#), unless otherwise approved by the Engineer.

- (2) For PVC pipe up to 15 inches, the connection shall be made using a saddle, solvent welded onto the cut pipe. The saddle shall be anchored with two stainless steel clamps in addition to the solvent weld. The saddle shall cover at least one half the outside diameter of the pipe. Connections greater than 15 inches shall be a flexible connection in accordance with [SPI 4.1.B](#).
- G. **Cutting PVC, Truss, PVC Solid-Wall Pipe and PVC Corrugated Pipe.** The cutting of PVC truss pipe and PVC solid-wall pipe lengths, where required, shall be performed by the use of tools or equipment that will provide a neat, perpendicular cut without damage to the plastic or filler material. Bowing or warping of PVC pipe can occur with temperature fluctuations. The Contractor shall store and protect from sunlight the pipe to minimize bowing. Nominal 12.5 foot pipe lengths having deviations from straight greater than 1 inch shall not be used.
- H. **Relining Existing Laterals with PE Pipe.** In accordance with Michigan Plumbing Code Section 717.
4. **Concrete Cradle.** Where a concrete cradle is required, it shall be built of concrete Grade 3500, as specified in [Section 6.1](#), and to conform to the details and at the locations shown on the Drawings or as approved by the Engineer.
5. **Testing and Inspection of Sewers.** All sanitary sewer pipes and their service laterals shall be tested and inspected for infiltration and exfiltration by the Contractor. Any construction which fails the requirements of this section will be sealed and retested at the expense of the Contractor. Any construction which cannot be sealed to bring the sewer within the requirement of this section will be reconstructed and retested at the Contractor's expense. The cost of the initial test and inspection will be included in the unit cost of the Construction of the sewer.
 - A. When requested by the Engineer, PVC solid wall and PVC truss pipe shall be inspected to ensure that the pipe has not deformed. The complete installation shall at no point have out-of-round deflections greater than 5 percent. The deflection test shall be conducted after final backfill has been in place for at least 30 days. All flexible pipe <200 psi and flexible pipe >200 psi with more than 12 feet of cover shall be tested. The Engineer shall have the option of requiring deflectometer or go/no go gauging tests run prior to acceptance of pipe on pipelines where high deflections are suspected. Pipe with deflections greater than 5 percent will be considered unacceptable and shall be re-laid by the Contractor at the Contractor's expense. The cost of such testing will be considered to have been included in the price bid for the sewer.
 - B. **Exfiltration Test** shall be conducted by a water test or a low-pressure air.
 - (1) **Water Test.** When the sewers are to be tested with water, the Contractor shall isolate a section or sections of the sewers between manholes by means of approved temporary type of watertight bulkheads. The isolated section of sewer shall then be filled with water to a level which is 2.5 feet above the existing water table, but not less than 2.5 feet above the end of the highest lateral or crown of the sewer pipe at the high end of the isolated section under test. The length of the section shall be such that, where possible, the water level at its lower end will not more than 5 feet above the crown of the pipe except as may be required by a high-water table. The length of time of the exfiltration test period shall be at the discretion of the Engineer. Determination of the amount of exfiltration shall be made by measurement of the loss of volume of water in the manholes. The amount of exfiltration over a 24-hour period will then be calculated from the measured loss of volume and time period.
 - (a) Infiltration shall be measured by the temporary placement of weirs in manholes capable of accurately measuring the infiltration which occurs.
 - (2) **Low-pressure Air Tests** shall be conducted according to ASTM F1417 for plastic pipe, C828 for vitrified clay pipe, and C924 for reinforced concrete pipe.

- (3) Rates of infiltration or exfiltration for sewers will not exceed 100 gallons per day, per inch of diameter, per mile of sewer.
- (4) Tabulation of this requirement for various diameters per lineal foot is as follows:

Table 4.1-1 Rates of Infiltration or Exfiltration			
Diameter of Sewer (in)	Infiltration or Exfiltration (gallons per day per foot)	Diameter of Sewer (in)	Infiltration or Exfiltration (gallons per day per foot)
6	.113	30	.568
8	.151	36	.681
10	.198	42	.795
12	.227	48	.909
15	.284	54	1.022
18	.341	60	1.136
21	.397	66	1.250
24	.454	72	1.363
27	.511		

- (a) Exceeding these amounts will be considered as failure for the tested lengths of sewer.
- (b) Any infiltration which is observed shall be sealed by the Contractor.
- (c) On any section of sewer that the Engineer shall deem it impractical to test by means of the water exfiltration test specified in this Section, the following air test shall be used. Air shall be slowly supplied to the plugged pipeline until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. The average back pressure is determined by inserting a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe and determine the pressure in the probe when air passes slowly through it. All gauge pressures in the test should be increased by this amount. At least two minutes shall be allowed for temperature stabilization before proceeding further.
- (d) The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 to 2.5 pounds per square inch.
- (e) The sewer shall be considered acceptable if the time interval for the pressure drop from 3.5 pounds per square inch to 2.5 pounds per square inch is not less than the holding time listed in the table which follows.

Low Pressure Air Test Tables
Time Required For 1.0 PSIG Pressure Drop
When Testing One Pipe Diameter Only for Size and Length of Pipe Indicated.

Table 4.1-2 PVC and DI Sewer											
Pipe Dia (in)	Min. Time (min:sec)	Length for Min Time (ft)	Time for Longer Length (sec)	Test 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	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Table 4.1-3
VCP and Concrete Sewer

Pipe Dia (in)	Min Time (min:sec)	Length for Min Time (ft)	Time for Longer Length (sec)	Test Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:50	57	20.939L	34:54	52:21	69:48	87:15	104:42	122:09	139:36	157:03

Note: When testing two sizes of sewer pipe simultaneously, time shall be computed by ratio of lengths involved.

Example: 400 feet of 8-inch PVC pipe and 150 feet of 6-inch VCP pipe.

$$\begin{aligned}
 \text{Time} &= \frac{\text{Time} = \text{Length}_1 \times \text{Time}_1 + \text{Length}_2 \times \text{Time}_2}{\text{Length}_1 + \text{Length}_2} \\
 &= \frac{400 \times 10:08 + 150 \times 2:50}{400 + 150} \qquad \frac{400 \times 6:08 + 150 \times 1:70}{400 + 150} \\
 &= 489 \text{ seconds} = 8:09 \text{ (min:sec)}.
 \end{aligned}$$

C. Video Inspection of Sewers.

- (1) After completion of a section of sewer and prior to placing the sewer into service, the Contractor shall perform a video inspection. The inspection shall be completed by trained and experienced personnel, with knowledge of the operation of the equipment, as well as the design and the construction of the sewer. The Camera shall move through the pipe line at a uniform rate with a maximum rate of speed of 30 feet per minute. The Camera shall stop as necessary at all potential defects and damage to ensure proper documentation of the pipe's condition.
- (2) The Camera shall have a minimum 300 line resolution, digital, video picture.
- (3) Video inspection shall be for all sewers less than 60 inches in diameter.
- (4) The Contractor shall submit an inspection log and digital video of the inspected sewer documenting: date and time of recording, all unusual conditions, collapsed sections, wide joints and cracked pipe. The inspection log and digital video shall list the location, in relation to the starting point, of all conditions.

- (5) The Contractor shall submit the sewer inspection video prior to placement of top course of pavement.

6. Sewer Joint Repairs and Joint Repair Testing.

- A. **Pressure Testing and Grouting.** Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following: ASTM Standards, F2304 - Standard Practice for Rehabilitation of Sewers using Chemical Grouting.

(1) **Chemical Grout information.**

- (a) Description of chemical grout materials to be used.
 - (b) Description of proposed additives to be used.
 - (c) Manufacturer's recommended procedures for storing, mixing, testing and handling of chemical grouts.
 - (d) SDS sheets for all materials to be used.
- (2) Upon completion of the repair of each pipe segment, submit to Engineer a report showing the following data for each joint and lateral connection tested, grouted or attempted to be grouted as required by the PACP:
- (a) Identification of the sewer pipe section tested by assigned sewer ID (if available) and length.
 - (b) Type of pipe material, diameter and depth of pipe to the surface at manholes.
 - (c) Length of pipe sections between joints.
 - (d) Test pressure used and duration of test.
 - (e) Pass/fail results for each joint/connection tested.
 - (f) Location stationing of each joint/connection tested and location of any joints/connections not tested with an explanation for not testing.
 - (g) Volume of grout material used on each joint or connection.
 - (h) Gel set time used (cup test results from tanks).
 - (i) Grout mix record of the batches mixed including amount of grout and catalyst, additives, temperature of the grout solution in tanks.
 - (j) Indicate operator conducting testing and sealing on the reports.
 - (k) Video Inspection:
 - (i) Video shall include testing and sealing operations for each joint/lateral (including inflation and deflation over the joint/lateral) displaying the final air test of joints or laterals.
 - (ii) Final recording shall include inspection of the pipe after all grouting work is complete.

7. Sewer Reconstruction.

- A. **Removal of Existing Sewer.** When so noted on the Drawings, the work under this section shall include the removal of all existing sewers and laterals, which are to be replaced by the reconstructed sewer system. No extra compensation will be paid for said removal or for any necessary plugs.

B. **Maintaining Existing Sewer and Sewer Services Flow.**

- (1) The Contractor shall maintain uninterrupted sewer service to all properties within and adjoining to the Project. The Contractor shall be responsible for the cost of any damages that occur because of a failure to maintain sewage flow.
- (2) The Contractor shall make every reasonable effort to maintain uninterrupted water and sewer service to all property owners adjoining the project. In the event that such interruption of service is unavoidable it shall be done only with prior approval of the Engineer. Any necessary pumping of sewage for any reason whatever shall be the responsibility of the Contractor. This responsibility shall commence at the time the Contractor commences reconstruction operations, or 48 hours after the award of the contract, whichever occurs first, unless otherwise required in the Project Special Provisions.
- (3) Dry weather flows from existing upstream sewers may be bypass pumped during work hours. Bypass pumping of wet weather flows will not be allowed.
- (4) The relaying of any sewer laterals shall be coordinated with the property owners and it shall be the responsibility of the Contractor to maintain sewage flow as necessary. Any interruption of service shall be done only with the prior approval of the Engineer.

- (5) The Contractor shall be held responsible and shall plan his construction activities such that continuity of sewage conveyance system is maintained. All costs, damages, and fines resulting from any failure shall be borne by Contractor.
- (6) When the Pay Item is included in the Bid Form, all costs for maintaining sanitary sewer flow shall be considered included in the **Maintain Sanitary Sewer Service**. When the **Maintain Sanitary Sewer Service** Pay Item is not included in the Bid Form, maintaining existing sanitary sewer and services flow will not be paid separately, and is considered included in other items.

C. **Reconnection of Laterals.** The Contractor shall carefully uncover the existing sanitary sewer and locate all connections thereto. It shall be the Contractor's responsibility to reconnect all live laterals. Where the property is either unoccupied/vacant or undeveloped, one lateral per lot shall be reconnected. The Contractor shall place tees or wyes in the reconstructed sewer as close to the existing laterals as is possible. Place new tees or wyes no closer than 3 feet apart on the main. Laterals shall be laid at right angles to the street line and sanitary main, no tee or wye shall be placed upstream from the lateral, unless otherwise approved by the Engineer. Tees and wyes shall be shop fabricated. No field connections into the reconstructed sewer line will be allowed, unless approved by the Engineer. Any necessary additional lateral alignment may be accomplished by using premium jointed bends, provided that no bends shall be sharper than 45 degrees.

- (1) During the process of construction, the Contractor shall video existing sanitary laterals for the purpose of making certain that all existing sanitary laterals have been reconnected. The Contractor shall make the arrangements necessary to gain access to buildings adjoining the project.
- (2) The Contractor shall clean and inspect the lateral to the property line and advise the Engineer of the condition of the lateral prior to making the connection.
- (3) The necessary field connection between the new lateral pipe and the existing lateral pipe shall be made by cutting the new lateral pipe to the proper length, inserting a prefabricated pipe to pipe adapter, and pouring a concrete collar not less than 6 inches thick by 12 inches wide around the joint. In the event the lateral is constructed of truss pipe no concrete collar is to be placed. No misalignment or angle point will be allowed at the field connection.
- (4) Existing laterals that are determined to be abandoned, shall not be connected or stubbed to the ROW line, so long as each property has at least one-line sewer lateral. All live services to be noted and placed on the record drawings.

d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, excavation, trenching, cofferdams, dewatering, cut-ins, furnishing and placing the sanitary sewer pipe, fittings and plugs, bedding, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.1.001	Sanitary Sewer, D2680, __ inch	Foot
4.1.002	Sanitary Sewer, F949, __ inch	Foot
4.1.003	Sanitary Sewer, C700X, __ inch	Foot
4.1.004	Sanitary Sewer, C76 Cl __, __ inch	Foot
4.1.005	Sanitary Sewer, DI Cl __, __ inch	Foot

4.1.006	Sanitary Sewer, DI Cl __, Epoxy Lined, __ inch	Foot
4.1.007	Tee/wye on __ inch Sanitary Sewer, __ inch	Each
4.1.008	Sanitary Sewer Lateral, SDR __, __ inch	Foot
4.1.009	Sanitary Sewer Lateral, D2680, __ inch	Foot
4.1.010	Sanitary Sewer Lateral, DI Cl __, __ inch	Foot
4.1.011	Sanitary Sewer Lateral, C700X, __ inch	Foot
4.1.012	Sanitary Sewer Lateral, Extra Strength, __ inch	Foot
4.1.013	Reconnect Existing Sanitary Sewer Lateral	Each
4.1.014	Maintain Sanitary Sewer Serv	Lump Sum
4.1.015	Core and Boot __ inch Sanitary Sewer into Sewer or Mh	Each
4.1.016	Core and Seal __ inch Sanitary Sewer into Sewer or Mh	Each
4.1.017	Video Sewer	Foot
4.1.018	Video Private Property Sewer Lateral	Dollars

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

- Sanitary Sewers of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe, without reductions in length for manholes or other structures.
- Sanitary Sewer Laterals of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe from the center of the main line sewer to the other end of the pipe.
 - Connection of proposed laterals to existing laterals at the right-of-way line shall be included in the price of the lateral, and shall include furnishing and placing all necessary bends, the pipe-to-pipe adapter, and or concrete collar, needed to connect the laterals.
- Tees and Wyes shall be measured as units furnished. Payment for laying tees or wyes shall be included in the price for furnishing and laying the sanitary sewer.
- When connecting laterals into concrete pipe or manhole, **Core and Boot __ inch Sanitary Sewer into Sewer or Mh** payment in full for lateral connections.
- When the placement of new sanitary sewer does not call for new sanitary sewer laterals on the Drawings or in the Bid Form. **Reconnect Existing Sanitary Sewer Lateral** shall be measured on the basis of a unit price for each connection, including furnishing and placing all necessary bends, any necessary sewer lateral pipe, the pipe-to-pipe adapter, the concrete collar, surface restoration (unless separate pay items are provided therefor) and all else necessary and incidental thereto. The Contractor will be compensated for the tee or wye under the appropriate item.
- Maintain Sanitary Sewer Serv** shall be payment in full for furnishing all labor, equipment, and material and all other work required for a complete job. The City will pay the Contractor for **Maintain Sanitary Sewer Serv** in accordance with payment schedule for Mobilization. When **Maintain Sanitary Sewer Serv** is not included in the bid form or call for on the Drawings, maintaining sanitary sewer service shall be considered included in the other contract Pay Items.
- Video Sewer** shall be payment in full for furnishing all labor, equipment all other work required for a complete job. Video Sewer shall also be payment in full for all traffic control, bypass pumping, cleaning, recording media, and inspection log.
- Video Private Property Sewer Lateral** shall be payment in full for furnishing all labor, equipment, and all other work required for a complete job of videoing laterals on private property, if needed during construction or when deemed necessary by the engineer. **Video Private Property Sewer Lateral** shall also be payment in full for all traffic control, bypass pumping, cleaning, recording media, and inspection log for such videoing.
- Core and Boot** and **Core and Seal __ inch Sanitary Sewer into Sewer or Mh** shall include reforming manhole flow channels when connecting to existing manholes.
- When connecting sewers or laterals into existing openings, **Core and Seal __ inch Sanitary Sewer into Sewer or Mh** shall be measured and paid, and shall include filling the ancillary space, finishing, and sealing around the new sewer with cement mortar or concrete.

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DIVISION 4 - UTILITIES

SECTION 4.2

STORM SEWERS

- a. **Description.** The work shall consist of constructing storm sewer pipe of the specified sizes placed in a trench and shall include furnishing and installing the storm sewer pipe, excavation and backfill. The work also shall include connections to the sewer, sewer laterals to the abutting property when specified and basin connections which connect catch basins to manholes or the storm sewers.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [4.2 of the Specified Products Index \(SPI\)](#). Material shall be new and free of defect from manufacture or transport.
 1. **Storm Sewer Pipe.** Storm sewer pipe and pipe used for basin connections, shall conform to one or all of the following current ASTM or other specifications as designated on the Drawings or in the Bid Form. Pipe furnished for a particular project shall be of the materials shown on the Drawings or specified in the Bid Form for that project. No changes in pipe material or size will be allowed between manholes.
 - A. **Concrete Pipe** conforming to the current ASTM Specification C76 Class I through V, as shown in the Drawings or specified in the Bid Form. (Basin connections 12 inches and larger)
 - B. **Ductile Iron Pipe** shall conform to the current ANSI Standard A21.50, thickness Class 53 or as approved by the Engineer. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI Standard A21.51 as shown on the Drawings or specified in the Bid Form. (Storm sewers or basin connections)
 2. **Storm Sewer Lateral Pipe** shall be PVC Truss, PVC Solid-Wall, or Ductile Iron Pipe, unless otherwise specified.
 - A. **PVC Truss Pipe** (Composite Sewer Pipe) shall conform to the current ASTM Specification D2680.
 - B. **Concrete Pipe** shall conform to the requirements of the current ASTM Specification C76 Class III for depths up to 10 feet. For depths over 10 feet, the pipe shall be as shown on the Drawings or listed on the Bid Form. (Laterals 10 inches or larger)
 - C. **PVC Solid-Wall Pipe** shall conform to the current ASTM Specification D3034 with a standard dimension ratio of 35 (SDR35).
 - D. **Ductile Iron Pipe** shall conform to the current ANSI Standard A21.50, thickness Class 53. Ductile Iron Pipe shall be cement mortar lined in accordance with the current ANSI Standard A21.51.
 3. **Storm Lateral Connections.**
 - A. **Concrete Pipe.** Lateral connections to concrete sewer pipe shall be per [Detail S-20](#) for sewers 12 inches or less.
 - B. **Flexible Connections for Concrete Pipe greater than 12 inches.** ([SPI 4.1.B](#))
 - (1) Rubber sleeve lateral connection shall conform to ASTM F477.
 - C. **Ductile Iron Pipe.** Lateral connections to ductile iron sewer pipe shall be made with manufactured ductile iron fittings.

4. **Storm Sewer Joints.** Joints for Sewer, Sewer Laterals and Catch Basin Connections shall conform to the following specifications.
 - A. **Concrete Pipe.** Joints for concrete Storm Sewer Pipe of 12-inch diameter and larger shall be of the round rubber gasket type, or Glipp Type, using a modified bell and spigot design. The spigot shall have an external groove accurately sized to receive the gasket, so that when the pipe is laid and the joint completed, the gasket shall be enclosed on all surfaces. Joints and gaskets shall conform to the current ASTM Specifications C443 except the taper on the conic surfaces of the inside of the bell and the outer surface of the spigot shall not be more than 2 degrees with respect to the longitudinal axis of the pipe. The durometer hardness of rubber gaskets shall be 45, plus or minus 5, and the gaskets shall have a circular cross section or be the Glipp Type. The Contractor shall furnish to the Engineer a detailed drawing showing the pipe and joint proposed to be furnished under these specifications.
 - B. **PVC Truss Pipe and PVC Solid-Wall Pipe.** Joints shall be chemically welded or shall be of the elastomeric gasket seal type as specified in the current ASTM Specification D3212. Care shall be taken to ensure that all joints are pushed to the full "home" position and held tightly in the "home" position during any grade or line adjustments. If solvent is used, pipe shall be rotated during joint insertion to ensure a complete spread of joining cement. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers and adhesives shall be used as recommended by the pipe manufacturer. Installations of solvent weld joint pipe shall be installed in accordance with current ASTM specification F402, and all required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe. Swab-type applicators shall be used to apply primer and cement. Opened containers in the trench shall be protected from dirt, water and other contaminants.
 - C. **Ductile Iron Pipe.** Joints shall be push-on type coupled in accordance with ANSI/AWWA C111/A21.11.
 - D. **Mortar Joints for Storm Sewers.** - Only when specifically shown on the Drawings, listed in the Bid Form, or approved by the Engineer, pipe joints on storm sewers can be made with mortar in lieu of the resilient rubber gasketed joint specified.
 - (1) Mortar joints shall be made as follows: After each section of pipe is laid, the lower portion of the bell shall be filled with mortar and the succeeding section shall be laid in place so that the inner surfaces of the abutting sections are flush. The remainder of the joint shall then be filled with mortar and sufficient additional mortar used to form a bead around the joint, which shall be flush with the outside diameter of the bell. The inside of the joint shall be wiped clean and smooth. The joints of concrete pipe shall be thoroughly wet before the mortar is placed. The use of a bituminous or similar type mastic will not be permitted.
5. **Pipe Test Certification.** Pipe Test Certification shall be as specified under [Section 4.1](#).
6. **Cement, Mortar.** Cement and mortar used for the work under this Section shall be as specified under [Section 6.1](#).

c. **Construction.** In accordance with [Section 4.1.c](#).

d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, excavation, trenching, cofferdams, dewatering, cut-ins, furnishing and placing the storm sewer pipe, fittings and plugs, bedding, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be

as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.2.001	Storm Sewer, C76 CI __, __ inch.....	Foot
4.2.002	Storm Sewer, DI CI __, __ inch	Foot
4.2.003	Tee on __ inch Storm Sewer, __ inch	Each
4.2.004	Basin Connection, C76 CI __, __ inch	Foot
4.2.005	Basin Connection, DI CI __, __ inch	Foot
4.2.006	Storm Sewer Lateral, C76 CI __, __ inch	Foot
4.2.007	Storm Sewer Lateral, DI CI __, __ inch	Foot
4.2.008	Storm Sewer Lateral, D2680, __ inch	Foot
4.2.009	Storm Sewer Lateral, SDR __, __ inch	Foot
4.2.010	Maintain Storm Sewer Serv	Lump Sum
4.2.011	Core and Boot __ inch Storm Sewer into Sewer or Mh	Each
4.2.012	Core and Seal __ inch Storm Sewer into Sewer or Mh	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
4.2.101	Underdrain, Subbase, __ inch	Foot

1. Storm Sewers of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe, without reductions in length for manholes or other structures.
2. Storm Sewer Laterals of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe from the center of the main line sewer to the other end of the pipe.
3. Tees and Wyes shall be measured as units furnished. Payment for laying tees or wyes shall be included in the price for furnishing and laying the storm sewer.
4. Basin Connections of the size(s) shown in the Bid Form shall be measured in lineal feet along the centerline of the pipe from the center of the manhole or receiving sewer to the center of the catch basin.
5. **Maintain Storm Sewer Serv** shall be payment in full for furnishing all labor, equipment, and material and all other work required for a complete job. The City will pay the Contractor for **Maintain Storm Sewer Serv** in accordance with payment schedule for Mobilization. When **Maintain Storm Sewer Serv** is not included in the bid form or call for on the Drawings, maintaining storm sewer service shall be considered included in the other contract Pay Items.
6. **Video Sewer** and **Video Private Property Sewer Lateral** shall be measured and paid in accordance with [Section 4.1](#).

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DIVISION 4 - UTILITIES

SECTION 4.3

WATER MAINS

a. Description.

1. The work shall consist of constructing ductile iron water mains and prestressed concrete water main of specified sized and appurtenances up to and including 24 inches in diameter as specified in the Bid Form and as shown on the Drawings, including the furnishing of all labor, equipment, and materials. The placement of water mains, water service connections, and appurtenances shall also include the excavation and backfilling of the trench as necessary.
2. All reference to American Water Works Association (ANSI/AWWA) standards and National Sanitation Foundation (NSF) shall be to the latest revision thereof.
3. All internal plumbing required to reconnect water services shall be in accordance with the current Michigan Plumbing Code.

b. Materials. Provide materials in accordance with the following specifications. Products shall be in accordance with part [4.3 of the Specified Products Index \(SPI\)](#).

1. General.

- A. The Contractor will furnish certification by the Manufacturer stating that the pipe, specials, valves, hydrants or other materials as required by the Engineer conform to the required specifications.
- B. In addition, all valves and hydrants are to be tagged or stamped by the Manufacturer stating that they conform to the Standard Specifications. The tag or stamp shall be permanently attached to valves and the barrel of hydrants.
- C. All water system components shall be new, ANSI/NSF 61 and ANSI/NSF 372 certified.
- D. All stainless-steel materials used in this Section shall conform to ASTM F593 or F594.
- E. All Ductile Iron pipe and fittings shall be made in the U.S.A.
2. **Ductile Iron Pipe.** [\(SPI 4.3.A\)](#) Ductile iron pipe shall meet or surpass ANSI/AWWA C151/A21.51 and be in accordance with the specifications noted herein. All pipe shall be centrifugally cast. Also, all pipe shall be lined with cement mortar on the inside in accordance with ANSI/AWWA C104/A21.4.
 - A. The raw material for ductile iron shall have an average minimum recycled content consisting of 90% scrap iron and steel.
 - B. Unless otherwise specified, the pipe joints will be push-on type coupled in accordance with ANSI/AWWA C111/A21.11.
 - C. Unless otherwise specified, all pipe shall be Class 53.
 - (1) Within the Downtown area (DGRI limit) all pipe shall be Class 56.
 - D. The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2001-06-01.
 - E. When indicated on the Drawings or required by the Engineer the Contractor shall use specialty rubber gaskets. Specialty gaskets include, but are not limited to Nitrile (NBR) gaskets, Viton Fluorel (FKM) gaskets, etc. These gaskets shall be supplied by the pipe manufacturer.

Ductile Iron Restrained Joint Pipe. [\(SPI 4.3.A\)](#) All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system installed.

Ductile Iron Fittings. [\(SPI 4.3.A\)](#) All fittings shall be ductile iron in accordance with ANSI/AWWA C153/A21.53 and with a minimum pressure rating of 350 P.S.I.

- F. Nominal thickness of ductile fittings shall be equal to Class 53 Ductile Iron Pipe Thickness. Fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4 and shall have mechanical joints in accordance with ANSI/AWWA C110.
3. **Concrete Water Pipe.** Concrete water pipe shall be in accordance with ANSI/AWWA C301 with a working pressure of 175 PSI.
 4. **Mechanical Joint Anchoring Fittings for Hydrants.** [\(SPI 4.3.B\)](#) Mechanical joint anchoring fittings may be furnished as an alternate to restrained joint pipe as noted in this Section.
 5. **Joint Restraining Glands.** [\(SPI 4.3.C\)](#) Joint restraining glands for mechanical joint pipe, fittings and valves. Restraining glands shall not be used for joint restraint on plain end fittings.
 6. **Joint Restraining Gaskets.** [\(SPI 4.3.D\)](#) Joint restraining gaskets shall be supplied by the pipe manufacturer and are acceptable for push-on joint pipe up to 16 inches. Restraining gaskets shall not be used for joint restraint on fittings.
 7. **Tie Rods, Clamps, Nuts, Eye-Bolts and Appurtenances.** All tie rods and nuts furnished as an alternative to restrained joint pipe as noted in this Section shall be stainless steel, ASTM F593 and F594. 3/4 inch Diameter eye-bolts and nuts required and as shown in the Standard Details will be corten steel or stainless steel. Clamps and other appurtenances which are not ductile iron, cast iron or stainless steel, shall be coated as specified herein.
 - A. Use tie rod restraint only as approved by the Engineer.
 8. **Gate Valves and Tapping Valves.** [\(SPI 4.3.E\)](#) This specification covers cast or ductile iron body, bronze mounted gate valves for use in the water distribution system in sizes from 4 inches through 12 inches nominal diameter designed for direct bury and operated through a standard valve box.
 - A. Valves are to be furnished in accordance with ANSI/AWWA C515 and in accordance with the following supplementary specifications:
 - (1) These valves are for ordinary water distribution system service in approximately level setting on buried pipelines. Unless otherwise noted on the Drawings, these valves shall be the same nominal size as the water main. They will be double disc gate valves with non-rising stems.
 - (2) An electronic copy (PDF or approved equal) of certified shop drawings shall be furnished as requested by the Engineer for each valve size and type including all repair parts ordering data.
 - (3) The valve shall have mechanical or restrained joint ends in accordance with ANSI/AWWA C515. Valves with mechanical joint ends will be furnished with accessories, including glands, gaskets, and corten steel or stainless-steel tee-head bolts and nuts.
 - (4) The valves will be installed vertically in a horizontal line.
 - (5) The stems shall be made of Grade D or E bronze as listed in ANSI/AWWA C515.
 - (6) The stuffing box shall be the O-ring type as listed in ANSI/AWWA C515.
 - (7) Gland bolts shall be of Class B, C, D, or E bronze, corten steel, or stainless steel as listed in ANSI/AWWA C515.
 - (8) All valves shall rotate clockwise to open, wrench nut to be painted red, and be 1-15/16 inches square at the top, 2 inches square at the base and 1-3/4 inches high. The nut or cap screw for the wrench nut shall be bronze or stainless steel per ASTM F593 and F594.
 - (9) Bonnet bolts shall be rust-proofed by cadmium or zinc coating.

- (10) The minimum number of turns to operate the valve from fully open to fully closed shall be in accordance with ANSI/AWWA C515 using stems with single lead threads:

Table 4.3-1 Gate Valve Turns	
Size (in)	Minimum Number of Full Turns
4	12
6	18
8	24
12	36

9. **Butterfly Valves.** (SPI 4.3.F) This specification covers tight shut off butterfly valves for water system distribution valves, 16 inches through 24 inches, and shall be designed for placement in valve chamber unless otherwise call for and approved by the Engineer.
- A. Valves shall be Class 150B and have mechanical or restrained joint ends in accordance with ANSI/AWWA C110. Valves furnished under this specification shall conform to ANSI/AWWA C504, except as herein modified. Unless otherwise noted on the Drawings, these valves shall be the same nominal size as the water main
- (1) An electronic copy (PDF or approved equal) of certified shop drawings shall be furnished as requested by the Engineer for each valve size and type including all repair parts ordering data.
 - (2) Valves will be furnished with corten steel or stainless-steel nuts and bolts.
 - (3) Manual operators shall be of the traveling nut slotted lever or link-lever type, sealed and gasketed, and lubricated to withstand submersion in water.
 - (4) The minimum number of turns to operate the manual valve from fully open to fully closed shall be the same as for gate valves using a single-lead stem in accordance with ANSI/AWWA C515.
 - (5) The operator or wrench nut shall be painted red and 1-15/16 inches square at the top, 2 inches square at the base and 1-3/4 inches high.
 - (6) The operator shall rotate clockwise to open and shall have the input shaft vertical.
 - (7) The body of the valve will be of the short pattern design unless specified otherwise.
 - (8) The maximum non-shock shutoff pressure rating shall be 150 P.S.I.
 - (9) Shaft seals shall be of the O-ring type and replaceable without removing the valve from service.
10. **Compression Type Fire Hydrants.** (SPI 4.3.G)
- A. Compression type fire hydrants shall be in strict conformity with the ANSI/AWWA C502 and the following specifications:
- (1) An electronic copy (PDF or approved equal) Certified shop drawings shall be furnished as requested by the Engineer for each hydrant including all repair parts ordering data.

- (2) The main valve stem operating and supporting mechanism shall not restrict the flow of water through the nozzles. Loss of head due to friction, within the hydrant, corrected for inlet and outlet velocity head, shall not exceed the maximum permissible head loss as given in the following table:

Table 4.3-2 Compression Type Fire Hydrants			
Number of Outlet (nozzles)	Nominal Diam. of Outlet Nozzles (in)	Total Flow from Outlet Nozzles (gpm)	Max. Permissible Head Loss (psi)
1	2-1/2	250	1.0
2	2-1/2	500*	2.0
1	4	1000	5.0
* 250 gpm approximately, from each outlet nozzle.			

- (3) If the operating mechanism is under the main valve, it shall be bronze to bronze mounted. The hydrant top shall be of the dry type bonnet design (free-draining) and contain no oil.
- (4) The hydrant valve shall be compression type and 5-1/4 inches in diameter.
- (5) The inlet at the hydrant butt shall be mechanical joint ANSI A21.11 standard 6-inch.
- (6) The delivery or head of the hydrant shall have two 2-1/2 inch and one 4 inch National Standard hose coupling male screw thread outlets with caps.
- (7) The hydrant shall have a bury length of 6 feet from the invert of the connecting pipe to the ground line. The distance from the center line of the connecting pipe to the center line of the outlet nozzles shall not be less than 7 feet 6 inches.
- (8) Each nozzle cap shall have a suitable rubber or synthetic rubber gasket and chains with **S hooks** attached to the barrel.
- (9) The hydrant shall be opened by turning the operating nut clockwise. A clearly visible arrow and the word **OPEN** shall be cast in relief on the top of the hydrant to designate the direction of opening.
- (10) The hydrant shall be painted with a zinc chromate primer and finish coat of paint above grade and with two coats of asphalt varnish below grade. Painting shall be in strict accordance with ANSI/AWWA C502.
- (a) Shop painted in accordance with NSF/ANSI Standard 61.
- (11) The hydrant operating nut and nozzle caps shall have a 1-3/4 inch square portion 1 inch high.
- (12) O-ring seals shall be installed in the hydrant top. Stuffing box seals may not be used.
- (13) The hydrant shall be capable of withstanding a minimum of 200 foot-pounds of torque in both the opening and closing directions without causing permanent deformation of metal parts.
- (14) Barrel and stem extensions shall be made at or above the ground line and without digging.
- (15) The hydrant mechanism shall be so designed that the valve may be easily removed and the valve seat, if required to be removed, shall have bronze to bronze mounting for easy removal.
- (16) Outlet nozzles shall be threaded into the barrel and pinned.
- (17) The hydrant shall be supplied with a tapped drain. The drain shall be plugged.
- (18) The Contractor will be required to present an affidavit from the Fire Underwriter Laboratory that the maximum permissible loss of head is not exceeded if requested by the Engineer.

11. **Copper Water Service Pipe.**
 - A. Copper water service pipe 2 inches and smaller in diameter shall be Type K, annealed seamless soft copper tubing in accordance with the current ASTM Specifications.
12. **Copper to Copper Connections.** ([SPI 4.3.H](#)) Connections shall be as per ANSI/AWWA C800 and certified to NSF 61.
13. **Tapping Saddles.** ([SPI 4.3.I](#)) Threads shall be as per ANSI/AWWA C800 (Standard Mueller Thread).
 - A. 1-1/2 inch and 2 inch taps require saddles on 4 inch through 16 inch water mains.
 - B. Direct Taps shall be allowed in non-buried applications such as valve chambers.
14. **Smith-Type Tapping Sleeves.** ([SPI 4.3.J](#)) Smith-type tapping sleeves are to be all stainless-steel sleeves with stainless steel flange.
15. **Corporation Stops.** ([SPI 4.3.K](#)) Threads shall be as per ANSI/AWWA C800 (Standard Mueller Thread).
16. **Curb Stops.** ([SPI 4.3.L](#)) Connections shall be as per ANSI/AWWA C800 and certified to NSF 61.
17. **Curb Boxes.** ([SPI 4.3.M](#)) Connections shall be as per ANSI/AWWA C800 and certified to NSF 61.
 - A. **Curb Box Lock.** ([SPI 4.3.M](#))
18. **Valve Boxes.** ([SPI 4.3.N](#)) Produced with Class 35 cast iron in accordance with and meeting all applicable terms and provisions of ASTM A48.
19. **Rust Preventive Coating.** ([SPI 4.3.P](#)) Fittings, clamps, bolts, nuts, appurtenances, etc., which are not ductile iron, cast iron, stainless steel or corten steel, and are buried in the ground shall be coated with a modified polyamine epoxy in accordance with ANSI/AWWA C210.
 - A. The application of the material shall be according to the specifications or instructions of the Manufacturer.
 - B. The cost of furnishing and applying such material shall be included in the unit price bid for water main of the sizes shown.
 - C. Existing steel water main encountered during construction shall be coated with a coal tar protective coating in accordance with ANSI/AWWA C203.
20. **Polyethylene Encasement.** Polyethylene encasement for use with ductile iron pipe shall meet all the requirements for ANSI/AWWA C105/A21.5.
 - A. In addition, polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils.
 - B. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

c. Construction.

1. **Excavation.** Excavation shall be done in accordance with [Section 2.5](#) and the following conditions:
 - A. **Alignment.** Alignment of the trench shall be as shown on the Drawings unless otherwise required by the Engineer.
 - B. **Depth.** Depth of the water main shall be 5 feet 9 inches from grade to center line of pipe or have a minimum 5 feet of cover to the top of the pipe, unless otherwise specified on the Drawings or required by the Engineer.
 - (1) All water main placed with cover between 4 feet (but not less) and 5 feet shall be covered with 2-inch extruded polystyrene foam insulation board per [Detail W-16](#).
2. **Horizontal and Vertical Changes.** The data shown on the Drawings is indicative of adjacent and/or interfering structures and features but is not guaranteed to be complete or exact in location and detail. Small adjustments can be made by deflecting joints as per manufacturers recommendation and not exceeding Table 4.3-3 and Table 4.3-4 as follows.

Table 4.3-3 Maximum Deflection Full Length Pipe - Mechanical Joint Pipe					
Diameter of Pipe (in)	Deflection Angle (degrees-min)	Maximum Deflection (in)		Approx. Radius of Curve Produced by Succession of Joints (ft)	
		18 ft Length	20 ft Length	18 ft Length	20 ft Length
4	8-18	31	35	125	140
6	8-07	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	13-1/2	15	285	320
16	3-35	13-1/2	15	285	320
18	3-00	11	12	340	380
20	3-00	11	12	340	380
24	2-23	9	10	450	500

Table 4.3-4 Maximum Deflection Full Length Pipe – Push-On Joint Pipe					
Diameter of Pipe (in)	Deflection Angle (degrees)	Maximum Deflection (in)		Approx. Radius of Curve Produced by Succession of Joints (ft)	
		18 ft Length	20 ft Length	18 ft Length	20 ft Length
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

- A. The Contractor shall do the work in the locations shown on the Drawings, with minor adjustments allowable if approved by the Engineer. Deflections in pipes and fittings shall be made with sufficient number of joints being deflected to allow for clearance of underground structures. The maximum deflection permissible shall be limited to that allowed in the deflection tables.

(1) For approved vertical changes the depth from centerline of main to grade shall not exceed 8 feet and the minimum distance from top of pipe to ground line is 5 feet

provided said vertical change can be accomplished within 40 linear feet each side of the conflicting utility. Shallow crossings shall be in accordance with [Detail W-16](#).

(2) For approved horizontal changes the separation of the edge of main to edge of structure or vertical foundation shall not be less than 5 feet.

(3) When using concrete pipe or restrained joint pipe, laying schedules will be required and followed unless adjustments are approved by the Engineer.

3. **Interruption of Water Service.** All water main shutdowns and tie-ins shall be coordinated and scheduled in a manner that carefully and considerably assures the minimum inconvenience of business and property owners. Interruption of service during business hours, except in emergency situations, will not be allowed. It is anticipated that the Contractor may be required to complete tie-ins at night and/or weekends, including Sundays.
 - A. Prior to any water main construction, the Contractor shall arrange a meeting with representatives from City Engineering and Grand Rapids Water System to discuss the coordination and scheduling of proposed water main construction. At this time, the Contractor shall request that the Grand Rapids Water System exercise (operate) all existing valves that will be required to complete any proposed shutdown.
 - B. Prior to a water main shutdown and/or tie-in, the Contractor shall schedule a meeting with City Engineering and Grand Rapids Water System to review shutdown procedures and sequencing. Such meetings shall occur at least seven days in advance of proposed shutdown or tie-in. In addition, the Contractor and a representative of the City shall notify impacted business and property owners at least 24 hours prior to a proposed shutdown. Interruption of service shall not exceed 8 hours in duration. It is expected that tie-ins will have to be made at night and on weekends to facilitate business operations of property owners.
 - C. In advance of a shutdown, the Contractor shall expose the existing water main to be impacted by the tie-in and determine if any unusual or unexpected conditions exist. The Grand Rapids Water System will shut down the main once the tie-in location has been exposed and, all necessary materials, labor, and parts are on hand to successfully complete the tie-in in a timely manner.
 - D. The shutdown of all water mains shall be coordinated with the Grand Rapids Water System. The Contractor is to coordinate the timing of the shutdowns with the Water Department. When directed by the City the Contractor shall also coordinate shutdowns with affected properties. The Contractor shall not operate any valve on any water main in service, except in case of emergency. In such emergency, the Contractor shall, with the approval of the Engineer, operate such valves consistent with normal valve operating procedures in order to relieve the emergency. The Contractor shall immediately notify the Fire Department, Grand Rapids Water System and consumers affected regarding the time and probable duration of each shut-off.
 - E. For cases in which the Grand Rapids Water System personnel operate the valves, the Contractor shall notify the Fire Department, Grand Rapids Water System and consumers affected at least one day in advance of the shut-off. The Grand Rapids Water System will then open and close valves on mains in service where necessary, in conjunction with the Contractor's work, subject to such limitation as to time and place as requirements of the Grand Rapids Water System shall impose.
 - F. Temporary Water Services placed in cases of a lead service line break or other emergency shall only be utilized for a maximum of 48 hours, unless otherwise approved by the Engineer. Place new permanent service within that time.
4. **Continuity of Service for Reconstructing an Existing Water Main.** Where the Contractor is replacing an existing water main, it shall be the Contractor's responsibility to schedule their work in such a manner so as to ensure that the time period during which water service is shut down is kept to a minimum. To this end, the Contractor shall construct the new water main while the existing water main remains in service. The following general procedure shall be employed to ensure minimum service interruptions:
 - A. The Contractor shall lay the entire new water main.
 - B. The new water main shall be tested and chlorinated.

- C. After the testing and chlorination has been approved, the Contractor shall connect one end of the new water main to the water system and plug the open end of the existing water main that is to be abandoned.
 - D. While the Contractor is proceeding with the reconnection of existing water services, both the old and the new water mains shall be in service. Each water main being connected to the water system at one end only.
 - E. Upon completion of the water service reconnections, the Contractor shall then remove the temporary plug from the **dead end** of the new water main and connect that end of the main to the water system to complete the loop and thereby disconnect permanently the old water main from the water system.
 - F. All work necessary to maintain service as described above shall be coordinated with the Engineer and the Grand Rapids Water System and shall be considered as included in other items of the contract.
5. **Pipe Installation.**
- A. **Handling.** Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and expedient completion of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench by means of derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
 - B. **Grade.** The Contractor shall always check the lines and grades of the pipe as constructed from the stakes furnished by the Engineer. Any variation therefrom shall be corrected as approved by the Engineer before continuing with the work.
 - C. **Pipe Kept Clean.** All dirt or other foreign material shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.
 - (1) Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at any time.
 - D. **Cutting Pipe.** The Contractor shall cut the pipe in a neat, straight and uniform manner wherever necessary for placing valves, hydrants, special castings, or closure pieces without damage to the pipe and without extra cost to the City. The area adjacent to cuts made on pipe shall be beveled before assembly of the joint.
 - (1) The method of cutting pipe shall be subject to the approval of the Engineer.
 - E. **Bell Ends to Face Direction of Laying.** Unless otherwise approved, pipe shall be laid with bell ends facing the direction of laying; and for lines on an appreciable slope, bells shall, at the direction of the Engineer - face up-grade.
 - F. **Railroad Crossing.** Whenever the line of the pipe shall cross any railroad or lie within the railroad right-of-way, all of the precautionary construction measures required by the railroad officials shall be followed by the Contractor.
 - G. **Spacers in Ductile/Cast Iron Sleeves.** In connecting ductile/cast iron pipe together with a ductile/cast iron sleeve, the space between the adjoining ductile/cast iron pipes shall not exceed 1 inch. Where the space between adjoining ductile/cast iron pipe exceeds 1 inch, a spacer shall be placed to fill the space. The spacer shall be a piece of ductile iron pipe of the same diameter and class as the adjoining pipes and shall be cut straight and uniform and be free of defects and damage.
 - H. **Zinc coating.** Repair scratches in the zinc greater than 1/8 inch in width, by field application of zinc paint, in accordance with ISO 8179, except when the pipe is to be encased in polyethylene encasement.
 - I. **In Casing Pipe.** Water main placed in casing pipe shall be restrained for the full length of the casing.
6. **Assembling Mechanical Joint Pipe.**
- A. **Preparation of Pipe Ends.** The last exterior 8 inch of the plain end and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), or any other foreign matter and then painted with a non-toxic, tasteless, odorless vegetable soap product recommended and/or supplied by the Manufacturer. The retaining gland shall then be slipped on the plain end of the pipe with the lip extension of

the gland toward the bell end of the pipe to be joined. The rubber gasket shall be cleaned and painted with the vegetable soap product and placed on the plain end with the thick edge toward the gland.

- B. **Alignment of Pipe in Bell.** The plain end shall be centered in the bell, the pipe forced **home**, and brought into alignment; it shall be secured there with sand carefully tamped under and around it, excepting at the bell holes. Care shall be taken to prevent dirt from entering into the joint space.
- C. **Bolting of Joint.** The entire section of the pipe shall be pushed forward to seat the plain end in the bell. The gasket shall then be pressed into place within the bell, being careful to have the gasket evenly located around the entire joint. The retaining gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a torque limit wrench. The torque limits for various sizes of bolts shall be as follows:

Table 4.3-5 Torque Limits	
Size (in)	Range of Torque (ft-lbs)
5/8	45 - 60
3/4	75 - 90
1	100 - 120
1-1/4	120 - 150

- D. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this cycle until all bolts are within the above range of torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation practice is not allowed.
7. **Assembling Push-On Joint Pipe.**
- A. **Preparation of Pipe Ends.** After the pipe is lowered in the trench and positioned for jointing, the inside of the bell and the outside of the plain end of the jointing pipe must be wiped clean to the guideline stripe. The gasket is then inserted in the groove in the bell by flexing so that it is in the proper position. A liberal coating of the vegetable soap product, as specified in this Section, shall be applied to the outside of the plain end from the plain end to the guideline.
 - (1) The condition of the trench bottom must be such that correct position and location of the pipe results in a joint of maximum tightness and a permanent seal is assured.
 - B. **Restrained Joint Pipe.** Restrained joint pipe will be assembled in the same manner as push-on joint pipe and as outlined in the Manufacturer's recommendations.
 - C. **Permissible Deflection of Joints.** Permissible deflection of joints in push-on joint pipe shall be in accordance with [Table 4.3-4](#). Permissible deflection for restrained joint pipe shall be in accordance with the Manufacturer's recommendation.
8. **Jointing Concrete Water Pipe.**
- A. **Preparation of Pipe Ends.** The joint rings and rubber gasket shall be cleaned and liberally lubricated with an approved type of vegetable oil soap.
 - B. **Alignment of Pipe in Bell.** The plain end, with the gasket placed in the groove, shall be centered into the bell of the pipe already laid, making sure that both pipes are properly aligned. The pipe is then forced **home**. After the plain end ring is well centered into the joint ring, so that the gasket shall be fully compressed and brought to its final shape, and

just before the pipe is brought fully home, each gasket shall be carefully checked with a suitable feeler gauge supplied by the pipe manufacturer for being in proper position around the full circumference of the joint. If the gasket is found not to be in proper position, the pipes shall be separated, and the damaged gasket replaced.

- C. **Pouring Cement Grout in Diaper.** When the pipe has been joined, a band of 5.5 inches wide minimum shall be placed around the outside of the pipe at the joint as recommended and available from the pipe manufacturer. The band shall serve as a form for placing a 1:2 cement mortar grout in the external recess formed by the face of the bell and the shoulder of the plain end.
 - (1) The cement mortar grout materials and preparation shall meet the requirements of ANSI/AWWA C301.
 - (2) If a reinforced paper joint band is used, it shall be drawn up tight around the pipe and the backfill tamped against it up to the spring line before pouring the grout. If a cloth band is used, it shall be wired around the outside of the pipe and the grout poured before backfilling. On pipes of 24 inch diameter or larger, the joint space remaining on the inside of the pipe shall be filled with a stiff mix of 1:2 cement mortar which shall be troweled in place so as to produce a continuous smooth flush surface across the joint.
 - D. **Permissible Deflection in Joints of Concrete Water Pipe.** Wherever necessary to deflect pipe from a straight line, either in a vertical or horizontal plane, to avoid obstructions, to plumb stems, or for any other reason, the degree of deflection shall be such so that the joint opening in the inside of the pipe shall not exceed 3/8 inch or the allowance as recommended by the pipe Manufacturer, whichever is the least.
9. **Polyethylene Encasement.** Where indicated on the Drawings or required by the Engineer, all buried ductile iron pipe, including all straight pipe, bends, tees, adapters, closure pieces, and other fittings or specials, and all valves, shall be provided with at least one wrap of polyethylene encasement. The use of plastic wrap does not preclude the need for the rust preventive coating as referenced in this Section.
- A. Locations where ductile iron pipe shall be double wrapped with polyethylene encasement are indicated on the drawings.
 - B. Polyethylene tube protection shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5. Method A. Preparation of the pipe shall include, but shall not be limited to, removal of lumps of clay, mud, cinders, etc., prior to installation. Also in accordance with all recommendations and practices of the AWWA M41, Manual of Water Supply Practices – Ductile Iron Pipe and Fittings, Specifically, the wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe and any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.
 - C. Where ductile iron pipe is also embedded or encased in concrete, the polyethylene tube shall be installed over the pipe for 5 feet either side of each end of the concrete encasement.
 - D. All installations shall be carried out by personnel trained and equipped to meet these various requirements.
 - E. The terms **polyethylene tube protection** and **polyethylene encasement** are interchangeable and shall have the same meaning.
10. **Setting Valves, Valve Boxes and Specials.**
- A. **General.** Valves and specials shall be set and jointed to new pipe in the manner heretofore specified for cleaning, laying and jointing pipe. All valves and specials shall be anchored in accordance with this Section.
 - B. **Valve Boxes.** Valve boxes shall be firmly supported and maintained plumb over the operating nut of the valve, with box cover flush with the grade line or at such level as may be directed. All other valves, as may be designated on the Drawings, shall be set in valve chambers with the operating nuts readily accessible for operation through the valve chamber opening or through a valve box top section let into the chamber top centered over the operating nut.

- C. **Valve Chambers.** Valve chambers when shown on the Drawings or called for in the Bid Form or Special Provisions shall be constructed in accordance with the Drawings or the applicable Standard Details and shall conform to the requirements of [Section 4.6](#).
11. **Setting Hydrants.**
- A. **Location.** Hydrants shall be set at the locations shown on the Drawings or as approved by the Engineer. All hydrants set within the street right of way shall have their grade line mark located 6 inches above the proposed centerline grade. All hydrants not located within a street right of way shall have their grade line mark set at the grade line shown on the Drawings, in the specifications or as in the applicable Standard Detail.
- (1) All necessary hydrant extensions shall be furnished and placed by the Contractor. When hydrant extensions are required because the water main is deeper than the standard as shown on the Drawings, or as required by the Engineer, or if the grade at the hydrant location is substantially different from the grade above the water main, then hydrant extensions shall be paid for separately. If a hydrant extension is required for any other reasons, it shall be provided by the Contractor at no additional cost as part of the work of installing the hydrant. All extensions shall be painted as noted in this Section.
- B. **Position of Nozzles.** All hydrants shall stand plumb and shall have their hose or 2.5 inch nozzles parallel with the curb, with the pumper nozzle pointing normal to the curb. The 4 inch nozzle shall be a minimum of 18 inches and a maximum of 24 inches above the finish grade.
- C. **Anchorage for Hydrants, Hydrant Valves, and Hydrant Laterals.** Each hydrant will be restrained to the hydrant lateral valve and the valve shall be restrained to the water main or tee with restrained joint pipe, mechanical joint anchoring fittings or stainless-steel tie rods as specified in this Section. Thrust blocks will not be used for restraint on hydrants or hydrant laterals. The entire hydrant lateral shall be restrained as provided for herein.
- D. **Pumping Hydrant.** All fire hydrants shall be pumped completely dry when the water main is placed in service.
12. **Laying Water Services.** Unless otherwise approved by the Engineer, place water services perpendicular to the water main, and place the curb stop a minimum 3 feet from the back of curb, generally in the middle of parkway. No water service should be within 7 feet of a tree in the right of way.
- A. **Curb Box Locks.**
- (1) For 1 inch and 3/4 inch curb stops and curb boxes installation place curb box lock on prepared subbase under the curb stop. If the anti-twist ring fits over the key of the curb stop then push the ring onto the curb box lock until it locks into place. If the curb stop has a cone shape design, place the larger end of the valve body in the larger side of the curb box lock.
- (2) When installing the curb box lock on soft or unstable ground the lock shall be secured to a larger base such as a block or brick. Screw curb box lock down onto a larger base with anchoring screws.
- B. For curb stops larger than 1 inch, the curb stop shall be installed on an approved block or brick support so that the valve can be operated normally after backfilling.
- C. The service shall be sealed shut by using a copper to copper connection or cast iron or ductile iron plug.
- D. Curb Boxes shall be a minimum 5 feet from the water main and 5 feet from the right of way line, unless approved otherwise by the Engineer.
- E. Under no circumstances is the water service laid by the Contractor to extend closer than 3 feet to the structure to be served unless said last 3 feet is laid under the supervision of a licensed plumber in possession of a valid connection permit.
13. **Tapping for Water Services.** Taps 2 inch in diameter and less shall be made either by the City or the Contractor, but no taps shall be made until a permit has been issued, the water main has passed hydrostatic and bacteriological testing and approval has been granted by the Engineer. The corporation stop shall be installed using a tapping machine approved by the Engineer and shall be installed along the horizontal axis of the pipe. Acceptable tapping

machines are those manufactured by Hayes, Mueller, Ford, A.P. Smith or an approved equal. The flow arrow shall point away from the main.

- A. Prior to construction of the proposed water service, the Contractor and licensed plumber shall coordinate with the Engineer and the property owner to determine the location of the proposed service, new meter (if required) and construction schedule.
 - B. All taps over 2 inch in diameter shall be made by the City and charged to the Contractor with material (including the corporation stop, any necessary saddle or tapping sleeves, etc.) to be furnished by the Contractor. Taps 2 inch in diameter and less which are made by the City shall be similarly charged to the Contractor as noted above. All service tees installed as part of the water main construction shall have a permit issued before construction commences.
 - C. Place Corporation Stops along the horizontal axis of the water main. Do not place Corporation Stop within 3 feet of a water main joint or fitting, or within 3 feet of another corporation stop unless otherwise approved by the Engineer.
14. **Reconnect Existing __ inch Copper Water Serv.** This work consists of all that is necessary to reconnect existing copper water services to the new water main including all copper water pipe, connections, fittings, sand backfill, and all else necessary to reconnect the water service, complete, in accordance with the Drawings and applicable Standard Details. The tap will be paid for under a separate item.
- A. The Contractor shall be required to obtain tapping permits prior to commencement of such work; however, said permit will be issued at no charge to the Contractor. The taps including the corporation stop and collar shall be paid for separately. The curb stop shall also be replaced but will be paid for separately.
15. **Construction of Water Services outside the Right of Way.**
- A. **General Requirements.** The City will obtain agreements from individual property owners for the water service construction outside the right of way when in association with public project. For Development projects, the City will assist with agreements, but the agreements will be the responsibility of the Developer's Engineer.
 - (1) Prior to starting any work outside the right of way, the Contractor shall verify with the Engineer that the appropriate grading permits and agreements have been obtained from the property owner.
 - (2) Plumbing permits will be required for work performed inside and outside existing buildings. The Contractor shall secure all required permits and pay all associated fees. All plumbing work inside and within three feet of a building shall be performed by a licensed plumber in possession of a valid permit. The Contractor will coordinate with the City plumbing inspector and water department. A list of names, addresses, and telephone numbers will be made available to Contractor.
 - B. **Exploratory Investigation.** The Contractor shall establish necessary lane, shoulder and/or sidewalk closures required to perform work. Advance the exploratory excavation using vacuum boring excavation, hand digging, conventional machine excavation, or a combination thereof subject to approval of the Engineer. Allow the Engineer access to document the necessary information. If the technique used to advance the excavation is causing damage to the existing facilities, cease all work until an alternate method approved by the Engineer.
 - C. **Water Service Outside of the Right of Way.** Where shown on the Drawings, the Contractor shall construct water services outside the public right of way and re-connect them to the new or existing copper water service at the curb stop. Schedule the work for the services such that at no time will connections from any new copper service piping be made to existing lead services.
 - (1) Place water services perpendicular to the water main unless otherwise approved by the Engineer, and a minimum of 5 feet deep from finish grade using trenchless technology.
 - (a) **Trenchless Technology Submittals.** When required by the Engineer, the Contractor shall furnish document(s) supporting the directional drilling Contractor's qualifications and experience.

- (b) **Equipment and Expertise.** The Contractor shall have equipment and expertise, appropriate for horizontal directional drilling, horizontal boring or other Engineered approved trenchless installations. This includes the preparation and maintenance of the bore path using drilling fluids as appropriate for the geology of the soils. The Contractor shall also have experience in safety and dependability installing, in similar geology, similar size and length of piping involved.
 - (c) **Work Plan.** Prior to beginning work, the Contractor shall submit to the Engineer a work plan detailing the procedure and schedule to be used to execute the project. The Contractor shall also submit all proof of all required permits. The work plan shall include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems. Work plan shall be comprehensive, realistic and based on actual working conditions for this particular project. Plan shall document the thoughtful planning required to successfully complete the project.
- D. **Basement Penetration.** Core drill 3 inch maximum hole for 1 inch or 1.5 inch copper service. Coordinate hole sized for copper services over 1.5 inch with Engineer. Hole to be minimum of 5 feet below exterior finished grade. If basement wall is nonexistent or cannot be drilled, the copper may be fed into the house through the basement floor with tunneling equipment. Seal void between hole and copper with a rapid-setting, cement-based water-stop mortar in accordance with [SPI 4.3.O](#). Existing service lines may not be used for new connections, unless approved by Engineer.
- E. **Connection of New Service Line.**
 - (1) Connect new shut off valve, copper horn, and meter within 3 feet of basement wall, or as approved by the Engineer.
 - (2) Continue copper to existing house plumbing, match existing size, 1 inch minimum. Connect to maximum pipe size of system. Provide all copper and fittings necessary to make connection.
 - (3) Flush water system until water clears, check all new plumbing for leaks.
 - (4) Restore temporary removals or damages to the lawn, driveway, or building.
 - (5) Have homeowner sign a letter of acceptance of the Work, in a form approved by Engineer.
 - (6) The contractor shall not connect proposed copper water service back to an existing lead service for any reason. Temporary or otherwise, unless approved in writing by the Engineer.
- F. **Remote Meters.** If building does not have a basement, or an area where meter can be installed inside of the first floor, utilize a meter pit. Install City of Grand Rapids standard meter pit per Standard [Detail W-11](#) on private property in a location approved by the homeowner. Run new copper into the home and install a new shut off valve. Install new copper to the existing house plumbing. Install remote meter reader per City standard detail, or as approve by the Engineer. Flush water system until water clears, check all new plumbing for leaks. Restore temporary removals or damages to the lawn, driveway, or building.
 - (1) Saw cut existing supply line just inside basement wall and plug pipe with threaded or soldered cap.
 - (2) For trench excavation approved by the Engineer, the Contractor shall saw cut existing bituminous and concrete surfaces and shall carefully remove all paved areas inside and around all buildings affected by the project. The Contractor shall directional drill the proposed water services in all instances where removal and replacement of walls, trees, concrete stairs, porch structures and other appurtenances not on the bid form would be required.

- (3) Following the placement of the water service, the Contractor shall restore the area disturbed outside the ROW to match the conditions prior to construction of the service.

16. Anchorage of Bends, Valves, Tees and Plugs.

- A. **General Requirements.** On water main work, all bends, tees, plugs, reducers and other fittings shall be securely anchored. Anchorage can be accomplished through the use of the following methods: Joint Restraint, Thrust Blocks and Encasements. However, thrust blocks will only be permitted at such locations where the Drawings specifically indicate that they will be allowed, or as approved by the Engineer. When using concrete pipe or restrained joint pipe, laying schedules will be required and followed unless adjustments are approved by the Engineer.

- (1) The cost of providing anchorage and for all work in connection therewith and incidental thereto shall be included in the price bid for the water main and no extra payment will be made.
- (2) For concrete pipe, the restraining element shall be of the type recommended by the Manufacturer and approved by the Engineer. Welded type restrained joint water pipe shall be assembled according to the Manufacturer's recommendations.

- B. **Joint Restraint.** Refers to mechanical devices such as restrained joint pipe, joint restraining glands, joint restraining gaskets, mechanical joint anchoring fittings or stainless steel tie rods.

- (1) **Restrained joint pipe** and **restrained joints** for any necessary closure pieces at specials shall be as specified in this Section unless an alternate method is given prior approval by the Engineer.
- (2) **Joint restraining glands** shall be as specified in this Section and may be used as an alternative to restrained joint pipe on 24 inch diameter pipe and less. Approved joint restraining glands will be permitted on mechanical joint pipe, fittings, and valves. Also, for hydrants, hydrant laterals and hydrant valves. Restraining glands shall not be used on plain end fittings.
- (3) **Joint restraining gaskets** shall be as specified in this Section and may be used as an alternative to restrained joint pipe on 16 inch diameter pipe and less. Restraining gaskets shall not be used as restraint on fittings and valves.
- (4) **Mechanical joint anchoring fittings** shall be as specified in this Section and are approved for use for anchorage of hydrants, hydrant valves and hydrant laterals only.
- (5) **Stainless steel tie rods** shall be as specified in this Section. The number of rods to be provided is listed below in [Table 4.3-6](#). Tie rod restrained joints shall only be used when approved by the Engineer.

Table 4.3-6 Number of Rods Per Joints	
Pipe Diameter (in)	No. of Rods
6	2
8	2
10	4
12	6
16	8

- (6) When joints are to be restrained with mechanical devices as noted above, all joints shall be restrained for a minimum distance from the fitting as required in [Table 4.3-7](#).

Table 4.3-7 Pipe Restraint Length Required							
Pipe Diameter (in)	Tees, 90° Bends (ft)	45° Bends (ft)	22-1/2° Bends (ft)	11-1/4° Bends (ft)	Dead Ends (ft)	Reducers (one size) (ft)	** (ft)
4	19	8	4	2	21		
6	27	12	6	3	30	14	63
8	35	15	7	4	38	15	55
12	51	21	10	5	55	27	120
16	65	27	13	7	70	28	110
20	79	33	16	8	86	28	104
24	93	39	19	10	101	40	99
** If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary. The length of restrained pipe required as shown in this table is based on trench backfill being compacted to 95% of the maximum unit weight as measured by the modified Proctor, AASHTO T-180. If the pipe is to be wrapped in polyethylene, the length of restrained pipe required will be as shown on the Drawings or in the special provisions. Table does not consider polyethylene wrapped pipe.							

- (7) **Special fittings and anchoring requirements.** All joints lying within the above minimum distances from the fitting must be restrained as noted herein and as referenced in the applicable Standard Details.
- (a) **Tees.** Tees shall be restrained in the branch direction as required in [Table 4.3-7](#). Also, to augment the above, in the straight through direction, the minimum length of the first pipe on either side of the tee shall be 10 feet. In those cases where a valve is placed at the tee, the valve shall be restrained to the tee as noted below and the next pipe shall be a minimum length of 10 feet.
 - (b) **Plugs.** All dead ends on water mains shall be capped or plugged with standard plugs or caps. The water main, including the plug or cap, shall be restrained back from the plug or cap as required in [Table 4.3-7](#).
 - (c) **Bends.** Bends shall be restrained in both directions as required in [Table 4.3-7](#).
 - (d) **Valves.** Valves used in conjunction with restrained joint pipe shall be restrained in accordance with the recommendations of the manufacturer of the restrained joint pipe. All valves at crosses or tees will be restrained to the tee by use of restrained joint pipe or stainless-steel tie rods. Anchorage of hydrant valves is shown in the Standard Details.
- C. **Thrust Blocks.** Thrust blocks shall be allowed only at the specific locations shown on the Drawings, or as specifically approved by the Engineer. At such locations, all fittings which have not been restrained through the use of restrained joint pipe or stainless-steel tie rods shall be securely blocked against the trench bottom and walls through the use of concrete thrust blocks. Thrust blocks shall be formed as shown on Standard [Detail W-7](#) or as approved by the Engineer according to the laying conditions encountered.
- (1) Forms for thrust blocks shall be of industry standard materials (i.e., steel, plywood, wood etc.) as necessary to ensure they are constructed to the dimensions shown. The concrete shall be separated from the water main by a layer of polyethylene plastic sheeting or other approved wrap to ensure that there is no bonding between pipe and concrete.

- D. **Concrete Encasements.** For water main greater than 16 inches in diameter, joint restraint may include encasements and shall be as required on the Drawings, in the Special Specifications, or on the applicable Standard Details.
17. **Hydrostatic Testing, Chlorination and Bacteriological Testing.**
- A. **General Requirements.** All newly constructed water mains and water services 4 inches and greater in diameter must be hydrostatically tested, chlorinated, and bacteriologically tested. Hydrostatic testing and chlorination may be performed by the contractor or performed by the Grand Rapids Water System, at the Contractor's option. Bacteriological Testing will be performed by the Grand Rapids Water System personnel. The Contractor shall provide a minimum of 72 hours advance notice to the Grand Rapids Water System to either schedule the testing crews or to schedule the observation of the testing in the event the Contractor elects to perform the same.
- B. **Construction Coordination.** Follow all requirements of [c.3 Interruption of Water Service](#) of this Section, and as specified below.
- (1) Contractors are encouraged to give as much advance notice as possible, particularly during the busy portion of the construction season.
 - (2) The Contractor shall make every effort to schedule well in advance of the anticipated time for testing and chlorinating. The Contractor shall ensure that all trenches are open, that riser pipes are easily accessible without use of ladders and that provisions have been made for the removal of ground water so that testing and chlorinating can begin immediately upon arrival of Grand Rapids Water System personnel.
 - (3) The Contractor will supply all of the necessary plugs, caps and galvanized riser pipes with gate valves. The main plugs or caps placed at the end of the water main and/or the end of the stub services for future main extensions for testing, flushing, and chlorinating, shall have an opening extension or connection of not less than 2 inches in diameter, so that filling, flushing and chlorinating can take place at a sufficient velocity to clean the main and reduce the time required for these operations (2 to 3 times the volume of the pipe at 3.0 fps). The Contractor shall also provide a clean city water supply to within 50 lin. ft. of the test site as shown on the applicable Standard Detail. For larger water mains riser pipes and gate valves sizes shall be adjusted to meet the flushing requirements of AWWA C651.
 - (4) The water main must be flushed in accordance with AWWA C651 (3.0 fps min) to ensure the removal of all foreign material prior to testing. The Contractor shall provide restraints adequate for the testing pressures. Provisions for flushing the mains without damage to surrounding property shall be made in advance by the Contractor. Such flushing may include the use of a polyethylene swab or the injection of compressed air into the water main as approved by the Engineer. The Contractor shall be responsible for providing a suitable and approved means for discharge of flushing, testing and chlorinating water. This includes disposing of heavily chlorinated water.
 - (5) The Contractor shall maintain the equipment and set up for testing (riser pipes, gate valves, etc.) in good and workable condition and shall make all necessary repairs prior to testing and chlorination.
 - (6) The Contractor will protect all exposed piping from freezing during the winter construction season. In the event it becomes necessary to thaw frozen piping and/or valves, the Contractor shall be responsible for damages caused by either the Contractor or the Grand Rapids Water System while attempting to thaw said frozen piping and valves. The Grand Rapids Water System will attempt to notify the Contractor of any such damages of which it is aware.
- C. **Hydrostatic Tests.** The allowable leaking for new water mains shall be as outlined in Table 5A of AWWA Standard C600. If the Contractor elects to perform the hydrostatic testing, said testing will be observed by Grand Rapids Water System personnel using a water meter supplied by the Grand Rapids Water System. Existing valves as necessary to flush and fill the main may be operated by the Contractor as approved by the Engineer and the Grand Rapids Water System.

- (1) The length of water main to be tested shall be as approved by the Engineer. Large test sections will not proportionally increase the leakage allowance but will be rounded off to the next higher 100 joint increment. Only when permission from the Engineer has been received, shall a test be made against an existing valve. The new facility shall be tested separate from existing water mains unless a connection is approved by the Engineer and the Grand Rapids Water System.
- (a) **Test Pressure.** The test pressure shall be 160 PSI. The pipe shall be filled with water slowly, and all air pockets removed by bleeding off at hydrants or standpipes. All valves and hydrants and the pipe will be pressurized to the specified pressure by a pressure pump.
- (b) **Acceptance.** Acceptance shall be determined on the basis of allowable leakage. If any test discloses a leakage greater than that specified in the table, the Contractor will be required to locate and repair the defects until the leakage is within the specified allowance. In addition to the allowable leakage, the test pressure shall not vary by more than +/- 5 psi for the duration of the test.
- (c) Allowable leakage per 100 joint of pipeline in gallons per 2 hours will be as follows and based on a test pressure of 160 PSI:

Table 4.3-8 Allowable Hydrostatic Test Losses	
Pipe Diameter (in)	Allowable Loss (gallons per 2 hours per 100 joints)
4	0.6
6	0.9
8	1.2
10	1.5
12	1.8
16	2.4
24	3.5
30	4.6
36	5.5

- (d) The test shall be repeated as necessary to maintain the test pressure for two hours. In all cases, the pressure shall be restored to 160 pounds at the end of the two-hour period. The loss shall not exceed the allowance in the table for the size of pipe and number of joints.
- (2) **Defects, Cracks or Leakage.** Any defects, cracks or leakage that develop or may be discovered, either in the pipe or in the castings or due to the negligence of the Contractor, shall be promptly corrected by the Contractor at his/her expense to the satisfaction of the Engineer.
- (3) **Leakage.** Leakage is defined as the quantity of water to be supplied into the newly laid pipe necessary to maintain the specified leakage test pressure after the pipe has been filled with water and air expelled.

- D. **Chlorination.** After the hydrostatic test has been satisfactorily completed the water main shall be chlorinated. This may be done by either the Contractor or the Grand Rapids Water System personnel at the Contractors option. If the Contractor elects to perform the work necessary to chlorinate the water main, the same shall be accomplished by use of an approved liquid chlorinator in accordance with the requirements of the Grand Rapids Water System and under the observation of Grand Rapids Water System personnel. Chlorination shall be as outlined in AWWA C651. Unless otherwise approved by the City and EGLE, the continuous feed method of chlorination shall be used. This method consists of completely filling the main to removed particulates, and refilling the main with potable water that has been chlorinated to 25 mg/L. Following the injection of the required chlorine solution, the water main shall be left for a period of at least 24 hours after which the water main shall be flushed again with City water to remove the chlorine solution. Following the 24 hour holding period in the main there shall be a free chlorine residual of not less than 10 mg/L.
- (1) The Contractor shall not place or inject any chlorine tablets or powder into the pipe during construction or prior to the testing and chlorination of the main.
 - (2) In certain situations, small sections of the new water main may, with the approval of the Engineer and the Grand Rapids Water System, be excluded from the overall chlorination. When this is the case, all pipe, fittings, or offsets must be cleaned of all dust, dirt or other deposits and then carefully swabbed with a chlorine solution containing 50,000 parts per million (5 percent bleach - Clorox, etc.) of chlorine immediately before installation.
- E. **Bacteriological Testing.** Once the hydrostatic testing and chlorination have been completed and the water main filled with City water, Grand Rapids Water System personnel will initiate sampling for bacteriological testing with the assistance of the Contractor.
- (1) Bacteriological testing shall be as outlined in AWWA C651. In no case shall the length of section for testing exceed 1200 feet unless specifically approved by the City and the EGLE.
- F. **Responsibility for Testing Costs.** All work performed by the Grand Rapids Water System in connection with initial testing and chlorinating the water main will be done at the expense of the City. However, if it is necessary to test or chlorinate more than once, all additional costs beyond the first test shall be borne by the Contractor. The cost for all work performed by the Contractor and materials supplied by the Contractor in connection with testing and chlorinating the water main shall be included in the unit the price bid for furnishing and laying the water main and no extra payment will be made therefore.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, excavation, trenching, cofferdams, dewatering, furnishing and placing the pipe, fittings and plugs, anchorage, bedding, all backfilling, disposal of excess materials, temporary sheeting and bracing, temporary support, removal of abandoned utilities and services, removal and replacement of existing utilities and services, and the replacement and repair thereof if damaged, connections to existing water mains, testing, disinfection, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.3.001	Water Main, __ inch	Foot
4.3.002	Water Serv, __ inch	Foot
4.3.003	Water Serv, __ inch, Curb Box to Main	Foot
4.3.004	Water Serv, __ inch, Curb Box to Meter	Each
4.3.005	Water Serv, __ inch, Curb Box to Meter, over __ feet	Each
4.3.006	Water Serv, Exploratory Investigation	Each
4.3.007	Water Main Construction, Plumbing Allowance	Dollars
4.3.008	Reconnect existing __ inch copper water serv	Each
4.3.009	Curb Stop and box on water serv, __ inch	Each
4.3.010	Curb Box on water serv, __ inch	Each
4.3.011	Tap for water serv, including corporation stop, __ inch	Each
4.3.012	Tap for water serv, including corporation stop and collar, __ inch	Each
4.3.013	Valve and box, __ inch	Each
4.3.014	Butterfly Valve and box, __ inch	Each
4.3.015	Tapping sleeve, valve and box __ inch by __ inch by __ inch	Each
4.3.016	Hydrant, 5 inch	Each
4.3.017	Four-way cross, __ inch by __ inch	Each
4.3.018	Tee, __ inch by __ inch by __ inch	Each
4.3.019	Reducer, __ inch by __ inch	Each
4.3.020	Sleeve, __ inch	Each
4.3.021	Bend, __ Degree, __ inch	Each
4.3.022	Fitting, Oversized	Dollars
4.3.023	Plug, __ inch	Each
4.3.024	Adj existing __ inch water serv	Each
4.3.025	Hydrant Extension, __ inch	Each
4.3.026	Thrust block, Det __	Each
4.3.027	Fire hydrant, rem	Each
4.3.028	Fire hydrant, rem and salv	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. Water main of the size(s) shown in the Bid Form shall be measured in linear feet along the centerline of the water pipe in place from end to end of the line of pipe including the lengths of specials and valves.
2. Water Services of the size(s) shown in the Bid Form shall be measured along the centerline of the pipe from the center of the water main to the end of the pipe.
3. Curb Stops and Boxes, Valves and Boxes, Valves, Hydrants, Taps and Specials shall be measured in units as shown in the Bid Form and includes furnishing and installing curb stops

and boxes, valves and valve boxes, taps including corporation stops and appurtenances, 5 inch hydrants, and specials.

4. **Gate and Butterfly Valves** in chambers are specified, measured and paid per [Section 4.6](#). Butterfly Valves shall be placed in chambers unless otherwise approved by the City Engineer.
5. **Water Serv, __ inch, Curb Box to Main** shall be payment in full for placement of new copper water service from the curb box to the water main utilizing directional drilling or other approved trenchless technology, and includes furnishing and placing all copper piping, fittings, and any incidental work required for the proper placement of the water services.
6. **Water Serv, __ inch, Curb Box to Meter** shall be payment in full for placement of new copper water service from the curb box to the building penetration at the meter or proposed meter location utilizing directional drilling or other approved trenchless technology, and includes furnishing and placing all copper piping, fittings, sand backfill, permit fees and any incidental work required for the proper placement of the water services.
7. **Water Serv, __ inch, Curb Box to Meter, over __ feet** shall be payment in full for placement of new copper water service in locations where the distance from the curb stop box to the building penetration location exceeds __ feet. **Water Serv, __ inch, Curb Box to Meter, over __ feet** will be measured and paid when the service exceeds a __ foot distance from the curb box to the building penetration and will be paid in lieu of **Water Serv, __ inch (Curb Box to Meter)** and includes furnishing and placing all copper piping, fittings, sand backfill and any incidental work required for the proper placement of the water services.
8. **Water Serv, Exploratory Investigation** will be paid for at the Contract unit price for the exploratory investigation of existing water services. **Water Serv, Exploratory Investigation** will be paid only if the exploratory investigation yields a location where abatement is not required. At locations where abatement is required and the excavation of the existing water service is part of the connection of a new copper service from the main to the curb box, the excavation will not be paid separately but will be considered included in the price of the new water service. **Water Serv, Exploratory Investigation** includes all labor, equipment and materials required to complete the work, including all costs associated with repair or replacement resulting from the contractor's activities.
9. **Water Main Construction, Plumbing Allowance** is an allowance established to pay for all materials, labor, and equipment, including the services of a licensed plumber, required to:
 - A. Replace the water service inside and within three feet of a building and connect the service to the existing or proposed service meter.
 - B. Assist property owners and building maintenance staff during water service interruptions. This may be caused during the installation of a new water main and may result in the accumulation of sediment in screens of faucets and private plumbing lines. This work may include shutting off service within a building to prevent draining of the internal water distribution system, cleaning of internal plumbing systems and screens, meeting attendance and other work as approved by the Engineer.

This work shall only be conducted at the request and approval of scope by the Engineer. Where the work is performed by a subcontractor or supplier, the Contractor will be paid for the amount invoiced plus an additional 6 percent of the invoiced cost as reimbursement for the Contractor's administrative costs. Where the Contractor will be performing the work with his own forces, the work will be paid for using predetermined, negotiated prices. If the Contractor and Engineer cannot agree upon prices, the work will be paid for by force account in accordance with Section 109 of the current MDOT Standard Specifications for Construction.
10. When approved by the Engineer, water services from curb box to meter may be placed in open trenches and will be measured and paid for per linear foot for **Water Serv, __ inch**, according to this Section, from the water main to the building penetration, and includes furnishing and placing all piping, fittings, sand backfill and any incidental work required for the proper reconnection of the water services.
11. When water services outside the right of way are placed by open cut, the restoration of surface over the new water service will be paid for separately under the related items.
12. **Fitting, Oversized** shall be an allowance to cover costs for oversized fittings and joint restraint glands required to connect to existing water main. **Fitting, Oversized** shall not be paid when

- it is known oversized fittings will be required at the time of bidding. The allowance will cover the invoiced cost difference between the standard fittings on the project and the oversized fittings.
13. **Adj existing __ inch water serv** shall be paid for at the contract unit price for each service adjusted and approved by the Engineer.
 14. Water Main offsets of the size(s) shown shall be paid for at the Contract unit price for water main and water main fittings required for the offset. All offsets shall be coordinated with each proposed utility, both shown on the drawings and revised in the field, and no extra payment will be made to remove, or relocate an offset that is found to be in conflict with another utility.
 15. **Hydrant Extension, __ inch** shall be paid for at the unit price bid per vertical half-foot (Each every 6 inch) of extension in those locations where extensions are indicated on the Drawings or as approved by the Engineer.
 16. When the placement of new water main does not call for new water services on the Drawings or in the Bid Form. **Reconnect existing __ inch copper water serv** shall be paid for at the contract unit price for each service reconnected.
 17. Specials as listed in the Bid Form shall be measured as a unit including furnishing and placing the Special. The cost of related work shall be included in the price bid for the water main.
 18. **Anchorage.** The cost of providing anchorage shall be included in the price bid for the laying of the pipe and no extra payment will be made.
 19. **Specialty Gaskets.** When shown on the Drawings or called for in Special Provisions the cost of providing and placing the specialty gaskets shall be included in the price bid for the water main.
 20. **Polyethylene Encasement.** When indicated on the Drawings or called for in Special Provisions the cost of providing and placing polyethylene encasement shall be included in the price bid for the water main.
 21. The furnishing and installation of the curb stop locks for 1 or 3/4 inch water services shall be included in **Curb Stop and box on water serv, __ inch.**
 22. Connection of proposed copper water services to existing water services at the right of way line shall be included in the price of the water service, and shall include furnishing and placing the pipe-to-pipe adapter needed to connect the service.
 23. Measurement and payment for all other water main items shall be as specified in the City of Grand Rapids Standard Construction Specifications and the other project Special Provisions.

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DIVISION 4 - UTILITIES

SECTION 4.4

FORCEMAINS AND FORCEMAIN STRUCTURES

- a. **Description.** The work shall consist of constructing a forcemain of the type and size and at the depths as shown on the Drawings, including excavation, backfill, and the furnishing of all labor, equipment, and materials.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [4.4 of the Specified Products Index \(SPI\)](#).

1. General

- A. The Contractor will furnish certification by the Manufacturer stating that the pipe, fittings, valves, or other materials as required by the Engineer conform to the required specifications.
- B. In addition, all valves are to be tagged or stamped by the Manufacturer with manufacturer's identifying symbols in order to demonstrate conformation with these specifications. The tag or stamp shall be permanently attached to valves.
- C. Furnish force main materials meeting the requirements of NSF 14 and 61.
- D. All stainless-steel materials used in this Section shall conform to ASTM F593 or F594.
- E. All Ductile Iron pipe and fittings shall be made in the U.S.A.

2. Ductile Iron Pipe.

Centrifugally cast ductile iron pipe meeting or surpassing ANSI/AWWA C150/A21.50 and C151/A21.51. [\(SPI 4.3.A\)](#) Unless otherwise specified, furnish pipe conforming to special thickness class 53. Furnish gaskets comprised of Styrene Butadiene Rubber (SBR) unless otherwise specified on the Drawings or required by the Engineer.

- A. Furnish ductile iron pipe with an interior cement mortar lining in accordance with ANSI/AWWA C104/A21.04.
- B. Furnish ductile iron pipe with an exterior coating of arc-sprayed zinc per ISO 8179-1. The mass of the zinc applied shall be 200 g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils.
- C. Furnish pipe with interior and exterior bituminous seal coat in accordance with ANSI/AWWA C110/A21.10. When called for in the Drawings, furnish ductile iron pipe with interior Ceramic Epoxy Lining in accordance with [Section 4.1.b](#) in lieu of interior bituminous seal coat.
- D. When indicated on the Drawings or required by the Engineer the Contractor shall use specialty rubber gaskets. Specialty gaskets include, but are not limited to Ethylene Propylene Diene Monomer (EPDM), Polychloroprene (CR/Neoprene), Acrylonitrile (BUNA-N/NBR/Nitrile), Fluoroelastomer (FKM/Flourel/Viton), etc. These gaskets shall be supplied by the pipe manufacturer.
- E. **Unrestrained Pipe.** [\(SPI 4.3.A\)](#) Push-on joints in accordance with AWWA/ANSI C111/A21.11
- F. Joint Restraint.
 - (1) **Restrained Joint Pipe.** [\(SPI 4.3.A\)](#) All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system installed.
 - (2) **Joint Restraining Glands.** [\(SPI 4.3.C\)](#) Joint restraining glands for mechanical joint pipe, fittings and valves. Restraining glands shall not be used for joint restraint on plain end fittings.
 - (3) **Joint Restraining Gaskets.** [\(SPI 4.3.D\)](#) Joint restraining gaskets shall be supplied by the pipe manufacturer and are acceptable for push-on joint pipe up to 16 inches. Restraining gaskets shall not be used for joint restraint on fittings.
- G. **Polyethylene Encasement.** Polyethylene encasement for use with ductile iron pipe shall meet all the requirements for ANSI/AWWA C105/A21.5.

- (1) Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils.
 - (2) The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.
3. **High-Density Polyethylene (HDPE) Pipe.** Furnish HDPE pipe manufactured in accordance with AWWA C901/C906 manufactured from PE 4710 resin in accordance with ASTM D3350 for cell classification of 445574C or 445576C. Piping shall conform to Ductile Iron Pipe Size, DR 11 (Pressure Class 250) in accordance with ASTM F714, unless otherwise specified on the Drawings.
 - A. Provide HDPE Pipe for Force Main applications with a minimum of three (3) continuous longitudinal green stripes for positive identification. Green stripes must be integrally colored with the pipe during the extrusion process to ensure durability.
 - B. Join HDPE joints with butt-fusion in accordance with ASTM F2620. Provide the Engineer sample joints to verify smooth and completed "rolled" internal joint bead.
4. **Fittings.**
 - A. All fittings shall be ductile iron and shall be mechanical joint and conform:
 - (1) 6-inch through 24-inch ANSI/WWA C153/A21.53
 - (2) 30- inch through 48-inch ANSI/AWWA C110/A21.10.
 - B. Special Fittings for HDPE Pipe. Furnish butt fusion fittings for HDPE Pipe in accordance with AWWA C901/906 manufactured from High Density Polyethylene PE4710 resin in accordance with ASTM D3350 with a minimum cell classification of 445574C or 445576C.
 - (1) Furnish butt fusion meeting the requirements of ASTM D3261.
 - (2) Furnish fabricated fittings meeting the requirements of ASTM F2206.
 - (3) Furnish electrofusion fittings meeting the requirements of ASTM F1055.
5. **Plug and Gate Valves. (SPI 4.4.A)**
 - A. Valves on force mains shall be plug valves for sizes up to an including 12 inches, and gate valves for sizes larger than 12 inches.
 - B. Plug valves shall be nonlubricated, eccentric type with resilient faced plugs as called for in the Valve Schedule. End connections shall be mechanical joint unless otherwise shown on the Drawings or applicable Standard Details. Port areas shall be equal to at least 80 percent of the nominal size pipe area. Valve bodies shall be suitably marked to indicate whether the valve is open or closed.
 - C. The seating surface of the rotating element shall be nitrile butadiene (hycar), or other material recommended by the manufacturer for sewage service. Bearings at the top and bottom supporting the rotating element shall be self-lubricating, corrosion-resistant type, suitable for sewage plant service. The valve shall be of the bolted bonnet design. Packing shall be visible for inspection without dismantling valve or removing operator. The packing shall be adjustable and replaceable without disassembling of the valve.
 - D. All plug valves shall be of adequate design to operate with a pressure of 50 psi on both sides or on either side of the valve without leakage.
 - E. Gate valves shall be double disk type as specified in [Section 4.3](#).
6. **Air Relief Valves.**
 - A. Air relief valves for force mains shall be AWWA C512, designed for 100 psig working pressure, wastewater service, and provided with all the accessories shown on Standard [Detail S-18](#). Accessories shall be provided by the valve manufacturer. Valve bodies shall be ductile or cast iron. Float and internal hardware shall be stainless steel.
 - (1) Unless otherwise noted, furnish combination air valves. Furnish air-release, air/vacuum as shown on the Drawings or as directed by the Engineer.

c. Construction.

1. **Excavation and Backfill.** Excavation and backfill shall be performed according to [Section 2.5](#), and the following.
2. **Pipe Laying.** In accordance with [Section 4.3](#) and the following.
 - A. **General.** Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
 - B. **Alignment.** Alignment of the trench shall be as shown on the Drawings unless otherwise approved by the Engineer.
 - C. **Depth.** The depth shall be 5 feet 9 inches from finished grade to the centerline of pipe unless shown otherwise on the Drawings or approved by the Engineer.
 - D. **Pipe Kept Clean.** All dirt or other foreign matter shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.
 - (1) Whenever work is stopped for the day, a standard plug shall be securely placed in the end of the pipe. No tools or other articles shall be stored in the pipe at any time.
 - E. **Cutting Pipe.** The Contractor shall cut the pipe in a neat and workmanlike manner in accordance with the manufacture's recommendations wherever necessary for placing valves, special fittings, or closure pieces without damage to the pipe and without extra cost to the City. The area adjacent to cuts made on slip joint pipe shall be beveled before assembly of the joint.
 - (1) Pipe shall not be cut with a hardy, chisels, or any tool or machine that will cause damage to the pipe or the cement lining. The method of cutting pipe shall be in accordance with the manufacture's recommendations, subject to the approval of the Engineer.
 - F. **Tracer Wire (HDPE Only).** Install an annealed copper-clad steel tracer wire. Ensure tracer wire is 12 American Wire Gauge (AWG) copper conductor with 30-mil thick high-density polyethylene (HDPE) insulation, rated for 30 volts and have 21 percent conductivity. Insulation color must meet the American Public Works Association (APWA) color code standard for identification of buried utilities. Ensure tracer wire is in accordance with ASTM B3, ASTM B170, ASTM D1248, ASTM D1238 and ASTM B910/B 910M and the requirements of the NEC. Clearly label and terminate tracer wire within structures as shown on the plans, and accessible at the ground surface without entry into chamber or structures. Ensure the locations of the terminations are noted on the as-built plans.
3. **Anchorage of Bends, Tees and Plugs.**
 - A. On all forcemain work, wherever necessary, all bends, tees, plugs and other fittings shall be restrained as specified for water mains in [Section 4.3 Table 4.3-7](#).
4. **Pressure Test.**
 - A. Pressure tests for forcemains shall be performed in accordance with the requirements for pressure testing water mains found in [Section 4.3.c.17](#), except that the HDPE pressure test must include an initial expansion phase prior to testing in accordance with the Plastics Pipe Institute "Handbook of Polyethylene Pipe" and AWWA Manual M55.
5. **Video Inspection (HDPE Only).** The entire length of completed force main shall be videotaped and reviewed by Engineer prior to placing the main in service.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, and shall include all clearing, excavation, trenching, cofferdams, dewatering, furnishing and placing the pipe, fittings and plugs, anchorage, bedding, all backfilling, disposal of excess materials, temporary sheeting and bracing, temporary support, removal of abandoned utilities and services, removal and replacement of existing utilities and services, and the replacement and repair thereof if damaged, testing, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.4.001	Forcemain, (Material), __ inch	Foot
4.4.002	Blowoff tee with plug, __ inch, on __ inch forcemain.....	Each
4.4.003	Air relief valve and chamber on __ inch forcemain Det S-18	Each
4.4.004	Forcemain, Discharge Mh, Det S-22	Each
4.4.005	Valve and box, __ inch, forcemain.....	Each
4.4.006	Tee, __ inch by __ inch by __ inch, forcemain	Each
4.4.007	Reducer, __ inch by __ inch, forcemain	Each
4.4.008	Bend, __ Degree, __ inch, forcemain	Each
4.4.009	Sleeve, __ inch, forcemain.....	Each
4.4.010	Plug, __ inch, forcemain	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. Forcemain of the size and class as shown shall be measured in linear feet along the centerline of the pipe in place, including the lengths of valves and specials. HDPE fittings, tracer wire and video inspection are not paid separately and considered included in the price of the forcemain.
2. **Air relief valve and chamber on __ inch forcemain, [Det S-18](#)** shall be measured as a unit and shall include the costs of all of the equipment and materials including chamber, valves and couplings shown [Detail S-18](#).
3. Specials as listed in the Bid Form shall be measured as a unit including furnishing and placing the special. The cost of related work shall be included in the price bid for the forcemain.
4. **Anchorage.** The cost of providing anchorage shall be included in the price bid for the laying of the pipe and no extra payment will be made.

DIVISION 4 - UTILITIES

SECTION 4.5

MANHOLES, CATCH BASINS, AND SIMILAR STRUCTURES

- a. **Description.** The work shall consist of the following items.
1. Constructing manholes, catch basins, and similar structures, according to the Standard Details or Drawings pertaining thereto.
 2. Rebuilding the top portion of existing manholes, catch basins, and similar structures.
 3. Adjusting existing castings to fit grade changes.
- b. **Materials.** Provide materials in accordance with the following. Products shall be in accordance with part [4.5 of the Specified Product Index \(SPI\)](#).
1. **Gray Iron Castings.** ([SPI 4.5.A](#)) In accordance with the current Standard Details and Michigan Department of Transportation Standard Specifications for Construction.
 - A. The manhole cover and frame, catch basin grate and frame, outlet hoods, and other similar combinations of castings shall be machined to fit and to the dimensions shown on the appropriate Standard Detail so that there will be an even bearing.
 2. **Precast Reinforced Concrete Manholes and Catch Basins.** ([SPI 4.5.B](#)) All manholes including their cone sections shall conform to current ASTM C478 and catch basins to current ASTM C913, with rubber gasketed joints conforming to current ASTM Specification C443 or flexible butyl sealant joints conforming to the current ASTM Specification C990.
 3. **Adjusting Rings.** Castings for structures specified in this Section shall be adjusted to finished grades using precast concrete rings, or concrete bricks as shown on the Standard Details.
 4. **Concrete** for adjustment of manhole castings and valve boxes shall be as specified in [Section 6.1](#).
 5. **Brick or Block Masonry** units and precast concrete sections shall conform to the ASTM Specifications as follows:
 - A. **Concrete Brick** shall conform to the requirements for Grade A of the current Specifications for Concrete Building Brick, ASTM C55.
 - B. **Concrete Blocks** shall conform to the requirements of the current Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes, ASTM C139.
 6. **Plastic Coated Steel Steps.** ([SPI 4.5.C](#))
 - A. **Plastic** shall conform to the requirements for Type II, Grade 49108 or Grade 16906 of the current Specifications for Propylene Plastic Molding and Extrusion Materials, ASTM D4101.
 - B. **Steel** shall conform to the requirements for Grade 60 of the current Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement, ASTM A615.
 7. **Flexible Connections.** ([SPI 4.5.D](#))
 - A. Flexible manhole connections shall conform to ASTM C923.
 8. **Precast Reinforced Concrete Structures, Concrete Mortar, and Steel Reinforcement.** Precast reinforced concrete structures, mortar, grout and steel reinforcement shall be as specified in [Section 6.1](#) and [Section 7.1](#).
 9. **Nonwoven Geotextile Separator** for Infiltration Basin stone shall be in accordance with the current MDOT Standard Specifications for Construction Section 910.
 10. **Infiltration Basin Stone** shall be Coarse Aggregate 6A as specified in Section 402 the current MDOT Standard Specifications for Construction or Engineer approved equal.
- c. **Construction.**
1. **Excavation.** Excavation and backfill shall be done in accordance with [Section 2.5](#). Excavation shall be of sufficient dimensions to provide ample space for sheeting and bracing where

sheeting and bracing are required, and ample space to perform the work in a satisfactory manner and in accordance with current MIOSHA and OSHA regulations.

- A. When the earth at the normal depth of the structure is unsuitable for a foundation for the structure, such unsuitable material shall be removed as required by the Engineer and replaced with MDOT Class II material, and shall be paid for separately as specified for [Subgrade Undercutting, Type](#) in [Section 2.4](#).
2. **Infiltration.** With the exception of Infiltration Basins and Catch Basins with bleeder pipes, all structures and manholes to be built under this section shall be made water-tight. Any infiltration which is detected shall be eliminated by the Contractor.
3. **Brick or Block Units.** Shall be laid in such a manner that the courses will be true to line and with the joints fully bonded.
 - A. In a structure of cylindrical design, radius blocks shall be used.
 - B. In a structure of rectangular design, the bricks shall be laid in alternate courses of headers and stretchers.
4. **Manholes, Catch Basins and Alley Basins.** All manholes, catch basins, and alley basins shall be constructed of precast reinforced concrete sections, as shown on the Standard Details or Drawings. Masonry and cast-in-place manholes, catch basins, and alley basins will not be allowed unless specified, or approved by the Engineer
 - A. Openings shall be provided in the manholes, catch basins, and alley basins for connections, including future connections, as shown on the Drawings of such size and at such elevation as required and shall be included in the cost of the construction of the manholes, catch basins, and alley basins. All openings in manholes, catch basins, and alley basins for the purpose of receiving pipes up to and including 24 inch diameter (including openings for future pipes) shall be fitted with a connection of the flexible type connector. Flexible connectors on manholes shall be factory installed. Openings for future connections shall be sealed by an approved prefabricated cap.
 - B. The outside surface of brick or block manholes shall be parged one-half inch thick with mortar. The inside surface of all brick or block catch basins shall be parged with mortar one-half inch thick from the bottom to the corbel. The mortar shall be as specified in [Section 6.1](#).
 - C. The manhole castings shall be set in a full bed of mortar made with high early strength cement with the top at the required elevation. Chimneys, including castings, shall be no more than 20 inches high, unless otherwise approved by the Engineer.
 - D. **Casting Finishing** for castings in pavement per [Detail P-22](#).
 - E. All catch basins shall be fitted with a standard cast iron hood as shown on the applicable Standard Details.
5. **Drop Inlet or Manholes to Catch Basins** shall be constructed to conform to the Standard Details and Drawings. When an inlet of this design is to be used for a direct connection to a manhole, and is so specified on the Drawings, the work shall be done in the same manner as when the connection discharges into a catch basin.
 - A. The castings to be used on this type of structure shall be a basin casting of the Grand Rapids Standard Design and shall be set in a full bed of mortar made of high early strength cement on top of the masonry, with the top at the required elevation.
6. **Drop Connections to Sanitary Manhole** shall be constructed to conform to the Standard Details and Drawings.
 - A. The drop connection pipe and fittings below the incoming sewer shall be fully encased in concrete.
 - B. The high-speed drop connection pipe and fittings below the lower fitting shall be fully encased in concrete.
7. **Adjusting and Finishing Castings and Oversized Castings.** In the prosecution of the work, the Contractor shall be required to adjust manhole, oversized manhole, catch basin and flat grate castings to the grade of the new work or as required by the Engineer. At locations where the existing castings are not suitable as determined by the Engineer, the Contractor shall furnish new castings. Old castings not suitable for reuse shall be disposed of by the Contractor, unless the Drawings, Special Provisions, or Bid Form items specifically call for them to be delivered to the City. The work of adjusting shall include the removal of (temporary lowering)

or building up of the top vertical foot of new masonry on the existing masonry, concrete grade rings or a combination of each. The top vertical foot measurement does not include the height of the casting. The following work shall be included:

- A. The excavation or removal of existing unclassified materials, such as pavement, pavement base, earth, etc. so that the work of adjusting the casting can be done.
 - B. The breaking out or removal of the existing casting from the manhole, catch basin or other structures.
 - C. The tearing down or the building up of the top one foot of masonry and concrete grade rings, where necessary, or a combination of each.
 - D. The setting and finishing of the existing casting or new casting in accordance with 4.D of this Section.
8. **Rebuilding Manholes or Catch Basins.** Whenever existing manholes, catch basins, or similar structures occur on a street improvement project, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and grade of the finished surface. Chimneys and castings shall be finished as specified for new structures.
- A. When it is required that the top of a structure be rebuilt, the work shall be done according to the Standard Specifications and the rebuilt structure shall conform to the appropriate Standard Detail for such structure.
 - B. When the top of the structure is raised or lowered one foot or more, payment will be made at the contract unit price per vertical foot of new masonry completed in excess of the first vertical foot, **Mh or Catch Basin, Rebuild**, which will be payment in full for furnishing all labor, material, and equipment for removing old and placing new masonry complete, and setting the casting to the required grade.
 - C. When rebuilding of the structure requires new flattop, the work shall be done in accordance with Standard [Detail S-10](#), and the cost of such work shall be included in the contract unit price for **Mh or Catch basin, Rebuild with flattop, Det S-10**. In this case, **Mh or Catch Basin, Rebuild**, shall not be paid separately and all repairs shall be considered included in **Manhole or Catch basin, Rebuild with flattop, Det S-10**.
 - D. When the top of the structure is raised or lowered less than one foot, the cost of such work shall be included in the contract unit price for **Mh Casting, Adj, Mh casting, oversized, Adj, or Catch Basin Casting, Adj**, unless otherwise specified.
9. **Bleeders** when identified on the Drawings are required for storm manholes and catch basins as shown on the applicable Standard Details. These installations shall not be allowed on sanitary manholes.
- A. Such bleeders shall be installed in accordance with the Standard Details unless otherwise shown on the Drawings.
10. **Backfill for Structures** specified in this Section shall be Granular Material Class II in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, unless otherwise shown on the Drawings or approved by the Engineer and placed in accordance with [Section 2.5](#).

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, excavation, trenching, cofferdams, dewatering, furnishing and placing the structures, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.5.001	Storm Mh, ___ foot dia, Det ___	Each
4.5.002	Storm Mh, ___ foot dia, Det ___, add depth over 15 foot	Foot
4.5.003	Catch basin, ___ foot dia, Det ___	Each
4.5.004	Drop inlet, Det S-6	Each
4.5.005	Drop Mh, Det S-6A	Each
4.5.006	Alley basin, ___ foot dia, Det S-7	Each
4.5.007	Ditch basin, ___ foot dia, Det S-8	Each
4.5.008	Infiltration basin, ___ foot dia, ___ foot sump, Det S-5	Each
4.5.009	Sanitary Mh, ___ foot dia, Det ___	Each
4.5.010	Sanitary Mh, ___ foot dia, Det ___, add depth over 15 foot	Foot
4.5.011	Drop connection, Det S-1A , on ___ inch Sanitary Sewer	Each
4.5.012	Drop connection, Det S-1A , on ___ inch Sanitary Sewer, add depth over 15 foot	Foot
4.5.013	Drop connection, High Speed, Det S-1B , on ___ inch Sanitary Sewer	Each
4.5.014	Mh casting, Furn	Each
4.5.015	Mh casting, Adj	Each
4.5.016	Mh, oversized, Furn	Each
4.5.017	Mh casting, oversized, Adj	Each
4.5.018	Mh or Catch basin, Rebuild	Vertical Foot
4.5.019	Mh or Catch basin, Rebuild with flattop, Det S-10	Each
4.5.020	Catch basin casting, Furn	Each
4.5.021	Catch basin casting, Adj	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. Manholes and catch basins shall be measured in units as shown in the Bid Form and includes furnishing and installing the structure, grade rings, casting and all other accessories as specified and detailed.
2. Furnishing, adjusting and finishing of castings on new manholes, catch basins and similar structures is considered included in the cost of the manhole, catch basin and similar structure and shall not be paid for separately.
3. Finishing of castings when furnished or adjusted for existing manholes shall include all labor, equipment, and materials and all other work required as shown in the Standard Details for a complete job.
4. **Infiltration basin, ___ foot dia, ___ foot sump, [Det S-5](#)** shall be measured in units as shown in the Bid Form and includes the furnishing and installing of structure, cast iron hood, geotextile fabric, stone backfill, grade rings, casting, and backfill.

DIVISION 4 - UTILITIES

SECTION 4.6

VALVE CHAMBERS, METER PITS AND SIMILAR STRUCTURES

- a. **Description.** The work shall consist of the following items.
1. Constructing valve chambers, meter pits, and similar structures, according to the Standard Details or Drawings pertaining thereto.
 2. Rebuilding the top portion of existing manholes, catch basins, and similar structures.
 3. Adjusting existing castings to fit grade changes.
- b. **Materials.** The materials used for valve chambers, meter pits, and similar structures shall be as specified in [Section 4.5](#). Valve Boxes shall be as specified in [Section 4.3](#).
1. **Access Door.** ([SPI 4.6.A](#))
 2. **Adjustable Pipe Supports.** ([SPI 4.6.B](#)) Adjustable pipe supports shall be stainless steel and conform to ASTM 304.
- c. **Construction.** In accordance with [Section 4.5](#), and as specified herein.
1. **Infiltration.** All structures and manholes to be built under this section shall be made water- tight. Any infiltration which is detected shall be eliminated by the Contractor.
 2. **Valve Chambers and Meter Pits** shall be constructed to conform to the Standard Details or Drawings governing the work. They shall be precast reinforced concrete structures as shown on the Standard Details, unless otherwise shown on the Drawings or approved by the Engineer.
 - A. Valve Chamber and Meter Pit Castings shall be finished in accordance with [Section 4.5.b.1](#).
 - B. Pipe Supports shall be securely anchored to the floor
 3. **Valve Boxes.** Valve and curb boxes in pavement and other existing valve boxes, shall be adjusted by the Contractor to fit the finished surface. Valve boxes in paved areas shall be adjusted according to the Standard Details.
 - A. Finishing for valve boxes in pavement per [Detail P-23](#).
 - B. Finishing for curb boxes in driving surface (streets, private drives or commercial driveways) per [Detail P-23C](#).
 4. **Adjusting and Finishing Castings, Valve Boxes and Curb Boxes.** In accordance with [Section 4.5.c.7](#).
 5. **Rebuilding Chambers or Meter Pits.** Whenever existing Valve Chambers, Meter Pits, or similar structures occur on a street improvement project, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and grade of the finished surface. Chimneys and castings shall be finished as specified for new structures.
 - A. When it is required that the top of a structure be rebuilt, the work shall be done according to the Standard Specifications and the rebuilt structure shall conform to the appropriate Standard Detail for such structure.
 - B. When the top of the structure is raised or lowered one foot or more, payment will be made at the contract unit price per vertical foot of new masonry completed in excess of the first vertical foot, **Chamber or Pit, Rebuild**, which will be payment in full for furnishing all labor, material, and equipment for removing old and placing new masonry complete, and setting the casting to the required grade.
 - C. When rebuilding of the structure require requires new flattop, the work shall be done in accordance with Standard [Detail S-10](#), and the cost of such work shall be included in the contract unit price for **Chamber or Pit, Rebuild with flattop**, [Det S-10](#). In this case, **Chamber or Pit, Rebuild**, shall not be paid separately and all repairs shall be considered included in **Chamber or Pit, Rebuild with flattop**, [Det S-10](#).

- D. When the top of the structure is raised or lowered less than one foot, the cost of such work shall be included in the contract unit price for **Mh casting, Adj, Valve box, Adj, or Curb box, Adj**, unless otherwise specified.
6. **Backfill for Structures** specified in this Section shall be Granular Material Class II in accordance with the current Michigan Department of Transportation Standard Specifications for Construction, unless otherwise shown on the Drawings or approved by the Engineer and placed in accordance with [Section 2.5](#).

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The prices shall be payment in full for furnishing all labor, equipment and material and shall include all clearing, excavation, trenching, cofferdams, dewatering, furnishing and placing the structures, all backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, temporary support, removal and replacement of existing utilities and services, and the repair and replacement thereof if damaged, connection of existing sewers, testing, and all other work required for a complete job.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.6.001	Valve chamber, with Gate Valve, ___ inch, Det W-1	Each
4.6.002	Valve chamber, with Butterfly Valve, ___ inch, Det W-2	Each
4.6.003	Valve chamber, with Butterfly Valve, ___ inch, Det W-2A	Each
4.6.004	Meter pit, Det W-11	Each
4.6.005	Curb box in Pavt, Det P-23C	Each
4.6.006	Chamber or Pit, Rebuild	Vertical Foot
4.6.007	Chamber or Pit, Rebuild with flattop, Det S-10	Each
4.6.008	Valve box, Furn	Each
4.6.009	Valve box, Adj	Each
4.6.010	Curb box, Furn	Each
4.6.011	Curb box, Adj	Each
4.6.012	Mh, Air Vent, Det W-17	Each
4.6.013	Chamber, Blowoff Assembly, Det W-18	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	
1.	Chambers and Pits shall be measured in units as shown in the Bid Form and includes furnishing and installing the structure, grade rings, casting, equipment, valves, couplings and all other accessories as specified and detailed.	
2.	Furnishing, adjusting and finishing of castings on new chambers, for valve boxes and similar structures is considered included in the cost of the chamber, valve boxes and similar structure and shall not be paid for separately.	
3.	Curb box in Pavt, Det P-23C shall be measured in units as shown in the Bid Form and includes furnishing and installing a valve box and cover, concrete rings and reinforcing steel as detailed in the drawings. The price shall be payment in full for furnishing all labor, equipment and material, and all other work required for a complete job.	
4.	Furnishing and/or adjusting Valve Chamber castings will be measured and paid with Mh casting, Furn and Mh casting, Adj standard pay items in accordance with Section 4.5 .	

DIVISION 4 – UTILITIES

SECTION 4.7

ELECTRICAL DISTRIBUTION

- a. **Description.** This work consists of furnishing and/or installing the items described below, and includes, but is not limited to, all of the necessary labor, materials, tools, and equipment necessary to result in a finished installation.

1. **Applicable Codes and Guides.** The following codes and guides apply to the work in this Division. Depending on the materials and methods, other codes may also apply:
 - A. Michigan State Construction Code Act of 1972, as amended
 - B. Michigan Building Code rules, Parts 1-9; Department of Labor
 - C. Michigan Occupational Health Standards for Construction; Michigan Department of Public Health
 - D. Michigan Occupational Safety and Health Act "MIOSHA", Act 154, P.A. 1974 as amended; Michigan Department of Public Health
 - E. Current Standard Specifications for Construction as amended; Michigan Department of Transportation
 - F. OSHA Safety and Health Standards (29 CFR 1926/1910)
 - G. City of Grand Rapids (City) Ordinances and State Rules and Regulations
 - H. National Electrical Safety Code
 - I. National Electrical Code

- b. **Materials.** Materials used to construct the street lighting system shall be as specified herein.

1. **Poles, Wood.** Wood poles shall be of the height, class, and type specified in the Bid Form, and shall meet the requirements of American National Standards Institute (ANSI) 05.1-2017 or latest revision thereof.
 - A. Poles shall be Southern Pine or Red Pine.
 - B. Treatment with CCA-C oxide preservatives.
 - C. Pole shall be treated in accordance with the requirements of the American Wood Preservers Association (AWPA) standard C1 "all timber products – preservative treatment by pressure process, and C4, preservative treatment with waterborne preservatives", except as noted in this specification.
 - D. Conditioning:
 - (1) Poles shall have a moisture content of 35% or less in the third inch from the surface of the pole.
 - (2) Only air-drying and kiln-drying are permitted.
 - (3) Poles shall be cool prior to treatment.
 - (4) Heating poles in the preservative is not permitted treatment.
 - (5) A maximum pressure of 150 PSIG for unlimited duration is permitted.
 - (6) A maximum fixation period of six hours by heating in steam or hot water at 220 degrees Fahrenheit is permitted in southern pine poles only.
 - E. Results of treatment:
 - (1) Retention: poles shall be treated to a retention level of 0.60 pcf as determined by an assay of the 0.50" to 2.0" zone of wood from the surface.
 - (2) Penetration: poles shall be penetrated in accordance with AWPA Standard C4, section 3.21.
 - (3) Retreatment: poles may be retreated, providing none of the limitations specified in AWPA standard C1, paragraph 6-retreatments are exceeded.
 - (4) Chemical constituents: CCA-type C waterborne preservatives used in the treatment of the utility poles shall be of the oxide form and not use constituents copper sulfate, sodium arsenate, or pyro-arsenate, potassium or sodium dichromate, or other constituents that will form water soluble electrolytes in utility poles.

- F. Poles shall be marked as follows, reading from top down as per the sketch herein:
- (1) Supplier's code.
 - (2) Plant location and year of manufacture.
 - (3) Species and preservative used.
 - (4) Reference mark (x) 6' plus or minus 2" from groundline.
 - (5) "GR ELC" or "GR SL" (owner code).
 - (6) Class and height.
- G. Framing: poles shall be slab gained and drilled as per the sketch herein.
2. **Cross Arms, Wood.** Cross arms for use with wood poles shall be the type and size specified in the Bid Form and shall meet the requirements of ANSI O5.3-2015 or latest revision thereof.
3. **Overhead Line Hardware.** Material used in the construction of overhead lines shall be the following:
- A. Machine bolts. Double Arming Bolts, and Steel Cross Arm Pins shall meet IEEE C135.1 and be galvanized according to ASTM Specification A153.

Table 4.7-1 Overhead Line Machine Bolts	
Size (in)	Minimum Tensile Strength (lbs)
3/8	8,500
1/2	16,000
5/8	25,000
3/4	36,000
7/8	50,000
1	66,000

- B. Steel insulator pins shall be 5/8-inch with square washer, nut, and lock nut, with 1-inch lead thread to accept insulator.
- C. Lag Screws shall be hot-dip galvanized, 1/2-inch x 4-inch with fether-drive and pilot point.
- D. Washers - Hot-dip galvanized in the following sizes.

Table 4.7-2 Overhead Line Washers		
Washer	Hole Diameter (in)	Bolt Size (in)
3" x 3" x 1/4" Curved Square	11/16	5/8
3" x 3" x 1/4" Square	13/16	3/4
1-3/4" O.D. x 10 Ga. Round	11/16	5/8
2" O.D. x 9 Ga. Round	13/16	3/4

- E. One Wire Rack (Clevis). Hot-dip galvanized shall have curved sides, 3-1/4-inch opening for spool insulator, 4-inch clearance from back plate to center of spool insulator. Spool insulator shall be 3-inch high, 3-1/8-inch wide, single groove of 11/16-inch radius, with sky gray glaze, ANSI Class 53-2.
- F. Cross Arm Braces shall be hot-dip galvanized 1-1/4-inch wide and 1/4-inch thick, with a 9/16-inch hole at one end and a 7/16-inch hole at the opposite end. Distance between the centers of the holes shall be 26 inches.
- G. Extension strap shall be hot-dip galvanized, 1-1/4-inch wide and 5/16-inch thick, with 11/16-inch holes at each end. Distance between the holes shall be 20 inches.
- H. Guying attachment shall be ductile iron grade 654512, ASTM 536, hot-dip galvanized per ASTM 123, minimum ultimate strength of 21,000 pounds, for two 3/4-inch machine bolts,

for a maximum of 1/2-inch cable installation, for use on flat or curved surfaces, for use with standard fiberglass insulators, and for use with insulated or uninsulated guy strand. Continental Electric Co. #UGA-66-4.

- I. Guy strand shall be utilities grade, zinc coating as listed in ASTM A363, of the following sizes:
 - (1) 5/16-inch, 3-wire at, 145-inch diameter 6500 lb., Grade 3.
 - (2) 3/8-inch, 7 wire at .120-inch diameter, 11,500 lb., Grade 4.
- J. 20,000 lb. capacity guy consists of 3/8-inch strand (11,500 lb.) installed in a loop configuration and clamped together.
4. **Overhead Line Insulators.** Insulators shall be of the following type:
 - A. Pin type shall be the following:
 - (1) Polymer ANSI Class 55-4
 - (2) Threaded for 1-inch diameter pin.
 - (3) Radio-free interference type
 - (4) Two-skirt construction
 - (5) Leakage distance: 9-inch
 - (6) Dry leakage distance: 5-inch
 - (7) Cantilever Strength: 3,000 lb.
 - (8) Sky blue glaze: ANSI 70
 - B. Suspension - Dead end type shall be the following:
 - (1) Use Hubbell 4010150215 epoxilator.
 - (2) MacLean HDSO-57 clamp.
 - (3) Ferrous cap and stud
 - (4) ANSI Class: 52.1
 - (5) Mechanical and Electrical Rating: 10,000 lb.
 - (6) Proof Test: 5,000 lb.
 - C. Guy strain shall be porcelain ANSI Class 54-3 with sky blue glaze, ANSI 70. Length = 5-1/2-inch, Diameter = 3-3/8-inch, for up to 5/8-inch strand.
 - D. Fiberglass guy strain shall have 54 inches of fiberglass rod, hot-dip galvanized malleable iron fittings at each end, one of which shall have a roller. Minimum breaking strength shall be 30,000 pounds. Joslyn #703-54, or Engineer approved equal.
5. **Overhead Sec /C.** Conductors shall be as indicated on the Drawings and shall be of the following:
 - A. #4 Triplex, code word "Whelk"
 - (1) Consisting of 2 - #4 solid aluminum phase conductors. Polyethylene insulated (one of which shall have an identification such as a ridge on the insulation) and 1-#4ACSR (6/1) bare neutral messenger (Stranding: 6 aluminum, 1 steel).
 - (2) Lay of the assembled conductors shall be 90 times the diameter of one insulated conductor.
 - (3) Common designation on Drawings can be "#4Tx" or "4-4(6/1)-4".
 - B. #1/0 Triplex, code word "Neritina".
 - (1) Consisting of 2 - #1/0 aluminum conductors, 7 strands each, phase conductors, polyethylene insulated (one of which shall have an identification such as a ridge on the insulation), and 1 - #1/0 ACSR (6/1) bare neutral messenger (stranding: 6 aluminum, 1 steel) bare conductor.
 - (2) Lay of the assembled conductors shall be 90 times the diameter of one insulated conductor.
 - (3) Common designation on the Drawings can be "#1/0Tx" or "#1/0(7) - #1/0(6/1) - #1/0(7)".
 - C. Lamp lead conductors shall be 2 conductor, #10 AWG copper, 7 strands, 600 volt, cross-linked polyethylene insulated-, or Engineer approved equal.
 - D. Insulated snap-on covers for insulating crimp splices and taps from or to the insulated conductor of Triplex:
 - (1) Burndy #CCD, for "D" die compression connectors, 2-3/4 inches long.
 - (2) Burndy #CCO, for "O" die compression connectors, 2-1/2 inches long, used for #4 tap and #1/0 lamp lead taps.

- (3) Blackburn #C2 for 5/8-inch dies compression connectors, 2 inches long used for #4 butt and #4 lamp lead taps.
6. **Underground Sec /C.** Conductors shall be as indicated on the Drawings and shall be of the following:
- A. #6 U.S.E.
 - (1) Consisting of #6 AWG stranded annealed copper conductors. Cross-linked Polyethylene, 600 volt rated insulation.
 - (2) Insulation shall solidly be pigmented throughout.
 - B. #2 U.S.E.
 - (1) Consisting of #2 AWG stranded annealed copper conductors. Cross-linked Polyethylene, 600 volt rated insulation.
 - (2) Insulation shall solidly be pigmented throughout.
 - C. Lamp lead conductors shall be 3 conductor, #10 AWG copper, 7 strands, 600 volt, cross-linked polyethylene insulated, or Engineer approved equal.
 - D. Receptacle lead conductors shall be 3 conductor, #10 AWG copper, 7 strands, 600 volt, cross-linked polyethylene insulated, or Engineer approved equal.
 - E. Conductors shall be colored as following:
 - (1) Street lighting line conductors: Red or Black
 - (2) Street lighting neutral conductor: White
 - (3) 24-hour line conductors: Blue or Orange
 - (4) 24-hour neutral conductor: Grey
 - (5) Ground conductor: Green
7. **Overhead Prim Line /C.** Conductors shall be as indicated on the Drawings and shall be of the following:
- A. #4(7/1) ACSR code word "Swanate", ultimate strength 2245 lb. Steel core to have Class B zinc coating.
 - B. #2(7/1) ACSR code word "Sparate", ultimate strength 3385 lb. Steel core to have Class B zinc coating.
 - C. #1/0(6/1) ACSR code word "Raven", ultimate strength 4140 lb. Steel core to have Class B zinc coating.
 - D. #3/0(6/1) ACSR code word "Pigeon", ultimate strength 6135 lbs. Steel core to have Class B zinc coating.
8. **Overhead Prim Neutral /C.** Conductors shall be as indicated on the Drawings and shall be of the following:
- A. #2(7/1) ACSR code word "Beech", ultimate strength 3350 lb., consisting of 7 strands of aluminum, 1 strand of steel, and overall covering of polyethylene.
9. **Underground Primary Conductors.** Conductors shall be as indicated on the Drawings and shall be of the following:
- A. **Underground Prim Line /C-#2/0 CU 15 kV.**
 - (1) **High Voltage Cables.** High voltage cable shall be rated 15 kV (133% insulated). Cable shall be a single, stranded copper conductor with ethylene-propylene rubber (EPR) insulation and copper tape shielding. The cable shall be rated for an operating temperature of 105° C. The cable shall meet UL requirements for MV-105, Sunlight Resistant and for Cable Tray use and shall be labeled accordingly. The cable shall be constructed with the following layers:
 - (2) **Wire Gauge.** The wire gauge of the conductor shall be 2/0. The conductor shall be Class B "compressed", with 19 strands of solid, uncoated copper wire. Diameter of the conductor shall be $0.400 \pm 2\%$ inches. The conductor shall not be "compacted".
 - (3) **Shield/Stress Control.** A semi-conducting or non-conducting stress control layer shall be provided between the conductor and insulation. The stress control layer shall be extruded material. The stress control layer shall meet the requirements of the Insulated Cable Engineers Association (ICEA) standard S-97-682. This layer shall be easily removable from the conductor without the use of heat or special tools.
 - (4) **Insulation.** The insulation shall be 220 mils of EPR compound. The EPR compound shall not contain any polyethylene and shall contain no more than 72% ethylene. The cable diameter over the insulation shall be 0.91 inches plus or minus 0.02 inches.

- (5) **Insulation Screen / Shield.** An extruded, semi-conducting, stress control layer shall be provided between the insulation and copper tape shield. The stress control layer shall meet the requirements of the ICEA standard S-93-639. This layer shall be easily removable from the insulation layer without the use of heat or special tools.
- (6) **Copper Tape Shield.** The metallic copper tape shield shall be constructed of tinned, 5 mil copper tape. It shall be applied helically with a minimum of 20% overlap.
- (7) **Jacket.** An overall jacket shall be supplied.
 - (a) The jacket shall be a minimum of 70 mils thick and shall be constructed of chlorinated polyethylene (CPE) or chlorosulfonated polyethylene (CSPE). The overall cable nominal diameter shall be 1.20 ± 0.05 inches. The jacket shall meet or exceed the requirements of the ICEA standard S-93-639 for and shall meet the requirements of UL 1072 for cable tray installation.
 - (b) The jacket shall be labeled with the name of the manufacturer, year of manufacture, sequential footage numbers to the end of the reel, and all appropriate ratings. In addition, a phase indication shall be provided. Cable shall be provided with one of three phase indications: X, Y or Z. All required labeling shall be provided continuously over the entire length of the cable. Labeling shall be embossed or indented in such a manner that it will remain readable after installation of the cable into conduit using conventional methods.
- (8) **Manufacturers.** The cable shall be manufactured by Kerite or Okonite. No other manufacturers will be accepted.
- B. **Underground Prim Neutral /C-#2 CU, 600V.** The neutral conductor shall be a #2 AWG copper, white cross-linked polyethylene jacket, Type USE-2.
10. **Terminator, 15KV, Prim Cable.** Use 3M cold shrink 7653-S-HSG-4 QT III, one piece silicone rubber termination kit per phase, with a 3M SC0020 stem. Tape shield grounding adapter shall be Cooper #5A2.
11. **Elbow, 15KV, Prim Cable.** Use a Eaton LE215CC07T load break elbow, or Engineer approved equal.
12. **Splice, 15KV, Prim Cable.** Use a 3M Cold Shrink QS-III kit 5513A with 3M CI-2/0 crimp barrel, or Engineer approve equal.
13. **Arrestor, Distribution, 10KV.** Use a Hubbell 2137097324 PDV 100 HD Optima Distribution Arrestor, or Engineer approved equal.
14. **Cut-out 200A with T Fuse.** Use Chance C730-143PB or Engineer approved equal with fuse as specified on the plans.
15. **Pole Mounted, Single Phase Transformers**
 - A. **Material of Construction.**
 - (1) All materials shall be new. No rebuilt or reconditioned materials shall be used.
 - (2) Each transformer shall be provided with a mild steel tank and cover.
 - (3) Cover clamp and cover clamp bolt shall be constructed of stainless steel.
 - (4) Cover clamp nut shall be constructed of bronze.
 - (5) The name plate shall be anodized aluminum or stainless steel.
 - (6) Primary and secondary windings shall be constructed of copper or aluminum conductors.
 - (7) The cooling liquid shall be PCB free mineral oil.
 - (8) All surfaces shall be finished with a two-coat system comprised of an epoxy primer with light gray alkyd finish.
 - B. **Construction Features.**
 - (1) The transformer shall be a liquid cooled; single phase transformer housed in a standard tank designed for pole mounting.
 - (2) The transformer shall comply with all applicable ANSI standards, including but not limited to:
 - (a) C57.12.00 - IEEE Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.
 - (b) C57.12.20 - Overhead-Type Distribution Transformers, 500 KVA and Smaller: High Voltage, 34500 Volts and Below: Low Voltage, 7970/13800Y Volts and Below.

- (c) C57.12.31 - Pole Mounted Equipment - Enclosure Integrity
 - (d) C57.12.35 - Bar Coding for Distribution Transformers.
 - (e) C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
 - (f) C57.91 - Guide for Loading Mineral-Oil-Immersed Overhead and Pad- Mounted Transformers rated 500 KVA and less with 55°C or 65 ° C average winding rise.
- (3) **Tank.**
- (a) The tank shall be ANSI double hanger-bracket style and shall be provided with tank grounding provisions and lift lugs.
 - (b) The name plate shall be laser or mechanically engraved. Name plate format shall conform to ANSI C57.12.00 name plate "A".
 - (c) The tank shall be provided with a recessed bottom to prevent tank damage from irregular surfaces.
 - (d) The tank coating shall be light gray and shall meet ANSI requirements for:
 - (i) Salt Spray
 - (ii) Humidity
 - (iii) Impact
 - (iv) Oil Resistance
 - (v) Ultraviolet Accelerated Weathering
 - (vi) Cross-Hatch Adhesion
 - (vii) Abrasion Resistance (Taber Abraser)
 - (e) The tank shall be provided with a pressure relief device as a means to relieve pressure in excess of normal operating pressure. The venting and sealing characteristics shall be:
 - (i) Cracking Pressure: 10 psig +/- 2 psig
 - (ii) Resealing Pressure: 6 psig minimum
 - (iii) Zero Leakage: From Reseal Pressure to -8 psig
 - (iv) Flow at 15 psig: 35 SCFM minimum
 - (f) The tank shall be provided with an internal marking indicating proper oil level per Section 6.2.3 of ANSI C57.12.20.
- (4) **Primary Connections.**
- (a) The primary shall be designed for a 60 Hertz, 12,470/7,200 Volt, grounded wye distribution system. Transformer primary windings shall be connected in grounded wye (single phase) configuration. All high voltage parts shall be protected and cleaned as necessary to assure that conditions which will not promote high voltage tracking are maintained.
 - (b) Two vertical cover mounted porcelain bushings shall be provided as the high voltage connections.
 - (c) The color of the high voltage bushings shall match Light Gray #70, Munsell Notation 5BG7.0/0.4
 - (d) High voltage bushing terminals shall be tinned to accommodate both aluminum and copper conductors.
 - (e) High voltage terminals shall be sized to accommodate AWG #8 Solid through AWG #2 Stranded conductors.
 - (f) The primary side basic insulation level (BIL) shall be 95 KV.
- (5) **Secondary Connections.**
- (a) The transformer secondary connections shall be designed for a grounded 120/240 Volt or a 240/480 Volt, single phase, three wire distribution system. Three low voltage bushings shall be provided.
 - (b) Low voltage bushing terminals shall be tinned to accommodate both aluminum and copper conductors.
 - (c) Low voltage terminals shall be sized to accommodate AWG #6 Solid through AWG #4/0 – 19 Stranded conductors.

- (d) Internal secondary leads shall be permanently embossed with the letters A, B, C and D per ANSI C57.12.00 and C57.12.20 to provide a means to identify leads for reconnection.
 - (e) The secondary side basic insulation level (BIL) shall be 30 KV.
 - (6) **Transformer.**
 - (a) The transformer shall be a liquid filled transformer. The KVA rating shall be as shown on the drawings.
 - (b) The transformer shall be provided with full capacity high voltage taps at 2.5% above, 5.0% above, 2.5% below and 5.0% below rated voltage. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized when operating the changer, as required in Section 6.2.1 of ANSI C57.12.20.
 - (c) The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings shall be energized to heat the coils and drive out moisture and the transformer will be filled with preheated, filtered, degassed insulating fluid.
 - (d) The core shall be manufactured of burr-free, grain-oriented, silicon steel and shall be precisely stacked to eliminate gaps in the corner joints.
 - (e) The coil shall be insulated with B – stage, epoxy coated, diamond pattern insulating paper which shall be thermally cured under pressure to ensure bonding of conductor and paper.
 - (f) The PCB content of the liquid shall be tested prior to delivery. A written certification of the PCB test results shall be provided to the City. A label indicating the correct PCB content shall be affixed to the exterior of the tank.
 - (7) **Performance.**
 - (a) The transformer manufacturer shall supply a statement of transformer characteristics to the City. The statement shall include "no load" losses, conductor losses at 100% load, total losses and impedance.
 - (8) **Manufacturers.**
 - (a) The manufacturer shall be a company with a minimum of five years successful experience in the design & manufacture of distribution transformers.
16. **Pad Mounted, Single Phase Transformer.**
- A. **Material of Construction.**
 - (1) All materials shall be new. No rebuilt or reconditioned materials shall be used.
 - (2) Each transformer shall be provided with a mild steel tank & cabinet.
 - (3) The cooling liquid shall be PCB free mineral oil.
 - (4) All surfaces shall be finished with a two-coat system comprised of an epoxy primer with light green alkyd finish.
 - (5) All hardware shall be constructed of stainless steel.
 - B. **Construction Features.**
 - (1) General.
 - (a) The transformer shall be a liquid cooled, dead front, pad mounted, single phase transformer.
 - (2) Enclosure:
 - (a) The enclosure shall comply with applicable ANSI standards for enclosures.
 - (b) Provisions for attaching the unit to a concrete pad shall be included in the design, installed at the factory and coated with the unit.
 - (c) Hinged access cover shall be provided, including three point, lever operated door locks with padlock hasps and security bolts per ANSI standards.
 - (3) Primary Connections:
 - (a) The primary shall be designed for a 60 Hertz, 12,470/7,200 Volt, grounded wye distribution system. Transformer primary windings shall be connected in a grounded wye configuration. All high voltage parts shall be protected and cleaned as necessary to assure that conditions which will not promote high voltage tracking are maintained.
 - (b) Two (H1A, H1B) 15KV, 200 ampere, load break bushings and bushing wells meeting IEEE 386 shall be provided for the ungrounded primary connection. Two

- 15KV, 200 ampere, feed-thru inserts (Elastimold #1602A3R or Cooper #LFI 215 or equivalent) shall be installed in the two bushing wells. The bushing wells shall provide a conducting surface for the semi-conducting bushing insert to the tank ground. The bushing wells shall be externally replaceable and externally clamped. Bolts securing the bushing wells to the tank shall not extend more than 0.25 inch beyond the face of the bushing well. Bushing well studs shall be capable of withstanding 25 ft-lb of torque when accessories are installed.
- (c) Hold-down tabs to secure accessories in the bushing well shall be provided. Tabs shall have rounded edges and not extend more than 0.25 inch beyond the face of the bushing well.
 - (d) Two replaceable, insulating parking stands (Elastimold #16SOP or Cooper #ISB 215S or equivalent) shall be installed in the transformer housing. Three 15 KV insulating caps (Elastimold #160DRG or Cooper #LPC 215 or equivalent) shall be installed, one on each parking stand and one on each unused bushing.
 - (e) One 15KV class, 10 MCOV, elbow type lightning arrester (Elastimold #167ESA-12 or Cooper # 3238018C012M or equivalent) shall be provided and installed on the transformer.
 - (f) The load breaking device must be a hot-stick operable assembly with a welded or bolted drip shield on the face of the tank to prevent oil from dripping on any electrical part. The shield shall be a minimum of 4 inches deep and 5 inches long. Bayonet fusing, Cooper Type 4000353C shall be provided for the transformer. Five extra fuses shall be provided to the City. An internal, current-limiting fuse which is designed to operate only on internal fault shall also be provided.
- (4) Secondary Connections:
- (a) The transformer secondary connections shall be designed for a 120/240 Volt or 240/480 Volt, single phase, three wire distribution system, as shown on the construction drawings. Secondary terminals shall consist of 0.625-11 UNC-2A threaded, low voltage bushings, each provided with a four hole "H" spade type connector constructed of tinned bronze or copper. Spades shall comply with ANSI 057.12.25-1981 Figure 4A. Bushings shall be externally clamped and externally replaceable.
- (5) Transformer:
- (a) The transformer shall be a liquid filled transformer with KVA rating as shown on the construction drawings. Hot spots shall not exceed 65 degree C.
 - (b) The ROB content of the liquid shall be tested prior to delivery. A written certification of the ROB test results shall be provided to the City. A label indicating the correct PCB content shall be affixed to the exterior of the tank.
 - (c) Windings shall be designed for 60 KV BIL (primary) and 30 KV BIL (secondary). The transformer shall be equipped with two 2.5% taps above and two 2.5% taps below standard operating voltage. The tap changer handle shall be designed for de-energized operation only.
 - (d) The transformer tank shall be designed to prevent direct contact between the tank and the pad. The tank shall be provided with plugged, threaded fittings which will accommodate gate valve installation at both the top and bottom of the tank.
 - (e) The tank shall be equipped with a pressure relief valve. Placement of the valve shall prevent oil from entering the valve with less than 11 % expansion of the oil above the volume at 25 degrees C. The relief device shall be one of the following:
 - (i) Tomco (Beta-Valve) 1712K-3, 1750K-3 or 1776X, with "Bug Out" disc
 - (ii) Qualitrol 202-030 or 201-020, with "Bug Cap"
 - (f) The tank grounding connector shall be capable of accepting wire in the range of #8 to #2/0 stranded copper.
- (6) Performance:
- (a) The transformer shall be designed to operate continuously with a 55 degree C temperature rise.

(b) The transformer manufacturer shall supply a statement of transformer characteristics to the City. The statement shall include "no load" losses, conductor losses at 100% load, and impedance.

(7) Manufacturers:

(a) The manufacturer shall be a company with a minimum of five years successful experience in the design & manufacture of distribution transformers.

17. Pad Mounted Three Phase Transformer.

A. The three phase pad mounted transformer shall be the same as the single phase pad mounted transformers except six (H1A, H2A, H3A, H1B, H2B, H3B) 15kV, 200 ampere, load break bushings and bushing well meeting IEEE 386 shall be provided with six 15kV, 200 ampere, feed-thru inserts; six replaceable insulating parking stands (Elastimold #16SOP or Cooper #ISB 215S or equivalent) shall be installed in the transformer housing; six 15 kV insulating caps (Elastimold #160DRG or Cooper #LPC 215 or equivalent) shall be installed; six 15kV class, 10 MCOV, elbow type lightning arresters (Elastimold #167ESA-12 or Cooper # 3238018C012M or equivalent) shall be provided and installed on the transformer. The secondary connections shall be designed for a three phase, three/four wire distribution system as specified on the plans.

c. Construction. Construction of items in this Division shall conform to these specifications, applicable Standard Details, all applicable codes and regulations, and accepted industry standards and practices.

1. **Light Poles.** Light poles of all types shall be installed plumb with the bracket arms at right angles to the curb lines. The work shall include the excavation, furnishing, and placing sand backfill and disposal of surplus excavated material.
2. **Bolt-Down Base.** Bolt-down bases shall be constructed when and where shown on the Drawings. Concrete shall be cast in place with the reinforcing steel, conduit elbows, and anchor bolts accurately located and securely tied.
3. **Overhead Line.** Overhead line shall be installed as shown on the Drawings. Overhead line construction shall not impose undue stress on the poles. Pole line shall remain parallel with the right-of-way, and poles shall not be bent or lean due to cable or guy tension. Exposed metal materials shall be protected from corrosion by painting with a zinc-rich paint.

4. Wood Cross Arms.

A. All holes shall be drilled through the centerline of the faces and shall not vary by more than 1/32-inch from the diameters specified herein.

- (1) Size 3-1/2-inch x 4-1/2-inch x 8 ft. (6 pin arm, double dead end to 1370#).
 - (a) Holes drilled in the 4-1/2-inch face shall be 11/16-inch diameter located at the center, and 42-inch each way from center, and 7/16-inch diameter located 19-inch each way from center (5 holes total).
 - (b) Holes drilled in the 3-1/2-inch face shall be 11/16-inch diameter, located 15-inch, 29-1/2-inch, and 44-inch each way from the center (6 holes total).
- (2) Size 3-1/2-inch x 4-1/2-inch x 10 ft. (3 phase switch arm).
 - (a) Holes drilled in the 4-1/2-inch face shall be 11/16-inch diameter located at the center, and 54-inch each way from center, and 7/16-inch diameter located 19-inch each way from center (5 holes total).
 - (b) Holes drilled in the 3-1/2-inch face shall be 11/16-inch diameter, located 15-inch and 56-inch each way from the center (4 holes total).
- (3) Size 5-1/2-inch x 7-1/2-inch x 8 ft. (Single - Dead end to 2550#, double dead end to 4800#).
 - (a) Holes drilled in the 5-1/2-inch face shall be 11/16-inch diameter located at the center, and 42-inch each way from center, and 7/16-inch diameter located 19-inch each way from center (5 holes total).
 - (b) Holes drilled in the 7-1/2-inch faces shall be 11/16-inch diameter, located 15-inch, 29-1/2-inch and 44-inch each way from the center (6 holes total).

5. Overhead Line Insulators.

- A. Suspension – Dead end.
 - (1) Two suspension insulators are required for dead-ending on wood structures. Three suspension insulators are required for dead-ending on steel structures.
- 6. **Primary Cables Installed in Conduit.**
 - A. Preparing Conduits and Manholes. A short time before the cable is to be installed, the conduits shall be tested and cleaned of any obstructions or foreign matter unless the conduits were installed very recently, and it is definitely known that they were properly cleaned and inspected on completion of installation. Where no end bells are provided, the ends of the conduits shall be reamed to prevent damage to the cable during or after installation. Upon completion of inspection, a pulling wire shall be left in each conduit in which a cable is to be installed, for later drawing-in of the wire rope which will be used to pull in the cable.
 - B. Installation of cable involves considerable work in manholes where space is limited and working conditions are imperfect at best. To provide suitable working conditions, especially for the making up of cable joints which requires the utmost in cleanliness on the part of the workman, any accumulated water shall be pumped out, mud and litter should be removed, and the manhole made as clean as reasonably possible.
 - C. Care shall be taken by the Contractor when pulling the cable through the conduit so as not to damage the cable in any way such as by excessive pulling tension or scoring of the sheath on irregularities in the conduit. The Contractor will be permitted to lubricate the cable with a suitable lubricant if he so desires.
 - D. If the cable is found to be defective while being installed or being energized, the defective section of cable shall be removed and replaced by the Contractor.
 - E. New primary cables shall be placed in one of the bottom new outside 4 inch conduits (paid for as part of this contract item). Provide 10 feet of additional primary conductor in each manhole for racking (paid for as part of this contract item). Provide 40 feet of additional primary conductor in each transformer vault for racking (paid for as part of this contract item). The Contractor shall label and tag each conductor in each manhole, transformer vault, pad mounted transformer and switch gear with engraved plastic tags (paid for as part of this contract item).
- 7. **Underground Conductor.** Provide additional of each conductor in each of the following locations:
 - A. Manhole, enough to rack around the interior wall of the structure.
 - B. Handhole, 4 feet from the face of the structure.
 - C. Pole base, 4 feet from the pole handhole.
 - D. Conductors shall be labeled and tagged with engraved plastic tags in each manhole, handhole, and junction box with the following information: circuit voltage and circuit ID (paid for as part of the contract item).
 - E. Alternate connections of lamp lead between red and black and receptacle lead between blue and orange in pole handholes.
- 8. **Transformers.**
 - A. The transformer shall be installed as shown on the plans and in accordance with the requirements of the National Electric Safety Code.
 - B. A ground rod with a minimum length of 8 feet shall be installed at the base of the pole supporting the transformer. An additional ground rod will be installed if required to obtain 25 ohms or less between the transformer tank and ground and between the neutral secondary lug and ground. Minimum ground conductor size shall be AWG #6 solid. All grounding conductors shall be solid copper. Wood molding shall be installed on all grounding conductors.
- 9. **Underground Sec Conductor Splicing.**
 - A. Splices below grade (ie. in manholes or handholes) shall be made using vice connectors and shall be covered with tape as follows:
 - (1) 2 layers of ½ lapped 33+ tape.
 - (2) 2 layers of ½ lapped 130C tape.
 - (3) 2 layers of ½ lapped 33+ tape.

- B. Splices above grade (ie. in pole base or pedestal) can use polaris connectors instead of the below grade splicing method.

- d. **Measurement and Payment.** The completed work as measured for work in this Division will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The prices shall be payment in full for furnishing all labor, equipment, and material, for any necessary grading, excavation, and backfill, for restoration when not paid for separately, and for performing the work complete. In some instances, the City will provide all or part of the materials for work under this Division. In those instances, the Bid Form will so indicate.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.7.001	Wood pole, ___ foot, Class _____, set Det E-200	Each
4.7.002	Cross arm, single, 3-1/2 inch x 4-1/2 inch x ___ foot.....	Each
4.7.003	Cross arm, double, 3-1/2 inch x 4-1/2 inch x ___ foot	Each
4.7.004	One wire rack, bolted	Each
4.7.005	Thimble eye nut, bolted.....	Each
4.7.006	Steel pin and insulator	Each
4.7.007	Suspension, dead end with epoxilator and clamp	Each
4.7.008	Suspension, dead end, with 20-inch extension strap, epoxilator, and clamp	Each
4.7.009	Overhead Sec /C, #4 triplex.....	Foot
4.7.010	Overhead Sec /C, #1/0 triplex.....	Foot
4.7.011	Overhead Prim Line /C, ___ ACSR	Foot
4.7.012	Overhead Prim Neutral /C, ___ ACSR	Foot
4.7.013	Underground Prim Line /C, ___ 1C-#2/0 CU 15 kV	Foot
4.7.014	Underground Prim Neutral, #2 CU, 600 V	Foot
4.7.015	Underground Sec /C, ___ -#___CU U.S.E.	Foot
4.7.016	Arrestor, Distribution Class 10KV	Each
4.7.017	Cutout, 200A with ___ A T fuse	Each
4.7.018	Two Pole Fusible Weather Proof Disconnect Switch ___ amperes	Each
4.7.019	Guy installation for wood pole, Det E-250 , ___ K rating, ___ foot Lead including fiberglass guy strain insulation	Each
4.7.020	Sidewalk guy installation for wood pole, Det E-255 , ___ K rating ___ foot Lead including fiberglass guy strain insulation	Each
4.7.021	Guy installation pole to pole, ___ K rating, including fiberglass guy strain insulation	Each
4.7.022	Ground Assembly for Wood Pole, Det E-205	Each
4.7.023	Terminator, 15 kV, Prim Cable.....	Each
4.7.025	Elbow, 15 kV, Prim Cable	Each
4.7.026	Splice, 15 kV, Prim Cable	Each
4.7.027	Transformer, Pole Mtd, Single Phase, ___ kV, ___/___ V Sec.....	Each
4.7.028	Transformer, Pad Mtd, Single Phase, ___ kV, ___/___ V Sec.....	Each
4.7.029	Transformer, Pad Mtd, Three Phase, ___ kV, ___/___ V Sec	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. Primary Cable Installed in Conduit of numbers and sizes specified will be paid for at the contract unit price bid per lineal foot. Measured from termination to termination.
2. Conductors of the numbers and sizes specified will be paid for at the contract unit price bid per lineal foot.

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DIVISION 4 – UTILITIES

SECTION 4.8

STREET LIGHTING

- a. **Description.** This work consists of furnishing and/or installing the items described below, and includes, but is not limited to, all the necessary labor, materials, tools, and equipment to result in a finished installation.

1. **Applicable Codes and Guides.** The following codes and guides apply to the work in this Division. Depending on the materials and methods, other codes may also apply:
- A. Michigan State Construction Code Act of 1972, as amended
 - B. Michigan Building Code rules, Parts 1-9; Department of Labor
 - C. Michigan Occupational Health Standards for Construction; Michigan Department of Public Health
 - D. Michigan Occupational Safety and Health Act "MIOSHA", Act 154, P.A. 1974 as amended; Michigan Department of Public Health
 - E. Current Standard Specifications for Construction as amended; Michigan Department of Transportation
 - F. OSHA Safety and Health Standards (29 CFR 1926/1910)
 - G. City of Grand Rapids (City) Ordinances and State Rules and Regulations
 - H. National Electrical Safety Code
 - I. National Electrical Code
 - J. Illuminating Engineering Society of North America "IES"

- b. **Materials.** Materials used to construct the street lighting system shall be as specified herein.

1. **Round Tapered Fiberglass Light Poles.** Fiberglass street lighting poles shall be round and hollow with a uniform taper of .15 inches per foot. A Bolt-Down Base meeting the requirement of the Standard Details shall be furnished as a part of the light pole. Wiring access and entrance holes shall be reinforced. The color of the pole shall be contained in the resin and shall be throughout the thickness of the pole.
- A. The inner core of the pole shall be formed by wrapping glass filaments treated in a bonding resin at a relatively wide angle (65° - 85°) to the longitudinal axis of the pole to form a number of layers with alternate layers crossing one another in opposite directions. An outer core section of greater weight than the inner section shall be formed by wrapping a number of relatively narrow bands of filaments treated in a bonding resin at a relatively slight angle (3°-15°) to the longitudinal axis, with alternating bands of filaments crossing each other in opposite directions. The pole shall be cured in an oven. The fiberglass and resin ratio of the pole shall contain at least 65% glass and the balance polyester resin.
 - B. A finish coating of pigmented urethane capable of withstanding exposure to ultraviolet, chemicals, and extreme weather conditions shall be applied to a minimum dry film thickness of one and one-half mils.
 - C. Poles shall be rated for 110 mph with a 30% gust factor AASHTO wind load areas.
 - D. Poles shall have no more than 5% deflection with a 200 lb. top horizontal load and shall withstand a 1200 lb. top vertical load without failure.
 - E. The manufacturer shall warranty the pole against structural failure from natural causes, within the criteria of these specifications, for a period of 20 years.
 - F. The fiberglass pole shall be equipped with the following:

- (1) A handhole with cover and wire entrance hole to be 2 inches by 5 inches.
 - (2) The handhole location shall be 2 feet. above the foundation.
 - (3) The finish shall be smooth.
- G. **Fiberglass Light Pole, 14-Foot.** for Post Top Luminaire.
 - (1) Total length - 14 feet.
 - (2) 14 feet. above foundation.
 - (3) Pole top tenon to be 3 inches diameter x 2-1/2 inches long.
 - (4) Color shall be black.
 - (5) Anchor Base: shall be sized to fit 1-inch anchor bolts on an 11-inch bolt circle.
 - (6) Base cover shall be a two-piece assembly.
- H. **Fiberglass Light Pole, 35-foot Mounting Height and __-foot Mast Arm.**
(Reinforced for Walk-Wait Signal and Banners)
 - (1) Reinforced Fiberglass pole with mast arm shall have the following attributes:
 - (2) Luminaire mounting height of 35-foot with an 8-foot mast arm that has 33-inch rise.
 - (3) Pole shall be designed to support:
 - (a) Two 12-foot mast arm with luminaires weighing 60 lbs. with an effective projected area of 1.2 sq. feet.
 - (b) Two cloth banners (2.5-feet by 7.5-feet) mounted at the top and bottom with the bottom mounted at 15-feet above the base.
 - (c) One fixture weighing 50-pounds on two 1.5-foot arms at 10-foot and 13-foot above the base.
 - (d) One sign with 3-square foot surface with the bottom at 8-foot above the base.
 - (4) Mast arms shall be aluminum, with a tapered elliptical form, and 2-inch slip fitter.
 - (5) Color shall be gray.
 - (6) Anchor plate shall be a slotted design which will accept 1-inch diameter anchor bolts installed on any bolt circle diameter from 13.5-inches to 15-inches.
 - (7) A 4-inch by 12-inch handhole shall be provided 2-feet above the base on the left side of the pole, where left is the left-hand side when facing the street. The handhole shall be equipped with a painted cover and slotted fastener. Covers, fasteners and exposed handhole reinforcement shall be non-metallic.
 - (8) A cast aluminum pole cap shall be installed on the pole. Cap attaching hardware shall not rust or discolor the pole.
 - (9) An aluminum name plate showing the manufacturer's name, model #, date of manufacture and "CITY OF GRAND RAPIDS" shall be permanently attached to each pole above the hand hole.
2. **Bracket Arm and Options.** Bracket arms and other options for fiberglass poles shall be as shown on the Standard Details unless otherwise called for on the Bid Form, Drawings, or in the Special Provisions.
 - A. Bracket arms for wood pole installation shall be as indicated on the Drawings, and shall be the following:
 - (1) 30 inches long, Utility Metals #P200S026, or Engineer approved equal.
 - (2) 8 feet long, Utility Metals #P200S080, or Engineer approved equal.
 - (3) 12 feet long, Utility Metals #D200S120, or Engineer approved equal.
 - (4) 20 feet long, Utility Metals #D200S200, or Engineer approved equal.
3. **Tapered Fluted Fiberglass Post Top Light Pole.** Poles shall be manufactured of filament-wound or spun-cast fiberglass. Pigmentation shall match the exterior color and be solid, uniform and continuous throughout the structure of the pole & base cover. The exterior shall be finished with an UV protective coating which shall be black in color. The protective coating shall have a minimum dry film thickness of 1.5 mils. The finish shall be uniform and consistent for the entire length of the pole and ornamental base cover.
 - A. Shaft Construction:

- (1) The poles shall be round, hollow and evenly tapered along the length of the pole. A mounting height of 12, 16, or 20 feet shall be provided, measured from the bottom of the base plate to the bottom of the exposed portion of the tenon. Sixteen flutes shall be evenly spaced around the pole circumference. Exterior of the pole shall be 5 inches diameter at the base of the tenon.
- (2) A 3.0 inch O.D., 6061-T6 aluminum alloy tenon shall be provided at the top of the pole for attachment of standard, slip-fit luminaires. The exposed portion of the tenon shall be 3 inches long and shall be painted to match the pole.
- (3) The pole shall be designed to be anchor base mounted. Anchor base shall be sized to fit 1-inch anchor bolts on a 13.5-15-inch bolt circle.
- (4) A two inch wide by five inch high handhole shall be provided in the pole at 14 inches above grade. A handhole cover shall be provided with each pole. The cover shall be finished to match the rest of the pole. All covers, fasteners and exposed handhole reinforcement shall be stainless steel or brass.
- B. Ornamental Base Cover
 - (1) Each pole shall be provided with an ornamental, two-piece, base cover. The base cover shall be fabricated of fiberglass reinforced plastic and shall be finished to match the pole. The base cover shall be held in place by hex socket locking screws.
- C. Performance
 - (1) The pole shall be designed with a minimum safety factor of 2. Before the safety factor is applied, the poles shall be designed to withstand a 100 mile per hour wind load with 10% gust factor applied to an effective projected area (E.P.A.) of 1.5 square feet. Deflection of the pole under the design conditions shall not exceed 2.5% of the length; i.e., 3.6 inches for 12 foot poles. Reinforcement shall be provided as necessary to maintain the required design strength and provide required openings.
4. **Ornamental Alum Light Pole, 24-Foot.** Poles, arms, filigree, and base covers shall be manufactured of cast and extruded aluminum. The pole finish shall be factory applied powder coat. The finish shall be uniform and continuous throughout the structure of the pole, arm, and covers. The final coat shall be gloss black in color. The couplings shall be finished to match the pole. Screws and other hardware not otherwise specified shall be bronze. Stainless steel hardware shall be supplied where bronze parts will not provide adequate strength.
 - A. Arm:
 - (1) The arm shall be smooth, round and hollow with an outside diameter of 2.6 ± 0.4 inch. The arm shall terminate in a rectangular section at each end. The rectangular portion shall be 4.0 ± 0.25 inches square and 6.0 ± 2.0 inches high. Two finials shall be installed on each rectangular section. One finial shall be installed vertically on top of each rectangular section. The other two shall be placed on the same axis as the arm. A hand hole/wireway cover shall be provided at each end of the arm. These access points shall be designed so as to provide easy field installation of lamp wire into the pole. Access covers shall prevent water from entering the arm, pole or luminaire. The inside corners of the arm shall be chamfered to prevent damage to lamp wire from sharp corners. Luminaire arms shall be oriented perpendicular with respect to the street and held captive in place.
 - B. Filigree:
 - (1) A filigree shall be provided below the arm. The filigree shall be decorative and shall provide structural support for the arm. Design of the filigree shall be identical to existing poles.
 - C. Shaft:
 - (1) The pole shafts shall be round and hollow.

- (2) The shaft shall be 23.0 feet long. It shall be straight and fluted, with a 6-inch outside diameter to a point 20.0 feet above grade. The remainder shall be smooth and straight with a 3-inch outside diameter.
- (3) One reinforced handhole opening shall be provided at 12 inches above the base plate and at an orientation of 180° clockwise from the street. The handhole shall be of adequate size to allow making electrical connections in the base of the pole.
- (4) A ½ inch, 13 UNC grounding lug shall be provided on the inside of the pole at the handhole level.
- (5) The pole shaft in accordance with the Drawings may include a reinforced junction box for a receptacle. The junction box shall have a weather proof in use cover painted to match the pole.
- (6) The pole shall be designed for anchor base mounting. The base mounting plate shall accept 1 inch diameter anchor bolts installed on any bolt circle from 13.5 inches to 15 inches. Holes shall be orientated at 45°, 135°, 225°, and 315° clockwise from the street.

D. Ornamental Base Cover:

- (1) An ornamental two-piece base cover shall be included with each pole assembly.
- (2) The base cover shall be 20 inches diameter at the base and 35 inches high. The tapered section shall be a concave design similar to existing poles. The base cover shall include appropriate decorative features.
- (3) Removable base covers shall be held in place by hex socket locking screws.

E. Breakaway Banner Bracket and Banner Arms:

- (1) The clamp-on break-away banner brackets for the poles shall consist of two clamp-on assemblies as described herein. The clamp-on assemblies shall be constructed of a suitable non-oxide material and include a connector designed to accept a 1 inch, left-hand, male NPT threaded adapter. The entire assembly shall be painted Black to match the pole after fabrication. All hardware used on the assembly shall be stainless steel.
- (2) A break-away adapter shall be installed in each clamp-on assembly. The adapters shall be machined from aluminum and be provided with a 1 inch, left-hand, male NPT, threaded on one end, and a ¾ inch, right-hand, female NPT threaded on the other. The adapters shall be designed to break when a banner 66 inches by 30 inches is subjected to a wind speed of 50 mph. The adapter shall include a safety wire to prevent the banner arm from falling after the adapter breaks. After machining, the adapters shall be finished to match the pole.

F. Performance:

- (1) The pole and arm shall be designed to support a 100 pound, pendant luminaire mounted at the end of the arm.
- (2) The poles shall be designed to withstand a 100 mile per hour wind load with a 10% gust factor applied to an effective projected area (E.P.A.) of 1.5 square feet. Deflection of the pole under the design conditions shall not exceed 2.5% of the length; i.e., 6.9 inches for 23 foot poles.
- (3) Reinforcement shall be provided as necessary to maintain the required design strength and provide required openings.

5. **Light Pole, 24 Foot Ornamental Aluminum Double Arm.** Poles, arms, filigree, and base covers shall be manufactured of cast and extruded aluminum. The pole finish shall be factory applied powder coat. The finish shall be uniform and continuous across the surface of the pole, arm, and covers. The final coat shall be gloss black in color. The couplings shall be finished to match the pole. Screws and other hardware not otherwise specified shall be bronze. Stainless steel hardware shall be supplied where bronze parts will not provide adequate strength.

A. Arm:

- (1) The arm assembly shall consist of two arms at 180°.

- (2) The arms shall be smooth, round and hollow with an outside diameter of 2.3 ± 0.1 inch. The arm shall terminate in an ovoid section at the shaft end. Two finials shall be installed on the ovoid section. One finial shall be installed vertically on top of the ovoid section as a cover for a handhole/wire way access point. The other shall be placed on the same axis as the arm. The access point shall be designed so as to provide easy field installation of lamp wire into the pole. The access cover shall prevent water from entering the arm, pole, or luminaire. The inside corners of the arm shall be chamfered to prevent damage to lamp wire from sharp corners. The luminaire arm shall be oriented perpendicular with respect to the street and held captive in place.
 - (3) The arm length shall be 3 foot or 4 foot as specified in the Drawings.
- B. Filigree:
- (1) A filigree shall be provided below the arms. The filigree shall be decorative and shall provide structural support for the arm. Design of the filigree shall be identical to existing poles.
- C. Pole Shaft:
- (1) The pole shafts shall be decorative square and hollow and shall have four tracks designed for supporting accessories.
 - (2) The shaft shall be 23.0 feet long. It shall be straight and fluted, with a minimum 5.75 inch decorative fluted outside to a point 20.0 feet above grade. The remainder shall be a 3 inch diameter by 36 inch tenon.
 - (3) The pole shall be designed for anchor base mounting. The base mounting plate shall accept 1 inch diameter anchor bolts installed on a bolt circle of 12 inches. Holes shall be orientated at 0°, 90°, 180°, and 270° clockwise from the street.
 - (4) The shaft shall have an integrated structural base that matches the design of existing poles. The base cover shall be 20 inches in diameter at the base and 43 inches high. One reinforced handhole opening shall be provided at 12 inches above the base plate, and at an orientation of 270° clockwise from the street. The handhole shall be of adequate size to allow making electrical connections in the base of the pole. A removable handhole base cover shall be held in place by hex locking screws.
 - (5) A $\frac{1}{2}$ inch, 13 UNC grounding lug shall be provided on the inside of the pole at the handhole level.
- D. Banner Couplings and Breakaway Banner Arms:
- (1) Two sets of banner arms shall be included with each pole.
 - (2) The banner coupling for the poles shall consist of two track mount assemblies as described herein. The track mount assemblies shall be constructed of a suitable non-oxide material. The entire assembly shall be painted black to match the pole after fabrication. All hardware used on the assembly shall be stainless steel.
 - (3) The banner arm shall be a $1\frac{1}{4}$ inch diameter pipe that is 33 inches long. The banner arm shall be welded to the break-away adapter. A removable ball shaped end cap shall be included with each banner arm.
 - (4) A break-away adapter shall be installed in each track mount assembly. The adapters shall be machined from aluminum. The adapters shall be designed to break when a banner 66 inches by 30 inches is subjected to a wind speed of 50 mph. The adapter shall include a safety wire to prevent the banner arm from falling after the adapter breaks. After machining, the adapters shall be finished to match the pole.
 - (5) The banner arm shall attach to the coupling using a $\frac{1}{4}$ " stainless steel latch pin.
- E. Receptacle:
- (1) The pole shall include a receptacle box with GFCI duplex receptacle and weather proof cast aluminum "in-use" cover.
- F. Performance:
- (1) The pole and arm shall be designed to support two 70 pound, pendant luminaires with a 2.5 square foot EPA, mounted at the end of the arm.

- (2) The poles shall be designed to withstand a 90 mile per hour wind load with a 14% gust factor. Deflection of the pole under the design conditions shall not exceed 2.5% of the length; i.e., 6.9 inches for 23 foot poles.
- (3) Reinforcement shall be provided as necessary to maintain the required design strength at the required openings.

6. **General Specification for LED Luminaires**

A. **Definitions.** Lighting terminology used herein is defined in IES LS-1. See referenced documents for additional definitions.

- (1) Exception: The term “driver” is used herein to broadly cover both drivers and power supplies, where applicable.
- (2) Clarification: The term “LED light source(s)” is used herein per IES LM-80 and TM-21 to broadly cover LED package(s), module(s), and array(s).

B. **References.** The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only. Versions listed shall be superseded by updated versions as they become available.

C. **American National Standards Institute (ANSI)**

- (1) C78.377-2011 (or latest), American National Standard for the Chromaticity of Solid State Lighting Products.
- (2) C82.77-2002 (or latest), American National Standard for Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment.
- (3) C136.2-2014 (or latest), American National Standard for Roadway and Area Lighting Equipment -- Dielectric Withstand and Electrical Immunity Requirements.
- (4) C136.10-2010 (or latest), American National Standard for Roadway and Area Lighting Equipment -- Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing.
- (5) C13.15-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment -- Luminaire Field Identification.
- (6) C136.22-2004 (R2009 or latest), American National Standard for Roadway and Area Lighting Equipment -- Internal Labeling of Luminaires.
- (7) C136.25-2009 (or latest), American National Standard for Roadway and Area Lighting Equipment -- Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures.
- (8) C136.31-2010 (or latest), American National Standard for Roadway Lighting Equipment - Luminaire Vibration.
- (9) C136.37-2011 (or latest), American National Standard for Roadway and Area Lighting Equipment - Solid State Light Sources Used in Roadway and Area Lighting.
- (10) C136.41-2013 (or latest), American National Standard for Roadway and Area Lighting Equipment -- Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver.

D. **American Society for Testing and Materials International (ASTM)**

- (1) B117-11 (or latest), Standard Practice for Operating Salt Spray (Fog) Apparatus.
- (2) D1654-08 (or latest), Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- (3) D523-08 (or latest), Standard Test Method for Specular Gloss.
- (4) G154-06 (or latest), Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

E. **Energy Star.**

- (1) TM-21 Calculator, Rev. 020712 (or latest) <http://www.energystar.gov/TM-21Calculator>

F. **European Union (EU).**

- (1) RoHS 11 Directive 2011/65/EU, on the restriction of the use of certain hazardous substances in electrical and electronic equipment recast.

- G. **Federal Communications Commission (FCC).**
 - (1) 47 CFR Part 15, Telecommunication--Radio Frequency Devices.
- H. **Federal Trade Commission (FTC).**
 - (1) Complying with the Made in USA Standard, December 1998 (<http://business.ftc.gov/advertising-and-marketing/made-usa>).
 - (2) Green Guides, 16 CFR part 260, Guides for the Use of Environmental Marketing Claims.
- I. **Illuminating Engineering Society of North America (IESNA or IES).**
 - (1) DG-4-03 (or latest), Design Guide for Roadway Lighting Maintenance.
 - (2) HB-10-II (or latest), IES Lighting Handbook, 10th Edition.
 - (3) LM-50-13 (or latest), IES Approved Method for Photometric Measurement of Roadway and Street Lighting Installations.
 - (4) LM-61-06 (or latest), IESNA Approved Guide for Identifying Operating Factors Influencing Measured Vs. Predicted Performance for Installed Outdoor High Intensity Discharge (HID) Luminaires.
 - (5) LM-63-02 (R2008 or latest), ANSI/IESNA Standard File Format for the Electronic Transfer of Photometric Data and Related Information.
 - (6) LM-79-08 (or latest), IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.
 - (7) LM-80-08 (or latest), IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources.
 - (8) RP-8-00, ANSI/IESNA American National Standard Practice for Roadway Lighting
 - (9) RP-16-10 (or latest), ANSI/IES Nomenclature and Definitions for Illuminating Engineering.
 - (10) TM-15-11 (or latest), Luminaire Classification System for Outdoor Luminaires.
 - (11) TM-21-11 (or latest), Projecting Long Term Lumen Maintenance of LED Light Sources.
- J. **Institute of Electrical and Electronics Engineers (IEEE).**
 - (1) IEEE C62.41.2-2002 (or latest), IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
 - (2) ANSI/IEEE C62.45-2002 (or latest), IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
- K. **LED Lighting Facts.**
 - (1) Submission Requirements.
<http://www.lightingfacts.com/About/Content/Manufacturers/SubmissionRequirements>
- L. **National Electrical Manufacturers Association (NEMA).**
 - (1) ANSI/NEMA/ANSI C78.377-2008 (or latest), American National Standard for the Chromaticity of Solid State Lighting Products.
- M. **National Fire Protection Association (NFPA).**
 - (1) 70 - National Electrical Code (NEC).
- N. **Underwriters Laboratories (UL).**
 - (1) 1449, Surge Protective Devices.
 - (2) 1598, Luminaires.
 - (3) 8750, Light Emitting Diode (LED) Equipment for Use in Lighting Products.
- 7. **Luminaire Requirements.**
 - A. **General Requirements.**
 - (1) Transmissive optical components shall be applied in accordance with OEM design guidelines to ensure suitability for the environment (e.g., electromagnetic, thermal, mechanical, chemical).
 - (2) Borosilicate or tempered glass optical enclosure is preferred
 - (3) Any plastic materials used in the optical assembly that affect the light output and distribution shall be appropriately heat and UV resistant. Plastic materials shall have

been evaluated and exhibit a Yellowness Index (YI) over the useful life of the product of no more than 30%. YI reference ASTM E313 (ASTM D1925). A list of relevant plastic materials used and the plastic material manufacturer's "YI" data report shall be provided with the bid documents.

- (4) The LED light source(s) and driver(s) shall be RoHS compliant.
 - (5) The luminaire shall accept the voltage or voltage range specified at 60 Hz, and shall operate normally for input voltage fluctuations of plus or minus 10 percent.
 - (6) All internal components shall be assembled and pre-wired using modular electrical connections.
 - (7) The following shall be in accordance with ANSI C136.37. Ingress protection: minimum rating of IP66 for Optical 4.2.7.1 assembly, and IP65 for Electrical components compartment.
- B. Painted or finished luminaire surfaces exposed to the environment.**
- (1) The luminaire shall be powder coated grey.
 - (2) The finish shall exceed a rating of 8 (per ASTM D1654) after 5000 hours of testing per ASTM B117.
 - (3) The finish shall exhibit no greater than 30% reduction of gloss per ASTM D523, after 500 hours of QUV testing at ASTM G154 Cycle 6.
- C. Vibration.**
- (1) All luminaires shall be 3G rated and meet requirements for Level 2 (bridge/overpass) per ANSI C136.31
- D. Thermal management.**
- (1) The luminaire shall start and operate in an ambient temperature range from -30C to 40C.
 - (2) The maximum rated case temperature of driver and other internal components shall not be exceeded when luminaire is operated in ambient temperature range specified.
 - (3) The mechanical design of protruding external surfaces (heat sink fins) shall facilitate hose-down cleaning and discourage debris accumulation.
 - (4) Non-passive means of cooling are not allowed. This includes the use of liquids or other mechanical cooling systems.
- E. Photocontrol receptacle.**
- (1) Receptacle. The luminaires shall be supplied with a 7-pin ANSI C136.41 compliant receptacle with the dimming leads from the driver connected to the receptacle pads and specified in ANSI C136.41.
 - (2) The 7 pin receptacles shall be fully prewired and ANSI C136.41 compliant. The dimmable LED driver shall be connected to the receptacle pads as specified by ANSI C136.41. Connection of the other two pads shall provide screw terminals to allow for future field wire access.
- F. Electrical safety testing.**
- (1) The luminaire shall be listed for wet locations by a U.S. Occupational Safety Health Administration (OSHA) Nationally Recognized Testing Laboratory (NRTL).
- G. Electrical Immunity.**
- (1) The luminaire shall meet the performance requirements specified in ANSI C136.2 for electrical immunity to an enhanced level (10kV/5kA).
 - (2) The surge protection device shall be connected in series with the luminaire load and shall disconnect power at the end of life. Device shall allow no more than 10% of pass-through to surge energy under either differential or common mode surge.
- H. Interference and power quality.**
- (1) The luminaire shall comply with FCC 47 CFR part 15 interference criteria for Class A (nonresidential) digital devices.
 - (2) The luminaire shall comply with section 5.2.5 (luminaires rated for outdoor use) of ANSI C82.77 at full input power and across specified voltage range.

I. Electrical Features.

- (1) The expected life of the LED shall be a minimum of 100,000 hours at 25°C.
- (2) The luminaire's lumen depreciation shall not be less than L80 at 100,000 hours.
- (3) Expected life of the electronic driver of 100,000 hours at a 25°C ambient.

J. Color attributes.

- (1) The Color Rendering Index (CRI) shall be no less than 70.
- (2) The nominal Correlated Color Temperature (CCT) shall be 4000K +/- 8%

K. Identification.

- (1) The luminaire shall have an external label per ANSI C136.15.
- (2) The luminaire shall have an internal label per ANSI C136.22.

L. Mechanical Features.

- (1) The die cast aluminum door frame and housing with the wildlife shield cast into the housing. The luminaire housing and door shall be made of cast aluminum A838, A340, or A380.
- (2) Mast arm mount fixtures shall be adjustable for arms from 1-1/4-inch to 2-inch (1-5/8-inch to 2-3/8-inch O.D.) diameter with 2-bolt clamping mechanism. The mount shall provide adjustability of +/- 5° of tilt.
- (3) Post top mount fixtures shall be for mounting on a 3-inch nominal O.D. by 3-inch tenon.
- (4) Pendant mount fixtures shall mount using a stem that is held captively to the pole arm. Threaded mounting is not permissible.
- (5) Tool-less entry to electrical compartment with 3 station terminal block and quick disconnects.
- (6) Bubble level located inside the electrical compartment for levelling of luminaire during installation.
- (7) All bolts and fasteners shall be stainless steel.

M. End of Life.

- (1) At the end of life of the LED light source, the ability to replace the LED light source or other components allowing for the reuse of the housing is preferred.

N. Quality Assurance.

- (1) Before approval and purchase, the City may request luminaire sample(s) identical to product configuration(s) submitted for inspection. The City may request IES LM-79 testing of luminaire sample(s) to verify performance is within manufacturer-reported tolerances.
- (2) Each luminaire shall be fully assembled and electrically tested before shipment from the factory.

O. Warranty.

- (1) The warranty shall be for a minimum period of 10 years, and shall cover maintained integrity and functionality of the following:
 - (a) The luminaire housing, wiring, and connections, controls, and driver.
 - (b) The LED light source(s)
 - (c) Failure of a single chip on board (COB) or more than 15 percent of individual LEDs constitutes luminaire failure.
 - (d) A 15% reduction in foot candles on the ground constitutes luminaire failure. Field testing will be performed comparing the luminaire in question to other equivalent luminaires.
 - (e) LED driver(s)
- (2) The warranty period shall begin with the date of the invoice to either the City or its LED Installation Contractor.
- (3) The warranty shall cover: cost (labor and equipment) for replacing the luminaire, delivery freight of replacement fixture, and return freight of the failed fixture if required by the manufacturer.

P. Manufacturer Services.

- (1) The manufacturer shall provide installation and troubleshooting support via telephone and/or email though the warranty period.

Q. Eligible Manufacturers.

- (1) Any manufacturer having a minimum of 10 years' experience with the manufacture of LED luminaires and offering products that comply with the required product performance and operation criteria may be considered.
- (2) US point of manufacture is required for luminaires and subassemblies (including LED Boards). Products and subassemblies manufactured in any territory that falls under NAFTA meet this requirement.
- (3) All luminaires of a given type on a project must be from the same manufacturer.

R. Required Submittals.

- (1) A Product Submittal Form with results of the application-based specification shall be submitted for each luminaire that is not on the Qualified Product List (QPL).
- (2) Product cut sheets
 - (a) Luminaire cut sheets
 - (b) Cut sheets for LED light source(s)
 - (c) Cut sheets for LED driver(s)
 - (d) Provide diagrams illustrating light output and input power as a function of control signal.
 - (e) Cut sheets for surge protection device
 - (f) Identify if surge protection failure disables the luminaire.
- (3) Instructions for installation and maintenance
- (4) IES LM-79 luminaire photometric report(s) from an accredited test laboratory.
 - (a) Lumen maintenance calculations and supporting test data (LM-80).
 - (b) Shall be in accordance with LED Lighting Facts guidance.
 - (c) Exception: calculations shall be based on 100,000 hours of operation and average ambient temperature of 25C (TM-21).
- (5) Computer-generated point-by-point photometric analysis of maintained light levels.
 - (a) See Appendices A-1 through A-4 for calculation setup criteria for each fixture.
 - (b) Calculation/measurement points shall be per IES RP-8. Separated vehicular lanes, bikeways, and walkways shall be evaluated separately.
 - (c) Calculations shall be for maintained values, i.e. Light Loss Factor (LLF) < 1.0, where $LLF = LLD \times LDD \times LATF \times MDF$
 - (d) Lamp Lumen Depreciation (LLD) shall be 0.90 or the value calculated in section 0, whichever is lower.
 - (e) Luminaire Dirt Depreciation (LDD) = 0.80
 - (f) Luminaire Ambient Temperature Factor (LATF) = 0.96 or value based upon the average ambient temperature specified in section 0, whichever is lower
 - (g) Material Depreciation Factor (MDF) (aka: Luminaire Component Depreciation Factor) = 1.0 for optics made of glass, 0.90 for optics made of acrylic, and .70 for optics made from polycarbonate.
 - (h) Light Loss Factor calculation shall be detailed in the photometric calculation.
 - (i) Mesopic multipliers (i.e., effective luminance factors) shall not be used. All values shall assume Photopic visual adaptation.
- (6) Submit IES LM-63 format electronic file containing luminous intensity data associated with submitted LM-79 report(s) and used for point-by-point calculations. Summary of reliability testing performed 10.7 for LED driver(s).

8. **Luminaire Types.** Use a below pre-approved fixture, or Engineer approved equal.

Table 4.8-1 Pre-Approved Street Light Fixtures			
Fixture Type	Style	Manufacture	Part Number
A	Cobra Head	American Electric Lighting	ATBS-P30-R2-RFD336035
B	Cobra Head	American Electric Lighting	ATBM-P50-R2-RFD302291
C	Cobra Head	American Electric Lighting	ATBL-C-R2-RFD-302292
D	Cobra Head	American Electric Lighting	ATBL-F-R2-RFD302293
E	Post Top	American Electric Lighting	245L-P55-RFD309214
F	Cobra Head	American Electric Lighting	ATBL-C-R2-RFD30048
G	Cobra Head	American Electric Lighting	ATBL-F-R2-RFD320049
H	Pendant	Holophane	ESL3-P20-TG4-RFD333782
J	Pendant	Holophane	ESL3-P30-TG4-RFD333783
K	Pendant	Holophane	ESL3-PP40-TG4-RFD333784
M	Ornamental Post Top	Holophane	GDV3-P20-GL3-RFD317500
N	Ornamental Post Top	Holophane	GDV3-P30-GL3-RFD317501
P	Ornamental Post Top	Holophane	GDV3-P50-GL3-RFD317906
Q	Ornamental Post Top	Holophane	WAE3-P50-GL5-RFD317417
R	Wall Mount	Holophane	TNLEDMED-PK6-WCR-RFD317416
S	Ceiling Mount	Holophane	TNLEDMED-PK4-CLN-RFD296487

c. Construction.

1. **General.** The location of underground utilities and other obstructions, if shown on the Drawings, although plotted from the best information available, may not be completely accurate. Also, underground obstructions may be encountered which are not shown on the Drawings or are unknown at this time. Locations of conduit and/or cable duct runs shown on the Drawings may have to be adjusted for the above conditions. Abandoned structures which may be encountered, and which would interfere with the conduit or cable duct run shall be removed sufficiently to permit the installation or construction of the conduit or cable duct run. The cost of such removals shall be considered as included in the price bid for the conduit.
 - A. **Fire Hydrants.** Fire hydrants shall be kept accessible for immediate use at all times.
2. **Execution.**

- (1) **Traffic Control.** The Contractor shall maintain traffic in accordance with the Special Provision for Maintaining Traffic.
- (2) **Holding Utility and Street Lighting Poles.** The Contractor shall support utility or street lighting pole(s) which may be located within the construction influence. The Contractor shall provide the necessary materials, labor, and equipment necessary for such support, for adequate compaction of backfill near the pole, and for temporary or permanent guys and anchors. Damage to underground and/or overhead utilities shall be the responsibility of the Contractor. Damaged utilities shall be replaced or repaired by the Contractor as directed by the utility owner.
- (3) **Supporting Underground Utility Lines.** The Contractor shall be responsible for the support of existing underground utility lines.
- (4) **Removal of Existing Street Lighting System.** The Contractor shall remove the street lighting system as noted on the plans or required by the Engineer. This work shall include, but is not limited to, the removal of the following items:
 - (a) Street lighting wiring. Street light poles, cross arms, insulators, dead ends, guys, and anchors.
 - (b) Items removed shall be removed from the site, and disposed by the Contractor, unless shown to be salvaged on the plans or directed to be salvaged by the Engineer.
 - (c) Arrangements for delivery of salvaged materials (as defined by the City ELC Department) shall be made by contacting the Energy Lighting and Communications Department at 616.456.3281.
- (5) **Poles.** Poles shall be installed plumb. Arms shall form a right angle with the adjacent curb, or as shown in the project plans and specifications. The anchor bolts shall be torqued to the manufacture's specifications. Wiring of poles shall be in accordance with the associated wiring detail. The wire used between the fuse holder in the base of the pole and the terminal block in the luminaire shall be individual XHHW insulated conductors or a multi-conductor assembly rated for: outdoor, sunlight, wet locations, and 600V, in-line splicing is not allowed.
- (6) **Luminaires.** Luminaires shall be installed on the light pole bracket arm combination furnished and installed under another item and shall include all the necessary wiring and connections to produce a balanced load with the existing or proposed single-phase three wire circuit with ground in accordance with the manufacturer's recommendations, to give a finished installation.
- (7) **Controls.** The controls, including enclosure and photocell, shall be securely mounted in location shown on the Drawings.

- d. **Measurement and Payment.** The complete work as measured for work in this Division will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for all labor, equipment, and material, for grading, excavation, and backfill, and for restoration, when not paid for separately, all duct, conduit, wire, cable, cable lubricant, ground rods, grounding, removing underground obstructions, and other work necessary to provide a complete installation.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.8.001	Fiberglass light pole, 14-foot.....	Each
4.8.002	Fiberglass light pole, 28-foot mounting height and 8-foot mast arm.....	Each
4.8.003	Fiberglass light pole, 35-foot mounting height and 10-foot mast arm.....	Each
4.8.004	Bracket arm on wood pole, __ foot, Det E-075	Each
4.8.005	Tapered Fluted fiberglass post top light pole.....	Each
4.8.006	Ornamental alum light pole, 24-foot.....	Each
4.8.007	Ornamental alum double arm light pole, 24-foot.....	Each
4.8.008	St Light Type __.....	Each
4.8.009	Light pole Fdn, __-inch dia.....	Each
Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

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DIVISION 4 – UTILITIES

SECTION 4.9

DUCTS AND COMMUNICATIONS

- a. **Description.** This work consists of furnishing and/or installing the items described below, and includes, but is not limited to, all of the necessary labor, materials, tools, and equipment necessary to result in a finished installation.
1. **Applicable Codes and Guides.** The most recent edition of the following codes and guides apply to the work in this Division. Depending on the materials and methods, other codes may also apply:
- A. Michigan State Construction Code Act of 1972, as amended
 - B. Michigan Building Code
 - C. Michigan Occupational Health Standards
 - D. Michigan Occupational Safety and Health Act MIOSHA
 - E. Current Standard Specifications for Construction; Michigan Department of Transportation
 - F. OSHA Safety and Health Standards
 - G. City of Grand Rapids Ordinances
 - H. National Electrical Safety Code
 - I. National Electrical Code
 - J. Illuminating Engineering Society of North America "IES"
2. **Submittals.** The Contractor shall submit data in accordance with the Special Provision for Shop Drawings to show compliance with this special provision, the plans, and the specifications. Standard submittal data sheets shall include conduit, poles, cable, wire, and electrical hardware.
- A. The Contractor shall electronically submit to the Engineer, for review, one complete set of the manufacturer's shop drawings of the equipment and materials prior to ordering materials or starting construction on the street lighting system. The Contractor shall also provide one complete bound set of submittals on paper.
 - B. Upon completion of the work, the Contractor shall submit one electronic and one paper copy of the complete set of each equipment manufacturer's operation, maintenance, service, and repair instructions. The Contractor shall also submit complete parts lists for each item of electrical equipment.
- b. **Materials.** Materials used to construct the Duct and Communications system shall be as specified herein.
1. **Ducts and Communications (General Information).**
- A. Minimum Bending Radius for Conduits:

Table 4.9-1 Minimum Bending Radius	
Conduit Size (in)	Minimum Bending Radius (in)
2	24
3	36
4	60

- A. Pull tape (minimum 1250 pounds tensile strength) shall be placed in all new conduits prior to surface restoration. One string in each bank / lateral shall be replaced with a green, AWG #12 solid conductor, type THWN tracer wire. The tracer wire and strings shall be secured on both ends to prevent accidental removal. Enough tracer wire shall be left in each manhole/handhole to extend to 3 feet above final grade.
- B. Conduit solvent shall be utilized to connect the sections of conduit placed.
- C. General. Conduit for electric use may be either direct buried or concrete encased. Such conduit shall be, insofar as possible, continuous with joints only as necessary and staggered both horizontally and vertically in multiple conduit rows. The conduit shall be laid in a straight line if possible and if bends are necessary, they shall be "long sweep" type. All conduits shall be graded so as to drain into handholes or manholes with no low spots between structures.
- 2. **Concrete Encased Conduit.**
 - A. Concrete encased conduit shall be DB-60, DB-120 or schedule 40 PVC.
 - (1) All concrete for duct encasement shall be Grade 3500 as specified in Division 7.
 - (2) Steel Reinforcement shall be as specified in Division 7.
- 3. **Direct Buried Conduit.**
 - A. Direct buried conduits shall be DB-120 or schedule 40 PVC, unless otherwise noted in the bid form and Drawings.
- 4. **Primary Riser Conduit.** Shall be rigid, galvanized steel conduit as listed in the Bid Form, and shown on the Standard Details. Height of the riser conduit shall be as specified in the bid documents.
- 5. **Secondary Riser Conduit and Cable.** The secondary riser conduit shall be rigid, galvanized steel conduit as listed in the Bid Form and shown on the Standard Details. Cable shall be an approved type as specified.
- 6. **Manholes - Precast Concrete (General Information).** Precast concrete manholes shall be designed by the manufacturer to meet the following design standards:
 - A. ASTM C857-87 and ASTM C858-83 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - (1) Live Load AASHTO HS20-44 Heavy Traffic
 - (2) Live Load Impact Use 24 inches cover → Increase live load by 20%
 - (3) Earth Cover Minimum 24 inches - Maximum 60 inches
 - B. Dimensions shall be the minimum inside dimensions.
 - C. The manhole shall be watertight to within 42 inches of grade.
 - D. One knockout for a 14-inch diameter sump pump crock shall be provided.
 - E. Mastic sealer shall be provided by the manufacturer for the joints/holes, including grade rings and pull-in irons.
 - F. Each manhole shall include the following: One 5/8-inch x 10-foot long - UL listed copperweld ground rod with an all bronze ground rod clamp with a stainless steel bolt. A #2CU U.S.E. XLP green grounding conductor attached to the wall (minimum of two attachments per wall).
 - G. A hook ladder of suitable length, when positioned at the proper climbing angle, and hooked to the bottom grade ring, shall be included as part of this pay item.
 - H. Manholes shall be delivered to the job site and unloaded in good condition. Cracked or otherwise damaged units shall not be accepted, nor shall any reimbursement be made for delivery or pick-up of damaged units.
 - I. Manholes shall be installed so that the floor is level. Compensation for additional depth of manholes will not be paid if the additional depth is required to assure the conduits entering the manhole maintain proper clearance from existing utilities and maintain proper slope towards the manhole.
 - J. Conduits entering the manhole shall be installed in the provided terminators, individually bored holes, or in windows constructed in accordance the project plans and

specifications. Conduits installed in bored holes shall be properly spaced, cut flush with the interior face of the wall and shall be grouted from the inside and outside of the manhole. Conduits shall be sloped toward the manhole.

7. **Mh, Precast Conc, 8 feet by 6 feet by 7 feet.**
- This manhole shall be a standard telecommunications type "J" design, and shall include the following:
 - Sixteen bell-end inserts for 4-inch PVC conduit provided in each wall of the manhole.
 - Eight auxiliary knockouts for 3-inch PVC in each wall.
 - Manhole shall have six (6) pull-in irons with backing plates (7/8-inch hot-dipped galvanized rolled steel U-bolt).
 - Metal bolt anchors for 1/2-inch bolts (five for each 36-inch cable rack stanchion) shall be cast into each wall. Spacing between inserts shall not exceed 24 inches horizontally. Inserts shall be protected during casting to prevent them from filling with concrete.
 - A top opening providing no less than a 39-inch diameter clear opening shall be provided. The top opening shall be centered longitudinally at one end of the manhole.
 - A minimum of one (1) 12-inch interlocking grade ring and two (2) 6-inch interlocking grade rings shall be provided. The grade ring with step shall be constructed of reinforced concrete and shall have a hot-dipped, galvanized step cast into the ring. Steps shall be no closer than 12 inches.
 - Only two 6-inch rings may be used per assembly, and when used, they shall be placed on top of the 12-inch ring(s).
 - Grade rings shall be suitable for use with East Jordan Iron Works model #1220 ring and cover. The minimum top, outside diameter of grade rings shall be 51-inches. The minimum inside diameter shall be 39 inches. The outsides of the rings shall be tapered, and the tops shall include an interlocking depression to prevent horizontal slippage of stacked rings.
 - Sufficient sealing mastic shall be provided with each grade ring to seal the ring to the structure below.
 - A cast iron ring and cover shall be provided with each manhole. The ring and cover shall be manufactured by East Jordan Iron Works and shall be Model 1220C (no alternatives) with the words "Signals & Lighting" cast into the cover ([Detail E-526](#))
8. **Mh, Hardware Package, for 8 feet by 6 feet by 7 feet.** A complete hardware package shall be included with each manhole where indicated on the plans. The hardware shall be hot-dipped galvanized or stainless steel. Cable racking and stanchions shall be installed in accordance with the manufacturer's recommendations. The minimum acceptable hardware package shall include:

Table 4.9-2 Manhole Hardware - Detail E-505	
Quantity (#)	Hardware
100	1/2 inch Hex bolts with washer x 1 3/8 inch, 316 Stainless
20	36 inch cable rack stanchion (Underground Devices #CR36) *
50	Cable Rack Saddle (Underground Devices #3HDS) *
1	Hook Ladder
* The fiberglass hardware package shall be manufactured by Underground Devices, Inc. or Engineer approved equal.	

9. **Mh, Precast Conc, 8 feet by 8 feet by 7 feet.**
- This manhole shall be a standard telecommunications type "A" design, and shall include the following:

- B. Twenty-four bell-end inserts for 4-inch PVC conduit provided in each wall of the manhole.
 - C. Manhole shall have four (4) pull-in irons with backing plates (7/8-inch hot-dipped galvanized rolled steel U-bolt).
 - D. Metal bolt anchors for 1/2-inch bolts (five for each 36-inch cable rack stanchion) shall be cast into each wall. Spacing between inserts shall not exceed 24 inches horizontally. Inserts shall be protected during casting to prevent them from filling with concrete.
 - E. A top opening providing no less than a 39-inch diameter clear opening shall be provided. The top opening shall be centered longitudinally at one end of the manhole.
 - F. A minimum of one (1) 12-inch interlocking grade ring and two (2) 6-inch interlocking grade rings shall be provided. The grade ring with step shall be constructed of reinforced concrete and shall have a hot-dipped, galvanized step cast into the ring. Steps shall be no closer than 12 inches.
 - G. Only two 6-inch rings may be used per assembly, and when used, they shall be placed on top of the 12-inch ring(s).
 - H. Grade rings shall be suitable for use with East Jordan Iron Works model #1220 ring and cover. The minimum top, outside diameter of grade rings shall be 51-inches. The minimum inside diameter shall be 39 inches. The outsides of the rings shall be tapered, and the tops shall include an interlocking depression to prevent horizontal slippage of stacked rings.
 - I. Sufficient sealing mastic shall be provided with each grade ring to seal the ring to the structure below.
 - J. A cast iron ring and cover shall be provided with each manhole. The ring and cover shall be manufactured by East Jordan Iron Works and shall be Model 1220C (no alternatives) with the words "Signals & Lighting" cast into the cover ([Detail E-526](#))
10. **Mh, Hardware Package, for 8 feet by 6 feet by 7 feet.** A complete hardware package shall be included with each manhole where indicated on the plans. The hardware shall be hot-dipped galvanized or stainless steel. Cable racking and stanchions shall be installed in accordance with the manufacturer's recommendations. The minimum acceptable hardware package shall include:

Table 4.9-3 Manhole Hardware - Detail E-520 & E-525	
Quantity (#)	Hardware
160	1/2 inch Hex bolts with washer x 1 3/8 inch, 316 Stainless
32	36 inch cable rack stanchion (Underground Devices #CR36) *
80	Cable Rack Saddle (Underground Devices #3HDS) *
1	Hook Ladder
* The fiberglass hardware package shall be manufactured by Underground Devices, Inc. or Engineer approved equal.	

11. **Mh, Precast Conc, 4 feet by 4 feet by 4 feet.**
- A. This manhole shall be a standard telecommunications type "S" design, and shall include the following:
 - B. Eight bell-end inserts for 4-inch PVC conduit provided in each wall of the manhole.
 - C. Manhole shall have four (4) pull-in irons with backing plates (7/8-inch hot-dipped galvanized rolled steel U-bolt).
 - D. Metal bolt anchors for 1/2-inch bolts (five for each 36-inch cable rack stanchion) shall be cast into each wall. Spacing between inserts shall not exceed 24 inches horizontally. Inserts shall be protected during casting to prevent them from filling with concrete.

- E. A top opening providing no less than a 39-inch diameter clear opening shall be provided. The top opening shall be centered longitudinally at one end of the manhole.
- F. A minimum of one (1) 12-inch interlocking grade ring and two (2) 6-inch interlocking grade rings shall be provided. The grade ring with step shall be constructed of reinforced concrete and shall have a hot-dipped, galvanized step cast into the ring. Steps shall be no closer than 12 inches.
- G. Only two 6-inch rings may be used per assembly, and when used, they shall be placed on top of the 12-inch ring(s).
- H. Grade rings shall be suitable for use with East Jordan Iron Works model #1220 ring and cover. The minimum top, outside diameter of grade rings shall be 51-inches. The minimum inside diameter shall be 39 inches. The outsides of the rings shall be tapered, and the tops shall include an interlocking depression to prevent horizontal slippage of stacked rings.
- I. Sufficient sealing mastic shall be provided with each grade ring to seal the ring to the structure below.
- J. A cast iron ring and cover shall be provided with each manhole. The ring and cover shall be manufactured by East Jordan Iron Works and shall be Model 1220C (no alternatives) with the words "Signals & Lighting" cast into the cover ([Detail E-526](#))
- 12. **Mh, Hardware Package, for 8 feet by 6 feet by 7 feet.** A complete hardware package shall be included with each manhole where indicated on the plans. The hardware shall be hot-dipped galvanized or stainless steel. Cable racking and stanchions shall be installed in accordance with the manufacturer's recommendations. The minimum acceptable hardware package shall include:

Table 4.9-4 Manhole Hardware - Detail E-515	
Quantity (#)	Hardware
40	1/2 inch Hex bolts with washer x 1 3/8 inch, 316 Stainless
8	36 inch cable rack stanchion (Underground Devices #CR36) *
16	Cable Rack Saddle (Underground Devices #3HDS) *
1	Hook Ladder
* The fiberglass hardware package shall be manufactured by Underground Devices, Inc. or Engineer approved equal.	

- 13. **Handholes - Precast Concrete (General Information).** Precast concrete handholes shall be designed by the manufacturer to meet the following design standards:
 - A. ASTM C857-87 and ASTM C858-83 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - (1) Live Load AASHTO HS20-44 Heavy Traffic
 - (2) Live Load Impact Use 24 inches cover → Increase live load by 20%
 - (3) Earth Cover Minimum 24 inches - Maximum 60 inches
 - B. Dimensions shall be the minimum inside dimensions.
 - C. The handhole shall consist of a 4 inch thick concrete round riser section reinforced with welded wire fabric centered in the concrete. An integral concrete base shall be provided as part of the riser section reinforced with welded wire fabric.
 - D. Four knockouts at 90 degrees shall be installed at 20 inches below the top of the riser section and two 1/2 inch diameter lift pin holes shall be installed 16 inches below the top of the riser section.

- E. Each handhole shall include the following: One 5/8-inch x 10-foot long - UL listed copperweld ground rod with an all bronze ground rod clamp with a stainless steel bolt. A #2CU U.S.E. XLP green grounding conductor.
- F. Handholes shall be delivered to the job site and unloaded in good condition. Cracked or otherwise damaged units shall not be accepted, nor shall any reimbursement be made for delivery or pick-up of damaged units.
- G. Handholes shall be installed so that the floor is level. Compensation for additional depth of manholes will not be paid if the additional depth is required to assure the conduits entering the manhole maintain proper clearance from existing utilities and maintain proper slope towards the manhole.
- H. Conduits entering the handhole shall be installed in the provided knockouts, or individually bored holes. Conduits installed in bored holes shall be properly spaced, cut flush with the interior face of the wall and shall be grouted from the inside and outside of the handhole. Conduits shall be sloped toward the handhole.
- 14. **Hh, Precast Conc, 36-inch round by 42-inch deep.**
 - A. A cast iron ring and cover shall be provided with each manhole. The ring and cover shall be manufactured by East Jordan Iron Works and shall be Model 1220C (no alternatives) with the words "Signals & Lighting" cast into the cover ([Detail E-526](#)).
 - B. Design according to [Detail E-530](#).
- 15. **Hh, Precast Conc, 24-inch round by 36-inch deep.**
 - A. A cast iron ring and cover shall be provided with each manhole. The ring and cover shall be manufactured by East Jordan Iron Works and shall be Model 1120C (no alternatives) with the words "Signals & Lighting" cast into the cover ([Detail E-536](#)).
 - B. Design according to [Detail E-535](#).
- 16. **Hh, Polymer, 17-inch by 30-inch.** The handhole shall be designed by the manufacturer to meet the following design standards:
 - A. ANSI/SCTE 77 Standard Practice for Minimum Structural Design Loading for Underground Polymer Concrete Utility Structures.
 - (1) Live Load ANSI/SCTE 77 TIER 15
 - (2) Design/Test Load 15,000/22,500 LBS
 - B. Dimensions shall be the minimum cover dimensions.
- 17. **Cable sec pedestal.**
 - A. The pedestal shall be in accordance with Detail E-560 or Engineer approved equivalent.

c. Construction.

- 1. **General Requirements for Duct and Conduit**
 - A. Before the acceptance of conduit by the Engineer, the Contractor shall pull a cleaning device through the conduit to remove any foreign material from the conduit.
 - B. Should any conduit be installed with "dead ends," i.e., not connected to structures at either end, such "dead ends" shall be carefully plugged.
 - C. If available, standard bell sections shall be installed at all duct entrances to handholes, manholes, etc.
 - D. In instances where obstructions are found which will interfere with the duct construction, the Engineer may allow the formation of ducts to be modified to circumvent the obstruction by installing ducts above, below, or around the obstruction with a 1-inch separation between the concrete encasement and the obstruction.
 - E. Conduit shall be run straight between structures i.e., handhole, manhole or building. (a total sum of 90 degrees of bend is allowed in a service lateral. Bends shall be factory made. (No field bending.)
 - F. Conduit shall be sloped toward structures at all points to prevent water from accumulating in the conduit, (no "low points".) When obstructions are encountered which require extra depth, the extra depth and slope shall be maintained until the next structure, i.e.,

handhole, manhole or building. Payment for extra depth required to avoid conflicts and maintain slope shall be included in the unit cost for the duct bank. No extra payment shall be made.

- G. Encasement must be kept at least 12 inches away from watermain when crossing over a water main.
 - H. Duct banks shall not be "splayed" to avoid conflicts without prior approval of the city.
 - I. Pull tape shall be placed in all new conduits prior to surface restoration, minimum 1250 tensile strength. One string in each bank/lateral shall be replaced with a green, AWG #12 solid conductor, type THWN tracer wire. The tracer wire and strings shall be secured on both ends to prevent accidental removal. Enough tracer wire shall be left in each manhole/handhole to extend to 3 feet above final grade.
 - J. Conduits shall enter structures through duct windows, cast-in terminators, or cored holes.
 - K. The Contractor shall maintain street lighting within the project limits throughout the project duration.
 - L. Backfilling around structures shall be in 1 foot lifts of class II sand or by flowable fill. Safety of the excavation may dictate the use of flowable fill.
 - M. The Contractor shall protect the footings and foundations of adjacent structures.
 - N. Connections and disconnections of lighting circuits to the Street Lighting System shall be coordinated with and performed by the City Energy, Lighting, & Communications (ELC) Department.
 - O. Conduit solvent shall be utilized to connect the sections of conduit placed.
 - P. Under certain conditions the Engineer may allow deflections or slight field bending. This work may only be done in the presence of this Engineer.
2. **Direct Buried Conduit.**
- A. Conduits shall be installed with minimum cover of 36-inches in a roadway section and may be installed with 24-inch cover if outside the roadway and if they are to be used with circuits rated for less than 600V.
3. **Concrete Encased Conduit.**
- A. Such conduits shall have a minimum 24-inch cover over the top of the encasement. The earth walls of the trench may be used to serve as forms for the concrete encasement except at open excavation around manholes or other structures where special concrete forms are necessary. All forms shall be securely braced to prevent spreading and shall be constructed of structurally sound lumber placed to provide a 3-inch concrete envelope on all sides.
 - B. The duct shall be placed on base-type spacers and shimmed to get 3 inch of concrete below the formation. Spacers are to be placed every 6 feet. Once the first layer or tier of ducts is laid, intermediate spacers shall be used for succeeding tiers of duct until formation is complete. All spacers are to be interlocked both horizontally and vertically with the spacer adjacent. Once duct formation is complete, the entire assembly shall be securely tied together with wire anchored by 5/8-inch reinforcing rods to avoid movement during concrete pour.
 - C. The concrete encasement shall be Grade 3500 with 17A aggregate. The concrete shall be fluid enough to allow it to flow between the ducts to eliminate all possible voids. Vibrate the concrete as it is poured. Neatly finish off and square the top of the concrete at the proper grade making sure there is 3-inch of concrete over the top of the ducts.
 - D. In instances where obstructions are found which will interfere with the duct construction, the Engineer may allow the formation of ducts to be modified to circumvent the obstruction by installing ducts above, below, or around the obstruction with a 1-inch separation between the concrete encasement and the obstruction.

- d. Measurement and Payment.** The completed work as measured for work in this Division will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The prices shall be payment in full for furnishing all labor, equipment, and material, for any necessary grading, excavation, and backfill, for restoration when not paid for separately, and for performing the work complete. In some instances, the City will provide all or part of the materials for work under this Division. In those instances, the Bid Form will so indicate.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
4.9.001	Mh, Precast Conc, __ feet by __ feet by __ feet.....	Each
4.9.002	Mh, Hardware Package, for __ feet by __ feet by __ feet	Each
4.9.003	Hh, Precast Conc, 36-inch round by 42-inch deep	Each
4.9.004	Hh, Precast Conc, 24-inch round by 36-inch deep	Each
4.9.005	Hh, Polymer, 17-inch by 30-inch.....	Each
4.9.006	Cable sec pedestal	Each
4.9.007	DB Conduit, __ , __ inch, schedule __ PVC	Foot
4.9.008	Conc Encased Conduit, __ , __ in, schedule 40 PVC	Foot
Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

DIVISION 5 – HOT MIX ASPHALT PAVEMENT

SECTION 5.1 HOT MIX ASPHALT

SECTION 5.2 HOT MIX ASPHALT ACCEPTANCE

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DIVISION 5 – HOT MIX ASPHALT PAVEMENT

SECTION 5.1

HOT MIX ASPHALT

- a. **Description.** This work shall consist of furnishing and placing an HMA mixture using Superpave Mixture Design and Marshall Mixture Design Methods. The HMA mixture shall be provided according to the requirements of Division 5 of the Michigan Department of Transportation (MDOT) Standard Specifications for Construction except as modified by this Section.
1. **Equipment.** Equipment to be used for placing HMA pavements shall conform to the requirements of the current MDOT Standard Specifications for Construction.
- b. **Materials.**
1. **Superpave Mix Design.** The HMA mixture design will be provided by the Contractor in accordance with Section 501 of the current MDOT Standard Specifications for Construction. The design will be submitted and evaluated according to the MDOT HMA Production Manual.
2. **Marshall Mix Design.** ([SPI 5.1.A](#)) The design will be submitted and evaluated according to the MDOT HMA Production Manual. Use a 50 blow Marshall hammer when compacting mixtures for developing Marshall mix designs.
3. **Recycled Mixtures.** Substituting reclaimed asphalt pavement (RAP) for a portion of the new material required to produce HMA mixture is allowed provided that the mixture is designed and produced to meet all criteria specified in the MDOT Standard Specifications for Construction, unless otherwise prohibited. RAP materials must be in accordance with the MDOT Standard Specifications.
4. **Temporary Mixtures.** Temporary HMA pavement materials shall be any HMA mixture approved by the Engineer as described in Division 5 of the MDOT Standard Specifications for Construction, or as specified in project Special Provisions.
5. **HMA Bond Coat.** When specified, shall conform to the current requirements of the MDOT Standard Specifications for Construction. Bond coat will be Low-Tracking Bond Coat Emulsified Asphalt, LTBC-1 unless otherwise specified.
6. **Hand Patching.** Hand patching shall be HMA, 13A/36A/EL for Top and Leveling Courses and HMA, 13A/3C for Base Course unless otherwise called out on the Drawings or as Directed by the Engineer.
- c. **Construction.** Construction methods to be used for placing HMA mixtures shall conform to the requirements of the current MDOT Standard Specifications for Construction except as noted herein. The Contractor shall give 24 hours-notice to the Engineer prior to beginning the paving operation in order that the Engineer may make arrangements for inspectors and testing personnel to be on hand during the paving operation. When a wedging course is specified, it shall be placed before the top course or leveling course is applied in order to eliminate the uneven street surface. The thickness will vary from zero on the high spots to the thickness necessary to eliminate the uneven surface.
1. **Pre-Production Meeting.** HMA placement procedures shall be reviewed at a HMA pre-production meeting. HMA construction practices including, but not limited to, materials, equipment, preparation of existing pavement, bond coat, transportation of mixtures, placing HMA, rolling, and weather and seasonal limitations shall be discussed as well as traffic control, emergency access, communication with local residents and businesses and work hours. The date and time of the meeting will be established by the Contractor such that the meeting will be held at least 7 days prior to start of HMA paving operations.
- A. An HMA pre-production agenda will be sent by the Engineer to required attendees in advance of the meeting. Required attendees include the Contractor, HMA Paving

Contractor, HMA Paving Contractor's foreman, HMA Producer if different from HMA Paving Contractor, Engineer's Testing Agency, Engineer's Inspector, and the Engineer.

2. **Preparation of Foundation.** The MDOT Standard Specifications for Construction shall be changed or modified in part by the following:
 - A. For the purpose of making joints at intersections, sections of the existing HMA pavement varying in width from six to eight feet adjacent to the proposed joint shall be removed as approved by the Engineer, unsuitable or defective HMA surfaces shall be removed. The work shall be paid for at the contract unit price bid per square yard on the Bid Form under the item Coldmill HMA Pavt inch, as specified in Section 2.3, which price shall be payment in full for the removal and disposal of the HMA pavement and shall include all costs in connection therewith and incidental thereto.
 3. **Placing of Leveling and Top Course Mixtures** as specified in the current MDOT Standard Specifications for Construction shall be changed or modified in part to the following:
 - A. Unless otherwise approved by the Engineer paving of all HMA surfaces shall take place in a manner that eliminates all longitudinal joints between the edges of the pavement by use of echelon paving. In addition to all project requirements for material and placement, multiple pavers and supporting rolling operations shall be used to place multiple-pass pavement courses. The individual pavers shall be located within a maximum distance of 100 feet of each other during paving, or as approved by the Engineer. Rolling and compaction of the joint shall not take place until adjoining mats have been placed. Both mats shall be placed to the same loose thickness at the joint prior to compaction. One longitudinal joint in the center of the roadway to facilitate maintaining traffic on the roadway and no transverse joints will be permitted unless approved by the Engineer.
 - B. When approved by the Engineer, all construction and transverse joints in the top course shall be close knit, conforming to the required crown and grade, and without an excess of coarse aggregate exposed. Each day's run of top course shall cover the entire width of the street unless otherwise permitted by the Engineer. All longitudinal joints left open to traffic shall be painted with bond coat when work is resumed at such joints. All transverse joints shall be trimmed to a straight line and painted with bond coat before work is resumed.
 - C. When the mixture is to be spread by hand at intersections and other places inaccessible to a machine, the resulting pavement shall have the same appearance as the adjoining pavement which was machine laid. It shall conform to the crown and grade required without an excess of coarse aggregate on the surface.
 - D. All materials shall be shoveled and not dumped from the truck when hand work is required and shall be placed to grade with a minimum of raking or luting. Use of the lute for final shaping is required. Shovelers shall not distribute the material any faster than it can be properly handled by the rakers. The rakers will not be permitted to stand in the hot mixture while raking, except to correct an error.
- d. **Measurement and Payment.** The completed work as measured for HMA Mixtures will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard) or for those contract items (pay items) listed in the Bid Form or Special Provisions. The price shall be payment in full for furnishing all labor, equipment and material and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid herein, and as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
5.1.001	Temp HMA Pavt	Ton
5.1.002	HMA, 2C	Ton
5.1.003	HMA, 3C	Ton
5.1.004	HMA, 4C	Ton

5.1.005	HMA, 13A	Ton
5.1.006	HMA, 36A	Ton

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
5.1.101	HMA, 2E	Ton
5.1.102	HMA, 3E	Ton
5.1.103	HMA, 4E	Ton
5.1.104	HMA, 5E	Ton
5.1.105	HMA, (type), High Stress	Ton
5.1.106	HMA, Approach	Ton
5.1.107	Hand Patching	Ton

- HMA Mixtures shall be measured in tons of pavement constructed at the weight per square yard noted in the Bid Form item, unless otherwise specified.
- HMA mixtures to be used for wedging shall be measured in tons of wedging material placed.
- Various tests will be performed on the HMA material and price adjustments will be made to the affected materials according to those described in the current MDOT Standard Specifications for Construction.
- Low-tracking bond coat** emulsified asphalt and **echelon paving** shall be considered included with the City and MDOT Standard Pay Items.
- For the leveling and top courses when measured and paid for in tons, the Contractor will not be paid for any tonnage of material placed that exceeds the number of tons of material authorized to be placed by more than 5%. The number of tons authorized to be placed will be computed by measuring the number of square yards of material actually placed by the Contractor and accepted by the Engineer and multiplying that number by the weight per square yard specified in the Bid Form, on the Drawings, or as approved by the Engineer. Any material placed in excess of this 5% tolerance will be at the Contractor's expense unless approved by the Engineer based on specific justification provided by the Contractor.
- The changes and modifications noted herein were made to adapt to the current MDOT Standard Specifications for Construction, to meet local conditions and not to downgrade or produce a finished job of lesser quality and stability than would be produced otherwise. Any overlapping or conflict between MDOT Standard Specifications for Construction and the changes and modifications noted in these specifications shall be so construed as to work to the advantage of the City so that the completed work is of the highest quality.
- Temp HMA Pavt** shall be payment in full for all labor, equipment, and material necessary to place and remove the entire cross-section, including 4 inch aggregate base, and **Temp HMA Pavt** as directed by the Engineer. The Contractor shall only be paid for **Temp HMA Pavt** when so required by the Engineer to place such materials. The Contractor shall not be paid for these items when used for the Contractor's convenience
- When **Hand Patching** is not included on the Bid Form it shall be considered included in other HMA items.
- When **HMA, Approach** is not included on the Bid Form it shall be considered included in other HMA items. The material for all intersection approaches is included in the main line paving quantities and will not be paid for as a separate item.

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DIVISION 5 – HOT MIX ASPHALT PAVEMENT

SECTION 5.2

HOT MIX ASPHALT ACCEPTANCE

- a. **Description.** This special specification provides acceptance testing requirements for HMA mixtures. The HMA mixture shall be provided to meet the requirements of the City of Grand Rapids Standard Construction Specifications.
- b. **Materials.** Aggregates, mineral filler (if required), and asphalt binder shall be combined as necessary to produce a mixture proportioned within the master gradation limits shown in the project documents and meeting the uniformity tolerances listed in [Table 5.2-1](#).

Table 5.2-1 Uniformity Tolerance Limits for HMA Mixtures						
Parameter			Top and Leveling Course		Base Course	
Number	Description		Range 1 (a)	Range 2	Range 1 (a)	Range 2
1	% Binder Content		-0.30 to +0.40	+/- 0.50	-0.30 to +0.40	+/- 0.50
2	% Passing	# 8 and Larger Sieves	+/- 5.0	+/- 8.0	+/- 7.0	+/- 9.0
		# 30 Sieve	+/- 4.0	+/- 6.0	+/- 6.0	+/- 9.0
		#200 Sieve	+/- 1.0	+/- 2.0	+/- 2.0	+/- 3.0
3	Crushed Particle Content (b)		Below 10%	Below 15%	Below 10%	Below 15%
a. This range allows for normal mixture and testing variations. The mixture must be proportioned to test as closely as possible to the Job-Mix-Formula (JMF).						
b. Deviation from JMF.						

1. Parameter number 2 as shown in [Table 5.2-1](#) is aggregate gradation. Each sieve will be evaluated on one of the three gradation tolerance categories. If more than one sieve is exceeding Range 1 or Range 2 tolerances, only the one with the largest exceedance will be counted as the gradation parameter.
 2. The master gradation should be maintained throughout production; however, price adjustments will be based on [Table 5.2-1](#). Aggregates which are to be used in plant-mixed HMA mixtures must not contain topsoil, clay, or loam.
- c. **Construction.** Submit a Mix Design and a JMF to the Engineer. Do not begin production and placement of the HMA until receipt of the Engineer's approval of the JMF. Maintain the binder content, aggregate gradation, and the crushed particle content of the HMA mixture within the Range 1 uniformity tolerance limits in [Table 5.2-1](#). For mixtures meeting the definition of top or leveling course, field regress air void content to 3.5 percent with liquid asphalt cement unless specified otherwise on HMA application estimate. For mixtures meeting the definition of base course, field regress air void content to 3.0 percent with liquid asphalt cement unless specified otherwise on HMA application estimate.
1. For production/mainline type paving, the City will obtain a minimum of two samples, each day of production, for each mix type. The Engineer will sample and maintain possession of the sample. Sampling from the paver hopper is prohibited. Each sample will be divided into two

parts with one part being for initial testing and the other part being held for possible dispute resolution testing. Obtain a minimum of three samples for each mix type regardless of the number of days of production.

2. Obtain samples that are representative of the day's paving. Sample collection is to be spaced throughout the planned tonnage. One sample will be obtained in the first half of the tonnage and the second sample will be obtained in the second half of the tonnage. If planned paving is reduced or suspended, when paving resumes, the remaining sampling must be representative of the original intended sampling timing.
3. Material acceptance testing will be completed by the Engineer within 14 calendar days, except holidays and Sundays, for projects with less than 500 tons (plan quantity) of HMA and within 7 calendar days, except holidays and Sundays, for projects with 500 tons (plan quantity) or more of HMA, after the Engineer has obtained the samples. Failure on the part of the Engineer or the laboratory to provide QA test results within the specified time frame does not relieve the Contractor of their responsibility to provide an asphalt mix within specifications.
4. For production/mainline type paving, the mixture may be accepted by visual inspection up to a quantity of 50 tons per mixture type, per project (not per day). For non-production type paving defined as driveways, approaches, and patching, visual inspection may be allowed regardless of the tonnage.
5. The mixture will be considered out-of-specification, as determined by the acceptance tests, if for any one mixture, two consecutive tests per parameter, (for Parameter 2, two consecutive aggregate gradations on one sieve) are outside Range 1 or Range 2 tolerance limits. If a parameter is outside of Range 1 tolerance limits and the second consecutive test shows that the parameter is outside of Range 2, then it will be considered to be a Range 1 out-of-specification. Consecutive refers to the production order and not necessarily the testing order. Out-of-specification mixtures are subject to a price adjustment per the Measurement and Payment section of this specification.
6. Contractor operations will be suspended when the mixture is determined to be out-of-specification, but contract time will continue to run. Submit a revised JMF or proposed alterations to the plant and/or materials to achieve the JMF to the Engineer. Effects on the Aggregate Wear Index (AWI) and mix design properties will be taken into consideration. Production and placement cannot resume until receipt of the Engineer's approval to proceed.
7. Pavement in-place density tests will be completed by the Engineer during paving operations and prior to traffic staging changes. Pavement in-place density acceptance testing will be completed by the Engineer prior to paving of subsequent lifts and being open to traffic.
8. Use of a nuclear density gauge requires measuring the pavement density using the Gmm from the JMF for the density control target. The required in-place density of the HMA mixture must be 92.0 to 98.0 percent of the density control target.

d. Measurement and Payment. The completed work shall be included in the items to place HMA pavement.

1. If acceptance tests, as described in section c. of this specification, show that a [Table 5.2-1](#) mixture parameter exceeds the Range 1, but not the Range 2, tolerance limits, that mixture parameter will be subject to a 10 percent penalty. The 10 percent penalty will be assessed based on the acceptance tests only unless the Contractor requests that the sample part retained for possible dispute resolution testing be tested. The Contractor has 4 calendar days from receipt of the acceptance test results to notify the Engineer, in writing, that dispute resolution testing is requested. If taken, the Contractors QC test results for the corresponding

QA test results must result in an overall payment greater than QA test results otherwise the QA tests will not be allowed to be disputed. The Engineer has 4 calendar days to send the dispute resolution sample to the lab once dispute resolution testing is requested. The dispute resolution sample will be sent to an independent lab selected by the City, and the resultant dispute test results will be used to determine the penalty per parameter, if any. Ensure the independent lab is a MDOT QA/QC qualified lab or an AMRL HMA qualified lab. The independent lab must not have conflicts of interest with the Contractor or City. If the dispute testing results show that the mixture parameter is out-of-specification, the Contractor will pay for the cost of the dispute resolution testing and the contract bid price for the material will be adjusted, based on all test result parameters from the dispute tests, as shown in [Table 5.2-2](#) and [Table 5.2-3](#). If the dispute test results do not confirm the mixture parameter is out-of-specification, then the City will pay for the cost of the dispute resolution testing and no price adjustment is required.

2. If acceptance tests, as described in section c. of this specification, show that a [Table 5.2-1](#) mixture parameter exceeds the Range 2 tolerance limits, the sample part retained for possible dispute resolution testing will be sent, within 4 calendar days, to an independent lab for further testing. The independent lab's test results will be used to determine the penalty per mixture parameter, if any. If the independent lab's results do not confirm the mixture parameter is out-of-specification, then no price adjustment is required. If the independent lab's results show that the mixture is out-of-specification and the Engineer approves leaving the out-of-specification mixture in place, the contract base price for the material will be adjusted, based on all parameters, as shown in [Table 5.2-2](#) and [Table 5.2-3](#).
3. In the case that the Contractor disputes the results of the test of the second sample obtained for a particular day of production, the test turn-around time frames given would apply to the second test and there would be no time frame on the first test.
4. In all cases, when penalties are assessed, the penalty applies to each parameter, up to two parameters, that is out of specification.

Table 5.2-2 Penalty Per Parameter		
Mixture Parameter out-of-Specification per Acceptance Tests	Mixture Parameter out-of-Specification per Dispute Resolution Test Lab	Price Adjustment per Parameter
No	N/A	None
Yes	No	None
	Yes	Outside Range 1 but not Range 2: decrease by 10%
		Outside Range 2: decrease by 25%

5. The quantity of material receiving a price adjustment is defined as the material produced from the time the first out-of-specification sample was taken until the time the sample leading to the first in-specification test was taken.
6. Each parameter of [Table 5.2-1](#) is evaluated with the total price adjustment applied to the contract base price based on a sum of the two parameter penalties resulting in the highest total price adjustment as per [Table 5.2-3](#). For example, if three parameters are out-of-specification, with two parameters outside Range 1 of [Table 5.2-1](#) tolerance limits, but within Range 2 of [Table 5.2-1](#) limits and one parameter outside of Range 2 of [Table 5.2-1](#) tolerance limits and

the Engineer approves leaving the mixture in place, the total price adjustment for that quantity of material is 35 percent.

Table 5.2-3 Calculating Total Price Adjustment		
Cost Adjustment as a Sum of the Two Highest Parameter Penalties		
Number of Parameters Out-of-Specification	Range(s) Outside of Tolerance Limits of Table 5.2-1 per Parameter	Total Price Adjustment
One	Range 1	10%
	Range 2	25%
Two	Range 1 and Range 1	20%
	Range 1 and Range 2	35%
	Range 2 and Range 2	50%
Three	Range 1, Range 1 and Range 1	20%
	Range 1, Range 1 and Range 2	35%
	Range 1, Range 2 and Range 2	50%
	Range 2, Range 2 and Range 2	50%

DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.1 CONCRETE, GROUT, MORTAR AND FLOWABLE FILL

SECTION 6.2 CONCRETE PAVEMENTS

SECTION 6.3 CONCRETE CURB AND GUTTER

SECTION 6.4 CONCRETE SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND APPROACHES, AND
ALLEY PAVEMENT AND APPROACHES

SECTION 6.5 QUALITY CONTROL AND ASSURANCE FOR CONCRETE

SECTION 6.6 BRICK PAVEMENTS

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DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.1

CONCRETE, GROUT, MORTAR, AND FLOWABLE FILL

- a. **Description.** This work consists of furnishing and/or installing the items described below, and includes; but is not limited to, all the necessary labor, materials, tools, and equipment necessary to result in a finished installation.
1. Concrete, grout, mortar, and flowable fill shall consist of mixtures of Air-Entraining Portland Cement, fine aggregate, coarse aggregate and water combined in the proportions specified for the various grades of concrete and other products. The concrete, grout, mortar and flowable fill shall be provided according to the requirements of Division 6 and Division 10 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction except as modified by this Section.
- b. **Materials.** Materials shall be in accordance with the current MDOT Standard Specifications for Construction, project Special Provisions and as specified herein.
1. **Portland Cement Concrete Mixtures for use in Pavement, including Alleys, Sidewalks and Ramps.**
 - A. The Contractor shall provide materials in accordance with Section 1004 of the current MDOT Standard Specifications for Construction. Concrete Grade 3000, 3500HP, 3500 and 3000 as specified, or as show on the Standard and Project Details.
 2. **Portland Cement Concrete for use in Structures including, Reinforced Concrete Structures, Curb and Headers.**
 - A. The Contractor shall provide materials in accordance with Section 1004 of the current MDOT Standard Specifications for Construction. Concrete Grades 3000, 3500, 4000, 4000HP, as specified, or as show on the Standard and Project Details.
 3. **Grout and Mortar.**
 - A. The Contractor shall provide materials in accordance with Section 1005 of the current MDOT Standard Specifications for Construction. Mortar or Grout Type R-1 (Grout), R-2 (Mortar) and R-3 (Mortar) as specified, or as show on the Standard and Project Details.
 4. **Flowable Fill.** Flowable fill shall consist of a mixture of Portland cement, fly ash, sand (2NS) and water. Use materials conforming to the standard specifications except as modified below. All non-structural flowable fill is intended to be removable using conventional mechanical excavation methods.
 - A. Use Type I Portland cement conforming to Section 901 of the MDOT Standard Specifications for Construction and Class F or C fly ash as specified by ASTM C618 except that there is no limit on loss on ignition.
 - B. Produce a mix of cement, fly ash, sand and water in the following proportions.
 - (1) Portland Cement 50 lb/cyd.
 - (2) Fly Ash 500 lb/cyd.
 - (3) Sand 2850 lb/cyd.
 - (4) Water approx. 376 lb/cyd. (sufficient to produce desired flowability)
 5. **Lightweight/Low Density Cellular Concrete Flowable Fill.** Use Cement and Fly Ash in accordance with Section b.4. Provide LDCC mixture with following properties.
 - A. Cast Density Range, 35-45 pounds per cubic foot.
 - B. Minimum Compressive Strength (28 Days), 200 pounds per square inch.
 - C. Flow Consistency, greater then 7 inches per ASTM D6103.
 6. **Water.** The water to used for mixing and curing the concrete shall be taken from the City's water main or other source approved by the Engineer.
 7. **Reinforcing Steel.** In accordance with Section 905 of the current MDOT Standard Specifications for Construction.

8. **Expansion Joint Material.** In accordance with Section 914 of the current MDOT Standard Specifications for Construction.
- c. **Construction.** In accordance with sections 602, 603, 1004 and 1005 of the current MDOT Standard Specifications for Construction and as specified herein.
1. **Protection and Curing.**
 - A. **Cold Weather Protection.** When existing temperature conditions will produce concrete of less than 50 degrees Fahrenheit, without heating materials, protection from freezing shall be accomplished as specified in the current MDOT Standard Specifications for Construction. No concrete shall be placed unless the temperature of the air in the shade and away from artificial heat is at least 25 degrees Fahrenheit and rising, unless specifically approved. The Contractor shall be responsible for the concrete placed during cold weather and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.
 - B. **Hot Weather Limitations.** Casting of concrete during hot weather shall be limited by the temperature of the concrete at the time of placing. Concrete shall not be cast when the temperature of the concrete is above 90 degrees Fahrenheit.
 - C. **Rain.** Newly laid concrete threatened with damage by rain shall be covered with burlap, cotton fabric, curing paper, polyethylene sheets or by other suitable means.
 - D. **Curing.** Exposed surfaces of concrete shall be covered with burlap or cotton fabric immediately after the forms are removed and shall be kept continuously wet for four days except as provided below. During this period, only such areas as are in the process of being finished may be uncovered. Footings may be cured by flooding, when permitted. Membrane curing compound may be used according to the current Michigan Department of Transportation Standard Specifications for Construction.
 - (1) Curing periods specified above apply only when concrete is placed at a temperature of approximately 70 degrees Fahrenheit. For lower temperatures, increase minimum curing periods to seven days.
 2. **Testing of Concrete.** During the progress of the work, standard 6-inch cylinders for compression tests of the concrete shall be prepared from each pour of walls, footings, floors, sidewalks, curb and gutter, and any other concrete work as determined by the Engineer. Concrete for test specimens and assistance for making them on the project will be furnished by the Contractor. The furnishing of molds, the actual making of the test cylinders, and all testing will be performed by the City in accordance with [Section 6.5](#).
 - A. The sample shall be tested in accordance with the specification of the American Society for Testing Materials, Serial Designation C-31 or the current MDOT Standard Specifications for Construction. If the average results from test specimens cured at an average temperature of 70 degrees Fahrenheit are below the 28-day required compressive strength, it will be sufficient reason for rejecting for further use the materials entering into the concrete.
 3. **Flowable Fill.** Produce and deliver flowable fill at a minimum temperature of 50 degrees F. Transport mixture to the point of placement in a revolving drum mixer or agitator. Secure all pipes and conduits within the backfill area to counteract the buoyant effect of flowable fill. Place the material evenly around manholes and in utility trenches to avoid dislocating pipes and conduits.
 4. **Lightweight/Low Density Cellular Concrete Flowable Fill.** Unless otherwise approved by the Engineer, use for filling abandoned utilities only. Maximum time a any given flowable fill operation with Lightweight/Low Density Cellular Concrete Flowable Fill is 4 hours.
- d. **Measurement and Payment.** The cost of Portland cement concrete for pavement, concrete for structures, grout and mortar mixtures is included in unit prices for related pay items. The completed work as measured for additional cement and non-reinforced bulkheads will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard). The price shall be payment in full for furnishing all labor, equipment and material and for any necessary

grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
6.1.001	Cement.....	Ton
6.1.002	Bulkhead, __ inch	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. The completed Work as measured for **Cement** for High Early Strength Concrete shall be paid for at the unit price for the following Contract items (Pay Item). The price shall be payment in full for furnishing all labor, equipment, and materials, and performing the Work complete
2. The additional cement for high early concrete, over the amount normally used, will be measured in tons of cement for the work to be constructed with High Early Strength Concrete. Extra cement used by the Contractor at their option will be paid for by the Contractor.
3. **Bulkhead, __ inch** will be measured in units as shown on the Bid Form. Only bulkheads for sewers specifically referred to in the drawings or specifications shall be measured for payment. **Bulkhead, __ inch** shall be payment in full for furnishing all equipment, labor materials, including, bulkhead material, restoration, bypass pumping and all other work required for a complete job to place the bulkhead.

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DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.2

CONCRETE PAVEMENTS

- a. **Description.** This work shall consist of constructing a jointed Portland cement concrete pavement, base course, or shoulder, without reinforcement, as specified. The concrete shall be provided according to the requirements of Division 6 and Division 10 of the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction except as modified by this Section.
1. The classification, materials, equipment, construction methods, and method of measurement and payment shall be as specified in the current MDOT Specifications for Construction, or any Special Provisions prepared by the City.
- b. **Materials.** Provide materials in accordance with Section 1004 of the current MDOT Standard Specifications for Construction and as specified herein.
1. **Concrete.** Concrete for Concrete Pavements shall be Grade 3500HP. Concrete Grade 3500HP requires optimized aggregate gradation and 25 to 40 percent replacement of the Portland cement in the concrete mixture with a supplementary cementitious material (SCM) (slag cement, fly ash). Do not use other concrete Grades or Types in lieu of Grade 3500HP. Prepare the optimized aggregate gradation and perform process control in accordance with Section 1004 of the current MDOT Standard Specifications for Construction.
2. **Curing Materials, Epoxy Coated Lane Ties, Bond Breaker Material and Joint Materials** in accordance with Division 9 of the current MDOT Standard Specifications for Construction.
- c. **Construction.** In accordance with Section 602 of the current MDOT Standard Specifications for Construction.
- d. **Measurement and Payment.** The completed work as measured for concrete pavement and joints will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard) or for those contract items (pay items) listed in the Bid Form or Special Provisions. The price shall be payment in full for furnishing all labor, equipment and material and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
6.2.001	Conc Pavt, Nonreinf, modified, __ inch	Square Yard
6.2.002	Conc Base Cse, Nonreinf, modified, __ inch	Square Yard

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
6.2.101	Joint, Contraction (type)	Foot
6.2.102	Joint, Contraction (type), Intersection	Foot
6.2.103	Joint, Expansion, (type)	Foot
6.2.104	Joint, Expansion, (type), Intersection	Foot
6.2.105	Joint, Plane-of-Weakness	Foot
6.2.106	Joint, Plane-of-Weakness, Intersection	Foot

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DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.3

CONCRETE CURB AND GUTTER

- a. **Description.** The work shall consist of constructing curb, gutter, combination curb and gutter, roll curb and gutter, valley curb and gutter, radius driveway returns, and radius alley returns, with or without steel reinforcement, as provided, on the prepared subgrade. See [Section 6.1](#) for related specifications.
1. The construction of concrete curb, gutter, combination curb and gutter, roll curb and gutter, driveway returns, or alley returns, shall precede the construction of non-rigid types of pavement or base course, but may either follow or precede, whichever is the more feasible, the construction of concrete pavement or concrete base course.
- b. **Materials.**
1. **Concrete.** Concrete for all work in this Section shall be Grade 3500 as specified in [Section 6.1](#), unless otherwise specified or call for in the Standard Details.
- c. **Construction.**
1. **Subgrade.** The subgrade shall be formed by trenching or filling to the required elevation for bottom of concrete or to the bottom of the subbase, if a subbase is specified. The subgrade shall be thoroughly tamped or otherwise compacted.
 2. **Subbase.** Subbase for curbs, gutter, etc., shall consist of Granular Material Class II and/or aggregate base as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction, placed under the structure, to the thickness shown on Standard [Detail P-1](#), or the Drawings, and as specified in [Section 3.1](#). For work performed under sidewalk repair contracts at individual locations of approximately 30 lineal feet in length, subbase is not required.
 3. **Consistency.** The Consistency of the concrete shall be as specified in [Section 6.1](#). The slump shall not be less than 3 inches and not more than 4 inches unless otherwise specified by the Engineer, except for curb or curb and gutter placed with a machine where the slump shall be as required by the Contractor to allow for adequate finishing while preventing any deflection as the machine proceeds.
 4. **Forms.** The Forms shall be metal, straight and free from distortion, and of sufficient strength to resist springing during the process of depositing and finishing the concrete. Wood forms or flexible steel forms shall be used on circular curb and on special sections and shall be subject to the approval of the Engineer. Circular curb shall be defined as any curved section of curb or curb and gutter constructed on a radius of 200 feet or less. They shall be of an approved section with a flat surface on top. The forms shall be of the full depth of the structure and shall be well built, substantial and unyielding. They shall be securely staked, braced, and tied to the required line and grade and sufficiently tight to prevent leakage of mortar. The inside surface of the forms shall be oiled with a light, clear paraffin-base oil which will not discolor or otherwise injuriously affect the concrete. Curb machines may be used at the Contractor's discretion.
 5. **Placing and Finishing Concrete.** No Concrete shall be placed until the subgrade and forms have been approved by the Engineer. The subgrade shall be thoroughly wetted and the concrete deposited to the proper depth. The concrete shall be spaded sufficiently to eliminate all voids and tamped to bring the mortar to the surface, after which it shall be floated smooth and even by means of a magnesium or wooden float.

- A. The edge of the gutter and the back-top edge of the curb shall be rounded with an approved finishing tool having a radius of 1/4 inches. All transverse joints shall be finished with a double edging tool having a 1/4 inches radius on each side. The face of the curb, at the top and bottom, shall be rounded with approved finishing tools having the radii shown on the Drawings and Standard Details.
 - B. The exposed surfaces of the curb, gutter, combination curb and gutter, and roll curb and gutter, roll and curb gutter and driveway returns shall be finished smooth and even by means of a moistened steel trowel and shall not vary more than 1/8 inches in 10 feet from the established grade. After smoothing the surfaces with a steel trowel, the surfaces shall be brushed lightly with a fine brush to remove tool marks. Neat cement shall not be used as a drier to facilitate the finishing of surfaces.
 - C. After the forms are removed, honeycomb and minor defects shall be filled with mortar composed of one-part Portland Cement, and two parts of fine aggregate, applied with a wooden float.
6. **Placing Steel Reinforcement.** Materials for steel reinforcement shall be as specified in [Section 6.1](#). When Steel Reinforcement or tie bars are called for on the Drawings, the bars shall be properly spaced and held in the correct position during the placing of concrete by the use of bar chairs or other approved devices.
7. **Joints.** Joints shall be constructed to provide for expansion and contraction of the concrete as follows:
- A. **General.** Joints shall be constructed perpendicular to the surfaces of the structure and shall not vary more than 1/4 inches from this position. The concrete at the faces of all joints shall be thoroughly spaded and compacted or vibrated to ensure satisfactory consolidation, and the surface shall be finished smooth and true to grade.
 - B. **Plane of Weakness Joints.** Plane of Weakness Joints shall be placed throughout the structure at intervals of approximately 10 feet. The unit length divisions shall be produced by use of division templates extending the full depth of the concrete, or by placing joints in the concrete, after troweling to a depth of not less than 1/4 the thickness of the section. These joints shall not be less than 1/8 inches nor more than 1/4 inches in width and shall be finished smooth and substantially true to line.
8. **Expansion Joints.** Expansion Joints, 1/2 inch thick, extending to the full depth of the curb, shall be placed at all street returns, at intervals of no greater than 100 feet, and elsewhere as shown on the Drawings.
9. Expansion joint filler shall extend to the full depth of the joint, and the top shall be recessed slightly below the finished surface of the structure.
10. **Backfilling.** Backfilling shall be performed after the concrete has set sufficiently and the forms have been removed. The spaces on both sides of the curb, gutter, combination curb and gutter, roll curb and gutter, and driveway returns shall be backfilled to the required elevation with MDOT Class II material, which shall be properly compacted and trimmed to the cross section shown on the Drawings.
11. **Positive Drainage.** The Engineer will set line and grade for the curb and gutter. Minimum longitudinal slope for concrete curb shall be 0.4% for straight runs and 0.5% for radius runs, unless otherwise approved by the Engineer. However, it shall be the responsibility of the Contractor to ensure that positive drainage (no "Bird Baths") is achieved. In the event that the curb and gutter as constructed does not have positive drainage ("Bird Baths" are evident) the Contractor shall, at his/her own expense, remove and replace sufficient curb and gutter so as to ensure that positive drainage is achieved.
- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, for furnishing and placing sand and aggregate sub-base, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be

as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
6.3.001	Curb and Gutter, (width) by (thickness) inch pan, Det P-5	Foot
6.3.002	Curb, (width) by (height) inch, Det P-5A	Foot
6.3.003	Roll Curb and Gutter, (width) by (thickness) inch pan, Det P-5B	Foot
6.3.004	Valley Gutter, (width) by (thickness) inch, Det P-5C	Foot
6.3.005	Median Island End Treatment, Det P-5D	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. Curb and Gutter, Curb, Roll Curb and Gutter, and Valley Gutter will be measured in place by length in linear feet, along the joint of the curbing with the pavement, with no deductions in length for catch basins, inlet castings, dub-down drive approaches, or dub-down alley approaches as shown on the applicable Standard Details. Circular curb shall not be measured separately.
2. Curb Ramp Openings for ADA ramps shall be measured and paid per [Section 6.4](#).
3. When called for in the Drawings, inverted curbs shall be measured and paid with the Standard Pay Items.
4. Removal of curing compound and painting shall be considered included in the price of the curb and median island end treatment pay items.
5. Concrete radius driveway returns as per Standard [Detail P-2](#) shall include the drive return to a line four (4) feet behind the face of the curb and will be measured and paid as **Curb and Gutter, (width) by (thickness) inch pan, [Det P-5](#)** in linear feet along the joint of the curbing with the pavement from tangent point to tangent point. Any concrete necessary beyond the back of the curb and gutter shall be placed under a separate item entitled **Driveway, Nonreinf Conc, __ inch** and shall be measured in square yards per [Section 6.4](#).
6. Concrete radius alley returns as per Standard [Detail P-2A](#) shall include the alley return to a line seven (7) feet behind the face of the curb and will be measured and paid as **Curb and Gutter, (width) by (thickness) inch pan, [Det P-5](#)** in linear feet along the joint of the curbing with the pavement from tangent point to tangent point. Any concrete necessary beyond the back of the curb and gutter shall be placed under a separate item entitled **Driveway, Nonreinf Conc, __ inch** and shall be measured in square yards per [Section 6.4](#).
7. **Median Island End Treatment** will be measured as units and will paid for at the contract unit price each. The price shall be payment in full for furnishing all labor, equipment, and material, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete. The price for **Median Island End Treatment, [Det P-5D](#)** shall also include the removal of curing compound and painting of the end treatment as directed by the Engineer.

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DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.4

CONCRETE SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND APPROACHES, AND ALLEY PAVEMENT AND APPROACHES

- a. **Description.** The work shall consist of constructing concrete sidewalk, sidewalk ramps, driveways and approaches and alley pavements and approaches of the required cross section, constructed on the prepared subgrade or subbase as shown on the Drawings, and shall include grading, and any necessary parkway and pavement restoration. Concrete thicknesses shall be as shown on the Drawings, on the Standard Details, or in the Special Provisions.
1. Ramps shall be constructed according to the applicable Michigan Department of Transportation (MDOT) Standard Plans when called out for on the Drawings, whenever new walk and curb is constructed within the crosswalk area, and when an existing curb or curb radius is disturbed within a crosswalk area during construction of the project. A crosswalk area is the area lying within the projections of the two-intersecting right of way.
 2. Concrete driveway and alley approaches and alley pavements shall be constructed according to the applicable City Standard Details.
 3. This specification shall not apply to the sidewalks constructed as an integral part of a bridge, grade separation, culvert, nor as an independent structure over an areaway.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [6.4 of the Specified Products Index \(SPI\)](#).
1. The concrete materials shall be as specified [Section 6.1](#), and as specified herein.
 - A. **Sidewalk and Sidewalk Ramps.** Concrete Grade 3500.
 - B. **Driveways and Alley Pavement and Approaches.** Concrete Grade 3500.
 2. **Detectable Warning Surfaces.** ([SPI 6.4.A](#)) Detectable warning plates shall be cast iron or galvanized steel. The cast iron plates shall be gray iron, ASTM A48, galvanized steel shall be G90 grade in accordance with ASTM A653. The plates shall be fully compliant with the American Disabilities Act Accessibility Guidelines (ADAAG). The plates shall incorporate an in-line dome. The field area of the plate shall consist of a non-slip surface.
 - A. Nominal plate size shall be 24 inches x 24 inches. Plate sizes of 18 inches x 24 inches and 30 inches x 24 inches may also be used as directed by the Engineer. Radial plates shall be used where shown on the drawings and as directed by the Engineer.
- c. **Construction.** Construct sidewalks, ramps and approaches in accordance with MDOT Standard Specifications of Construction Section 801 and 803, and as specified herein.
1. **Joints.**
 - A. **Plane of Weakness Joints.** Plane of Weakness Joints shall be placed throughout the structure at intervals of 5 feet for standard lineal sidewalk.
 - B. **Expansion Joints.** Expansion joints, 1/2-inch thick, extending to the full depth of the concrete, shall be placed between the concrete and the back of the abutting curb or gutter at intersections and at those locations where the concrete extends from a building or other rigid structure to the curb, and at intervals of no greater than 50 feet. Expansion joint material shall extend to the full depth of the joint and the top shall be slightly below the finished surface.
 - C. **Edges.** The edges on all concrete shall be rounded to a radius of 1/4 inch with an approved finishing tool.
 - D. All joints shall be rounded with an approved double edging tool having a radius of 1/4-inch on each side. The surface shall then be brushed lightly to produce a slightly roughened surface and remove the finishing tool marks. Saw cut joints may be used with approval from the Engineer.

2. **Cross Slope.** Cross slope shall be 1.5% +/- .5% (or max 2%) on all new sidewalks unless approved by the Engineer.
3. **Curb Ramps and Landings.** Unless otherwise noted on the Drawings, minimum ramp and landing slab thicknesses to be 6 inches for first 5 feet behind the curb and 4 inches for the remaining.

- d. **Measurement and Payment.** The completed work as measured for concrete sidewalk including ramps, concrete driveway and approaches, and concrete alley pavement and approaches, will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment and materials, for any necessary grading, excavation and backfill, and performing the work complete, Pay Items (City Standard).

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid herein, and as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
6.4.001	Sidewalk Ramp, ADA curb	Foot

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
6.4.101	Sidewalk, Conc, __ inch	Square Foot
6.4.102	Curb Ramp, Conc, __ inch	Square Foot
6.4.103	Detectable Warning Surface	Foot
6.4.104	Curb Ramp Opening, Conc	Foot
6.4.105	Driveway, Nonreinf Conc, __ inch	Square Yard

1. **Sidewalk Ramp, ADA Curb** shall be measured in linear feet and payment in full for furnishing all labor, equipment, and material, to place an integral concrete curb at the back of sidewalk where required to meet ADA grade guidelines for a sidewalk ramp. **Sidewalk Ramp, ADA Curb** shall be payment in full for all excavating and backfilling for the placement of the curb.
2. Varied thicknesses of sidewalk and driveway pay items shall be utilized for ADA, driveways and alley pavements and ramps.
3. **Curb Ramp Opening, Conc** shall be measured and paid for openings placed to meet ADA requirements. Driveway and other miscellaneous curb openings will be paid for per [Section 6.3](#).
4. **Driveway, Nonreinf Conc, __ inch** shall be measured and paid for driveway and alley approaches.

DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.5

QUALITY CONTROL AND ASSURANCE FOR CONCRETE

- a. **Description.** This work consists of providing and maintaining quality control and assurance for concrete flatwork, pavement and structure placement.
- b. **Materials.** None specified.
- c. **Construction.**
 - 1. **Quality Control Considerations.** The Contractor shall provide and maintain an effective Concrete Quality Control (QC) Program as required by the contract Special Provisions. If the project does not include QC program Special Provisions, as a minimum, the Contractor shall provide the following.
 - A. **Contractor Responsibilities.**
 - (1) Provide all necessary concrete mix designs, such that specified temperature, slump, air content, and compressive strength of concrete will be attained.
 - (2) Submit mix designs for each grade of concrete required on the project to the Engineer for review. Mix designs, including all required documentation, shall be submitted at least 10 calendar days prior to the anticipated date of concrete placement.
 - (3) Provide and maintain a numbering system for each mix design that will easily designate and identify the mix design documentation with all respective testing data. Mix designs which do not include all required documentation and identifications will be considered incomplete and will be returned to the Contractor without review.
 - (4) Notify the Engineer prior to any changes from one approved mix design to another for each grade on concrete, according to requirements described in Section 1003 of the current MDOT Standard Specifications for Construction.
 - 2. **Quality Assurance Considerations.** The City will sample and test concrete for quality assurance (QA). Refer to the contract Special Provisions for additional concrete quality assurance considerations.
 - A. **City Responsibilities.**
 - (1) Perform verification testing as outlined in Section 1003 of the current MDOT Standard Specifications for Construction.
 - (2) Select a random sampling technique that will be used to determine sample locations based on the volume or truckloads for the project.
 - (3) Conduct compression testing on cylinders which have been cured by the City's testing consultant.
 - (4) Calculate the pay adjustment for critical pay item concrete. Take the appropriate steps to investigate unacceptable concrete which has tested with compressive strengths consistently below the rejection limit.
 - (5) There are three methods of verification of proposed concrete mix designs that are acceptable
 - (a) **Method 1.** Verification based on the City's experience with the same mix design and the same materials. There are to be no substitutions of materials permitted under this method, including admixtures or changes in mix proportions.
 - (b) **Method 2.** Verification based on the City's experience with an established mix design like the proposed mix design that used aggregate materials like those to be used on this project. No other substitutions of materials are permitted.
 - (c) **Method 3.** Verification based on trial batches using a new mix design. Mix design verification using trial batches shall be based on the same materials and proportions proposed for use on the project.
 - (6) If the Contractor proposes a mix design with temperature, slump or air content characteristics other than those specified in [Section 6.1](#) or [Section 6.2](#), it shall be

requested in writing at the time the mix design is submitted. Only Method 3 may be used in submitting this request.

- (7) The Mix Design Documentation shall include enough information on constituent materials (source, type, aggregate absorption, specific gravity, and unit weights) and admixtures along with compressive strength test results to allow the Engineer to fully evaluate the mix design and its expected performance.
- (8) The Contractor shall notify the Engineer of any proposed changes from one approved mix design to another for the same grade of concrete. Minor adjustments in the material proportions (such as increases in cementitious material content within the specified limits, increased coarse aggregate content, or decreased water content) of an approved mix design may be permitted. However, any changes made to approved mix designs shall be approved by the Engineer and recorded in the Contractor's quality control records along with the rationale for the changes.
- (9) Continued production of concrete which does not meet specification with negative pay adjustment, in lieu of making adjustments to bring the work into conformance, will result in project shutdown until necessary adjustments are made.

- d. **Measurement and Payment.** Concrete QC will not be paid separately but is considered included in the project concrete pay items. Concrete QA will be paid for by the City.

DIVISION 6 – PORTLAND CEMENT CONCRETE AND BRICK PAVEMENTS

SECTION 6.6

BRICK PAVEMENT

- a. **Description.** This work shall consist of a wearing surface of new or salvaged brick, laid on a sand cushion and constructed on the prepared concrete base or other foundation.
- b. **Materials.**
 1. **Paving Brick.** Paving brick shall conform to the requirements of this Section and of the Special Provisions for Brick Pavement issued for projects where such materials are to be used. Products shall be in accordance with part [6.6 of the Specified Products Index \(SPI\)](#). Salvaged paving brick may be purchased from the City's supply, when available, upon written authorization from the Engineer, or provided by the City at no cost to the Contractor if specifically stated in the Bid Form or Special Provisions.
 - A. **New Brick Paver. (SPI 6.6.A)**
 - (1) The brick shall be manufactured from clay, shale or similar naturally occurring earthy substance which is subjected to heat treatment (firing). The heat treatment shall develop sufficient bonding of the particle constituents to provide the strength and durability requirements as specified.
 - (2) The bricks are to have a wire cut face with no lugs and no chamfered edges. The corners shall be square. The bricks shall be laid in a running bond pattern as shown in the plans. The brick shall be 2-3/4 inches deep by 4 inches wide by 8 inches long.
 - (3) **Physical requirements.**
 - (a) The cumulative length of chips or edge breakage on any single brick unit shall not exceed 10 percent of the total edge perimeter. A chip is defined as breakage exceeding 5/16 inch in depth along an edge, or 1/2 inch at the corner.
 - (b) The concave or convex warpage along the face of any brick unit shall not exceed 1/16 inch for the entire length.
 - (c) Tolerance on dimensions (maximum permissible variation from specified dimension, plus or minus):
 - (i) Depth - 1/16 inch.
 - (ii) Width - 3/32 inch.
 - (iii) Length - 1/8 inch.
 - (d) The paver brick shall meet or exceed the current ASTM C1272, Application PX, Type F for Heavy Vehicular Paving Brick. The bricks shall be manufactured in accordance with the following requirements per the current ASTM C67:
 - (i) **Compressive Strength.** A minimum of 10,000 psi, (average of 5 bricks) or 8800 psi for any single brick
 - (ii) **Modulus of Rupture.** A minimum of 1500 psi (average of 5 bricks) or 1275 psi for any single brick
 - (iii) **Cold Water Absorption.** A maximum of 6 percent (average of 5 bricks) or 7 percent for each individual brick
 - (iv) **Efflorescence.** Visual inspection shall result in an evaluation of "No Efflorescence" (10 units)
 - B. **Salvaged Brick Paver.**
 - (1) Salvaged historic brick shall be Metropolitan (Canton) block, salvaged Bessemer (Youngstown) block, or approved equal.
 - (2) Salvaged brick shall match the specifications for new brick pavers.

2. **Sand Filler.** The sand filler shall be Masonry Sand, No. 8 Sand, per the current ASTM C144, and shall meet the following grading requirements, including angularity index (A.I.):

Table 6.6-1 Grading Requirements for Sand Filler	
Standard Sieve	Sieve Analysis, Total % Passing (a)
3/8 in	100
No. 4	100
No. 8	100
No. 16	70 – 100
No. 30	40 - 75
No. 50	10 – 35
No. 100	2 – 15
No. 200	0 – 5
Angularity Index (AI) 5.0 (minimum)	

3. **Sand Cushion.**

- A. **Fine Aggregate.** The fine aggregate shall consist of clean, hard, durable, uncoated particles free from clay lumps, organic materials, soft or flaky materials and other foreign matter.
- B. The fine aggregate shall meet the following grading requirements including angularity index (A.I.):

Table 6.6-2 Grading Requirements for Sand Cushion	
Standard Sieve	Sieve Analysis, Total % Passing (a)
3/8 in	100
No. 4	95 - 100
No. 8	80 - 95
No. 30	50 - 75
No. 50	10 – 35
No. 100	2 – 10
No. 200	0 – 3
Angularity Index (AI) 5.0 (minimum)	

- C. The fine aggregate shall be tested stock. The testing frequency shall be a minimum of three complete tests (physical and sieve analysis and Angularity Index (A.I.)). The tested stockpile shall be uniform and not subject to extreme variations within the requirements.
4. **Fiber Joint Filler.** In accordance with Section 914 of the current MDOT Standard Specifications for Construction.

c. Construction.

1. Preliminary Work.

- A. **Removing and Salvaging Brick.** Remove brick or Remove and salvage brick as specified in [Section 2.3](#).
- B. **Repairing Existing Foundation.** After the brick wearing course has been removed, all of the existing sand cushion or mastic cushion shall be removed together with all other foreign matter, so that the condition of the existing base course may be examined by the Engineer. If the concrete base course is defective, it shall be removed to the extent required by the Engineer. In the event that the defective base course was caused by unstable subgrade, the subgrade shall be removed to the extent required by the Engineer and replaced with sand-gravel or other suitable material and compacted as required to the original elevation of the subgrade. The concrete base course shall then be replaced as specified in [Section 6.2](#) of these specifications.
- C. **Changing Crown or Grade.** When the crown or grade elevation is to be raised, the sand cushion or mastic cushion shall be removed, the existing concrete foundation shall be swept clean, and the crown or grade shall be built up by placing concrete or mortar on the existing concrete foundation to conform to the Drawings or required by the Engineer. On those areas where the elevation is to be raised two (2) inches or more, concrete Grade 3500HP shall be used, and on those areas where the elevation is raised less than two (2) inches, mortar shall be used. The concrete and mortar shall be as specified in [Section 6.1](#) and this Section.
- D. **New Concrete Base Course.** When called for in the Drawings or in the Bid Form place new concrete base course in accordance with the details and as specified in [Section 6.2](#).

2. Concrete Header.

- A. Construct concrete header in accordance with the details on the Drawings. Concrete shall be Grade 3500 as specified in [Section 6.1](#).

3. Brick Pavement.

- A. **Placing Sand Cushion.** When the concrete base course has been placed, repaired, or the crown or grade has been changed, as above specified, the sand cushion shall be spread over the prepared concrete base to a uniform thickness which will not exceed one inch when the brick surface is rolled. (It is estimated that 1-1/2 inch loose will compact to the required one-inch after rolling.)
 - (1) The sand cushion shall be carefully shaped to a true cross section parallel with the surface of the finished pavement by means of an approved template so designed as to be easily drawn on the edge of the adjacent brick pavement or on other approved guides.
- B. **Handling Brick.** Brick must be delivered from the piles to the brick-layers by hand, or mechanically on conveyors. No throwing, dumping or other rough handling of the brick will be permitted.
 - (1) Deliver packaged new masonry materials in their original unopened containers clearly labeled with the manufacturer's name and brand designation, the type and class as applicable.
 - (2) Handle and store new brick masonry materials in such a manner to prevent damage or inclusion of any foreign and/or deleterious material. Store under waterproof covers and on planking clear of the ground. Label each palette of brick with the manufacturer's name, palette identification number, quantity of brick and shipping date.
 - (3) Transport and stockpile aggregates separately according to their sources and gradations. Handle at all times in such a manner as to prevent segregation or contamination with earth or foreign material.
- C. **Laying Brick.** When the area to be paved is one or more City blocks in length and extends from curb to curb, the brick shall be laid upon the prepared sand cushion in straight courses at right angles to the curb between street intersections. The brick courses in intersections shall be laid in the directions shown on the Drawings. For salvaged brick with lugs, the brick shall be laid carefully with lugs in the same direction and with the better face up and so that the lugs of the brick in one course will touch the brick in the adjoining course. The

ends of the brick shall be as close together as possible without wedging or bridging. The spaces between the brick shall be kept clean and open to the bottom until the grout filler is applied. Joints shall be broken by starting each alternate course with a half brick. Bats or broken brick shall not be used except at headers, and they shall not be less than 3 inches in length. The course shall not deviate from a true line more than 1 inch in 50 feet.

(1) When the area to be paved is less than one City block in length and is less in width than the full width of the street, the brick used shall be of the same size and color as in the adjacent pavement. The end bricks in the existing pavement adjacent to the area to be paved shall be whole bricks only, so that the new work may be neatly "toothed" into the old and produce a firm and neat surface.

(2) Immediately after laying, the brick surface shall be swept and inspected. All brick which is soft, cracked, spalled, off-color, underburned, overburned or otherwise undesirable will be marked by the Inspector. The Contractor shall at once remove such brick from the pavement with flatnosed tongs, without disturbing the sand cushion and replace them with approved brick. Slightly chipped brick, if not otherwise defective, may be turned over and if the reverse side is satisfactory, may be replaced in the pavement.

D. **Rolling Brick.** After the bricks have been laid, and after all objectionable bricks have been removed, they shall be brought to a true surface by means of rolling with a power-driven tandem roller weighing not less than 5, or more than 8 tons. The pavement shall be rolled in longitudinal and diagonal directions. The longitudinal rolling shall begin at the curb and progress toward the center of the pavement. The pavement shall then be thoroughly rolled at an angle of 45 degrees with the curb. When this rolling has been completed, the brick shall again be inspected and all that are broken or damaged shall be removed from the pavement and replaced with approved brick. If necessary, to secure a uniform surface, the brick shall again be rolled diagonally across the pavement at right angles to the first diagonal rolling. To prevent the brick from being left careened, the roller shall in all cases cover exactly the same area in making its backward trip as was covered in its forward trip and shall proceed at a very slow rate of speed until the entire pavement has been rolled. Portions of the pavement inaccessible to the roller shall be tamped to grade by the use of hand tampers applied upon a 2 inch board.

(1) After final rolling, the pavement shall be tested with a 10 foot straight edge laid parallel with the centerline of the pavement, and any depression exceeding 1/8 inch shall be corrected, and if necessary, the entire surrounding area shall be again rolled.

E. **Opening to Traffic.** After the completion of the rolling, the pavement shall be swept clean, and all construction equipment removed.

4. **Final Clean-Up.** Before final acceptance of the work, the Contractor shall clean the street surface, walks, gutter, fences, lawns, private property and structures, leaving them in as good a condition as originally found, and shall remove all machinery, tools, surplus and waste materials, temporary buildings and other temporary structures from the site.

d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment and material, and for any necessary grading, excavation and backfill when not paid for separately, and for performing the work complete.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
6.6.001	Brick Pavt	Square Yard
6.6.002	Brick Pavt, Salvd Pavers	Square Yard
6.6.003	Brick Pavt, Conc Header	Foot
6.6.004	Brick Pavt, Repr	Square Yard

6.6.005 Brick Pavt, Conc or Mortar Shim Cubic Yard

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Brick Pavt** will be paid for at the contract unit price per square yard, which price shall be payment in full for furnishing all labor, equipment and materials for performing the work complete, ready for use. Sand cushion will not be measured separately but shall be considered as included in the price bid for the item **Brick Pavt**. Concrete pavement base, where called for on the Drawings or in the Bid Form, will be paid for separately in accordance with [Section 6.2](#).
2. **Brick Pavt, Salvd Pavers** will be paid for at the contract unit price per square yard, which price shall be payment in full for furnishing all labor, equipment and materials for performing the work complete, ready for use. Salvaged Pavers shall be supplied by the City or previously removed and salvaged from the road per [Section 2.3](#). Sand cushion will not be measured separately but shall be considered as included in the price bid for the item **Brick Pavt, Salvd Pavers**. Concrete pavement base, where called for on the Drawings or in the Bid Form, will be paid for separately in accordance with [Section 6.2](#).
3. **Brick Pavt, Conc Header** will be paid for at the contract unit price per linear foot, which price shall be payment in full for furnishing all labor, equipment and materials for performing the work complete. The price includes all required reinforcement and tie bars as detailed in the Drawings.
4. Removing and replacing concrete foundation will be paid for at the contract unit price in accordance with [Section 2.3](#) and [Section 6.2](#).
5. **Brick Pavt, Repr** will be paid for at the contract unit price per square yard, and shall include all preliminary work, brick pavement and final clean-up as specified in this Section, and includes the removal and replacement of the aggregate and concrete base, sand cushion and brick pavement (new or salvaged). Any saw cutting necessary for the removal of the pavement shall also be included in this item.
6. **Brick Pavt, Conc or Mortar Shim** will be paid for at the contract unit price per cubic yard, which price shall be payment in full for furnishing all labor, equipment and materials, and performing the work complete, ready for application of cushion.

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DIVISION 7 – STRUCTURES

SECTION 7.1 REINFORCED CONCRETE STRUCTURES

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DIVISION 7 - STRUCTURES

SECTION 7.1

REINFORCED CONCRETE STRUCTURES

- a. **Description.** This work shall consist of construction of all reinforced concrete structures, both above and below ground and all items directly related to the proper functioning of the completed concrete work, including foundation excavation, forming steel reinforcement, waterproofing, backfill and related items. Concrete, Grout, Mortar and Flowable Fill shall be as specified in [Section 6.1](#)
- b. **Materials.**
1. **Concrete.** Concrete for all work in this division shall be Grade 3500 as specified in [Section 6.1](#) unless otherwise specified.
 2. **Form Material.** All face form lumber for exposed surfaces shall be either dressed tongue and groove, dressed shiplap, or square edged lumber sized uniformly. Face form lumber shall be of uniform width and thickness and shall be sound and free from loose or rotten knots, knot holes, check splits, or wane showing on the surface in contact with concrete.
 - A. For exposed surfaces, to be left unfinished, dressed tongue and groove or shiplap lumber not less than 3/4 inch actual thickness and not more than eight inches in width shall be used.
 - B. Instead of face form lumber, the Contractor may use plywood for structural boarding. It shall be at least 5 ply, not less than 3/4 inch in thickness, and in computing stud spacing it will be considered as 1 inch lumber.
 - C. The Contractor shall not use defective face form lumber which may produce work inferior to that resulting from new material.
 - D. Metal forms shall be of such thickness and so constructed that the forms will remain true to shape. All bolt and rivet heads occurring in the inside face of the forms shall be countersunk. Use of the metal form shall result in a plane smooth surface of the desired contour.
- c. **Construction.** Excavation and backfill for sewers shall be done in accordance with [Section 2.5](#), and as specified herein.
1. **Foundation Excavation.** Foundation Excavation shall be made of sufficient size to permit construction of the foundation units and to provide for adequate drainage. Excavated material suitable for the purpose of backfilling shall be stored and used later.
 - A. Special care shall be taken not to disturb the bottom of the excavation. The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation. The final removal of the foundation material to grade shall not be made until just before the foundation is placed. All unsound material underlying proposed structures shall be removed and replaced with bank run gravel or coarse aggregate, in layers not exceeding 6 inches in depth, and each layer shall be thoroughly compacted by tamping or by vibrating. The thickness of each layer of backfill may be increased to more than 6 inches, provided the full depth of each layer of backfill is compacted to not less than 95 percent of maximum.
 - B. Concrete shall not be placed until the depth of excavation has been checked, and the suitability of foundation material has been approved by the Engineer.
 - C. Where soil conditions allow and when approved by the Engineer, the footing forms may be omitted. Footing excavation may be trimmed to the exact size of the footing. In this case, guide forms to establish the grade for the top of the footing will be required.

2. **Forms.** All forms shall be of wood or metal and shall be built mortar-tight of sound material sufficiently strong and rigid to prevent distortion during the placing and curing of concrete.
 - A. **Form Design.** Design, erect, support, brace and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure.
 - (1) Design form work to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
 - (2) Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only.
 - (3) Provide for openings, offsets, linkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work.
 - B. **Form Construction.** Forms shall be constructed and maintained to prevent warping and the opening of joints due to shrinkage of the lumber. Forms shall be secured to studs or uprights with true horizontal joints.
 - (1) Forms shall be built true to the lines designated and shall be so maintained until the concrete has sufficiently hardened to allow their removal.
 - (2) Form work shall be built to be readily removable, without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Forms shall be fabricated for ready removal without hammering or prying against concrete surfaces.
 - (3) Crush plates or wrecking plates shall be provided where stripping may damage cast concrete surfaces.
 - (4) Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
 - (5) Forms shall be securely braced to prevent movement while placing concrete.
 - (6) Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete.
 - (7) Form work shall be constructed so that concrete members and structures are of correct size, shape, alignment, elevation and position. Forms shall be constructed to size, shape, line and dimensions shown, to obtain accurate alignment, location, grades, level and plumb work in finished structures. The maximum deflection of form facing material between supports, and the maximum deflection of form supports such as studs and wales, shall not exceed 1/4 inch per 10 feet of span.
 - (8) All face form lumber on upright studs shall be secured to the studs or uprights with true horizontal joints.
 - (a) Temporary openings shall be provided at the base of wall and column forms and other interior area of form work where it is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Temporary openings shall be located on forms at inconspicuous locations.
 - (b) Forms and bracing shall be retightened after concrete placement as required to eliminate mortar leaks and maintain proper alignment.
 - (c) Selected materials shall be used to obtain required finishes. Joints shall be solidly butted and provided with back-ups at joints to prevent leakage of cement paste.
 - (d) Unless otherwise provided on the Drawings or by authorization, all buried corners shall be finished square without moldings. All exposed corners and edges shall be chamfered 3/4 inch minimums, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
 - (e) Coordinate the installation of joint materials, perimeter insulation, and vapor retarders with placement of forms and reinforcing steel.

- C. **Use of Forms.**
 - (1) Special care shall be exercised to keep metal forms free from ruts, grease, or other foreign materials such as will tend to discolor the concrete.
 - (2) **Cleaning and Tightening.** Forms and adjacent surfaces to receive concrete shall be thoroughly cleaned. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.
 - (3) Metal forms which do not present a smooth surface or line up properly shall not be used.
 - (4) **Oiling.** The inside of all forms for exposed concrete surfaces shall be oiled with a light, clear, paraffin-base oil which will not discolor or otherwise injuriously affect the concrete surface. Oiling shall be done after all necessary planning is completed.
- D. **Coordination Issues.** Openings in the concrete form work shall be provided when necessary to accommodate work of other trades. Size and location of openings, recesses and chases shall be determined from trades providing such items. Items built into forms shall be accurately placed and securely supported.
- 3. **Placing of Steel Reinforcement.** Materials for steel reinforcement shall be as specified in [Section 6.1](#). Steel reinforcement shall be accurately placed in the position shown on the Details or Drawings. If not shown, steel reinforcement shall be placed in accordance with the current Standards of the American Concrete Institute.
 - A. Bars shall be placed with a variation between adjacent bars of not more than one-sixth of the spacing shown on the Drawings, and the clear distance from the surface of the concrete to the reinforcement shall not vary by more than one-fourth of the dimensions.
 - B. Bars shall be tied at all intersections except where spacing is less than one foot in each direction when alternate intersections shall be tied. Supports for reinforcement which are to remain in the work shall be precast concrete blocks of approved shape and dimensions.
 - C. Steel reinforcement shall be accurately secured against displacement by standard chairs, bolsters, spacers, and the like, supplemented by such additional supporting and spacing devices as may be required. Metal chairs for use in flat slabs when permitted by the Engineer shall be of sufficient strength to satisfactorily support the reinforcing.
 - D. When placed in final position, reinforcement shall be free from dirt, rust, mill scale, paint, oil or other foreign material. When there is a delay in depositing concrete, reinforcement shall be re-inspected and corrected as to position and cleaning where necessary. Projecting reinforcement from prior concrete pours shall be cleaned of adhering mortar and loose rust before being incorporated in the new concrete pour.
- 4. **Building in Work.** All necessary ties, anchors, bolts, inserts, manholes and steps and other work shall be accurately set and securely held in concrete work according to details shown on the Drawings or standard practice.
 - A. Suitable sleeves shall be set in concrete for all small piping of every kind and for all large piping where shown on the Drawings where such piping passes through concrete work. Such sleeves shall be set with due regard to their position in the final surface finish. Proper allowance shall be made in concrete work, where necessary, for other installed work.
- 5. **Placing Concrete.** Concrete shall be placed in any unit of the structure only after the forms, bracing and preparations for casting have been approved. At the time concrete is placed, the forms shall be clean and all sawdust, chips and other debris shall have been removed from the interior of the forms. Struts, stays, and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their location, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.
 - A. The concrete shall be promptly placed with a minimum of handling to avoid segregation of the materials. Each pour shall be completed in a continuous operation with no interruption in excess of 45 minutes between the placing of contiguous adjacent portions of concrete. Each layer shall be placed and compacted before the preceding layer has taken an initial set.

- B. Concrete during and immediately after depositing shall be compacted thoroughly by means of suitable tools. For thin walls or inaccessible portions of the forms where rodding or forking is impracticable, the concrete shall be assisted into place by tapping or hammering the forms opposite the freshly deposited concrete, and the concrete shall be worked thoroughly around the reinforcement, around embedded fixtures, and into the corners of the forms. Internal vibrators may be used.
 - C. To obtain clean and firm bearing surfaces, all water and softened material shall be removed from excavations immediately before concrete is deposited. Concrete shall not be deposited in water, nor shall water be allowed to rise over the concrete until the concrete has hardened sufficiently to prevent injury thereto. Any flow of water into the excavation shall be diverted through proper side-drains to a sump or shall be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting or other means approved by the Engineer after the concrete has thoroughly hardened.
 - D. The concrete shall be deposited in the forms in horizontal layers not more than 12 inches thick unless otherwise specified by the Engineer and to as near final position as possible. When placing operations would involve dropping the concrete more than 5 feet, it shall be deposited through sheet metal or other approved pipes made in sections not to exceed 4 feet in length. The use of long troughs, chutes or pipes for conveying concrete from the mixing plant to the forms will not be permitted. Short troughs, chutes or pipes used as aids in placing concrete shall be arranged and used in such a manner that the concrete ingredients do not become separated. Where steep slopes are required, troughs and chutes shall be equipped with baffle boards or shall be arranged in short lengths that reverse the direction of movement. Troughs and chutes shall be of metal or shall be lined with metal and shall extend as nearly as possible to the point of deposit. When the discharge must be intermittent, provide a hopper or other device for regulating the discharge shall be provided.
 - E. Before depositing concrete on or against concrete which has set, the forms shall be retightened, and the surface of the hardened concrete shall be roughened as required by the Engineer and thoroughly cleaned of foreign matter and laitance. The new concrete placed in contact with hardened or partly hardened concrete shall contain an excess of mortar to insure bond. To ensure this excess mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces of the hardened concrete, including horizontal, vertical and inclined surfaces, shall first be slushed with a coating of neat cement grout or of mortar against which the new concrete shall be placed at once before the grout or mortar has attained its initial set.
 - F. The placing of concrete shall be so regulated that the pressures caused by wet concrete shall not exceed those used in the design of the forms. The consistency of the concrete shall be as specified in [Section 6.1](#). The slump shall not be less than 3 inches and not more than 4 inches unless otherwise approved by the Engineer.
 - G. Such spading as is necessary to ensure smooth surfaces and dense concrete shall be done along form surfaces and in corners. After the initial set of the concrete, the forms shall not be jarred. All forms above concrete being placed, and all placing equipment, shall be kept clean and free from coatings of hardened concrete. Water used for flushing the placing equipment shall be discharged clear of the concrete and forms.
6. **Construction Joints.** In general, necessary construction joints are shown on the Drawings, and modifications of locations shall be subject to the approval of the Engineer.
- A. Construction joints when called for on the Drawings between footings and walls and/or in walls below grade shall be provided with a polyvinyl chloride thermoplastic type water stop as approved by the Engineer. All water stops shall be continuous with ends lapped or spliced to make the joint watertight, and plates shall be adequately supported in accurate position and in a manner that does not interfere with the reinforcing steel. Water stops shall be placed at junctions of walls with floor slab and/or as shown on the Drawings.

- B. The contact surface of concrete already in place, and the faces of all joints shall be thoroughly wetted before placing new concrete. The face edges of all joints shall be carefully finished true to line and elevation.
7. **Patching and Finishing Concrete.** Immediately following the removal of forms, all fins and other irregular projections shall be removed from exposed surfaces. On all surfaces, the cavities produced by form ties and other holes, broken corners and edges and similar defects shall be thoroughly cleaned. After being saturated with water for not less than one hour, surfaces shall be carefully pointed and trued with a mortar of cement and fine aggregate of the same proportions as the concrete being finished. Mortar used in pointing shall be not more than one hour old.
- A. If, in the judgment of the Engineer, any defects present in the concrete are of such a nature as to warrant condemnation, such portion of the pour may be ordered replaced in its entirety and the Contractor shall promptly replace the same.
- B. Where not specifically designated, the top surface of the concrete slabs shall be struck off at the elevations shown on the Drawings and given a smooth wood float finish. Where floors contain active drains, they shall slope uniformly to the floor drain.
8. **Waterproofing.** The materials and methods for waterproofing will be done according to the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction Division 7, Waterproofing and Protective Covers, where called for on the Drawings, Special Provisions or otherwise authorized.
9. **Backfill.** Backfill against structures shall be Granular Material Class II, in accordance with the current MDOT Standard Specifications for Construction, unless otherwise approved by the Engineer. Backfill shall not be placed against any portion of the structure until the structure has been approved by the Engineer for backfilling. The backfill shall be carried up to the surface of the adjacent ground or to the elevation for the proposed earth grade, and its surface shall be neatly graded.
- d. **Measurement and Payment.** The completed Work as measured for reinforced concrete structures will be paid for on the basis of the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall be payment in full for furnishing all labor, equipment, materials, including excavation, dewatering, bypass pumping, backfill, steel reinforcement forming, concrete, waterproofing, restoration, and performing the work complete unless otherwise provided in the Provisions or in the Bid Form.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
7.1.001	Bulkhead, reinf, Det __	Each
7.1.002	Wall, reinf, Det __	Foot
7.1.003	Junction Chamber, reinf, Det __	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Bulkhead, reinf, Det __** will be measured in units as shown on the Bid Form. Only bulkheads for sewers specifically referred to in the drawings or specifications shall be measured for payment. **Bulkhead, reinf, Det __** shall be payment in full for furnishing all equipment, labor materials, including steel reinforcement, waterproofing, restoration, bypass pumping and all other work required for a complete job to place the bulkhead.
2. **Wall, reinf, Det __** will be paid for by length as measured along the top of the finished wall and shall include all materials, labor and equipment required to construct the complete wall and footing, including excavation, backfill, steel reinforcement, forming, concrete, and curing.

Separate payment will not be made for the work required to provide an acceptable concrete mix design.

3. **Junction Chamber, reinf, Det __** shall include all concrete, reinforcement, waterstop and water proofing, butyl rope mastic, precast manhole riser sections, adjusting rings, manhole casting, manhole steps, grout, mortar and all other materials, equipment and labor required to construct the cast in place junction chamber as detailed on the drawings. Payment for **Junction Chamber, reinf, Det __** includes all excavation, trenching, dewatering, bypass pumping, forming, backfilling, disposal of excess material, temporary sheeting and bracing, removal of abandoned utilities and services, and the repair and replacement thereof if damaged, connection of sewers, testing, and all other work required for a complete job.

DIVISION 8 – MISCELLANEOUS

SECTION 8.1 MAINTAINING TRAFFIC, PAVEMENT MARKING AND DETECTOR LOOPS

SECTION 8.2 PRECONSTRUCTION DOCUMENTATION

SECTION 8.3 TREE PROTECTION

SECTION 8.4 LAWN RESTORATION

SECTION 8.5 TREES AND LANDSCAPING

SECTION 8.6 DESIGN AND INSPECTION BY CONSULTING ENGINEERS

SECTION 8.7 TRENCH CUTS AND RESTORATION IN PUBLIC STREETS

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DIVISION 8 - MISCELLANEOUS

SECTION 8.1

MAINTAINING TRAFFIC, PAVEMENT MARKING AND DETECTOR LOOPS

- a. **Description.** This work shall consist of the necessary provisions for Maintaining Traffic in and around the Work, furnishing and installing reflectorized pavement markings for new and reconstructed pavement surfaces, and furnishing and installing pre-wired traffic count and traffic detector loops with lead-in conduits and handholes in new and existing pavements, as shown on the Drawings, listed in the Bid Form and specified in this Section.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [8.1 of the Specified Product Index \(SPI\)](#).
1. **Maintaining Traffic.**
 - A. Temporary traffic control devices shall meet the design requirements of the Michigan Manual of Uniform Traffic Devices (MMUTCD), Part 6 and the requirements set out in the project Special Provisions and Maintaining Traffic Typical.
 - B. **Temporary Neighborhood Signs.**
 - (1) Signs shall be placed on steel signposts and secured to bases held in place by sandbags, as necessary. Temporary signs will be located as required by the Engineer.
 - (2) Signs will be obtained and supplied to the Contractor by the City.
 2. **Pavement Markings.**
 - A. In accordance with Section 811 of the current Michigan Department of Transportation (MDOT) Standard Construction Specifications.
 - B. All markings, shapes, and dimensions shall conform with the current MDOT typical Drawings for pavement markings, Special Provisions, or applicable Standard Details.
 3. **Detector Loops.**
 - A. **Loop Wire.** Wire shall be 14-gauge THHN stranded or as shown on the Drawings.
 - B. PVC lead-in and detector loop conduit and fittings: The PVC conduit shall be schedule 80, 3/4" nominal inside diameter. Fittings shall be plastic for use with PVC conduit. Type "T" and pulling elbows shall have rubber gaskets and screw covers in order to protect the wire from moisture infiltration. Glue used for connections shall be PVC cement or similar to endure durable and waterproof connections.
 - C. Handholes: Handholes shall be City of Grand Rapids type as shown on the Drawings or the applicable Standard Details.
 4. **Bollards.**
 - A. **Pipe.** Pipe shall be schedule 40 steel, hot dip galvanized after fabrication.
 - B. **Concrete.** Pipe fill and footing shall be Grade 3500 per [Section 6.1.b.2](#).
- c. **Construction.**
1. **Maintaining Traffic.**
 - A. **Public Safety and Convenience.** The Contractor shall at all times conduct their work so as to create the least possible obstruction to both vehicular and pedestrian traffic and to ensure the safety and convenience of the general public including the residents along the street. Unless otherwise specified, streets shall remain open to local and emergency traffic during construction operations.
 - (1) Complete protection of persons and property shall be provided by the Contractor. To this end, the Contractor shall provide and maintain adequate barricades, signs, lights, temporary pavement marking, and flags to warn and guide the public, and shall provide flag persons and watch persons as required. The Contractor shall contact Mobile GR at least three business days prior to commencement of work on any street where traffic will be maintained, and at least 10 business days prior to the closing of any street, or implementation of the required detour.

B. Restrictions.

- (1) No work shall be performed, or lane closures allowed during the Memorial Day, Fourth of July, or Labor Day holiday periods, unless approved otherwise by the Engineer.
- (2) As determined by the City Engineers Office and Traffic Safety, no work shall be performed, or lane closures allowed during City-wide events.
- (3) All work shall be conducted during daytime hours only. Night work may be permitted, at the discretion of the Engineer. However, any additional cost for such work shall be borne by the Contractor.
- (4) Vehicular and pedestrian access to all businesses/parking lots and parking areas shall be maintained at all times.
- (5) Keep all side streets and alleys free of construction related materials, equipment, and activities to allow clear visibility and access to all properties and businesses.
- (6) Access for construction vehicles between the travel lanes and work areas will be restricted to specific locations. The number of access points and their locations will require the prior approval of the Engineer.
- (7) Undercuts or excavations immediately adjacent to active traffic lanes shall be restored to no less than a 1 on 4 slope at the end of each working period unless otherwise approved by the Engineer. Fencing shall be required to protect open trenches during non-working hours and shall be provided by the Contractor as part of the trenching item utilized.
- (8) Sidewalks on both sides of a road under construction shall not be closed concurrently. All temporary sidewalks shall be at least five feet wide and shall consist of at least a 2-inch HMA top course, or as approved by Engineer. In areas where there is sidewalk only on one side of the road, temporary restore the sidewalk to the satisfaction of the City at the end of each day. Temporary gravel used to restore sidewalks is considered included in roadway grading.
 - (a) Replacement of removed sidewalk squares shall not exceed 4 consecutive days for placement, sawing and curing of the new concrete.
- (9) Ingress and egress to all buildings for pedestrians and vehicles shall be maintained. Temporary driveways and roads may be constructed.
- (10) Contractors, employees, and subcontractors shall not park vehicles or store equipment in areas that are needed for residential or commercial vehicle or bike parking, or bus stop locations.
- (11) Removing, obstructing, relocating or otherwise tampering with a regulatory traffic sign without prior approval of the Engineer is prohibited. Do not remove or obstruct regulatory signs until necessary to complete street reconstruction or without prior approval of the Engineer. Temporary regulatory signs shall be placed in accordance with the MMUTCD once the permanent signs are removed and shall be maintained until the permanent signs are reinstalled.
- (12) Daily waste pickup, mail deliveries, and deliveries at all homes and business buildings shall be coordinated by the Contractor. The Contractor shall provide an accessible central waste pickup location when barricading and/or excavations does not allow for a refuse packer to enter the site.
- (13) Driveway access shall be maintained at all times except when underground utility construction occurs directly adjacent to a driveway. Duration of driveway closure shall be minimized, and at no time shall extend overnight. Contractor shall provide property owners with written notice a minimum of two days prior to the anticipated driveway closure and shall inform residents of anticipated duration of driveway closure.

- C. Existing Traffic Signs.** Unless otherwise specified, removal and replacement of existing signs pertaining to traffic, either moving or parked, shall be accomplished by the City at no cost to the Contractor. However, any traffic sign damaged or destroyed by the Contractor shall be repaired or replaced by the City and the cost deducted from payments to the Contractor. Under no circumstances shall the Contractor remove, obstruct, relocate, or tamper with any traffic regulatory sign. In the event a conflict is foreseen or encountered, the Contractor shall notify the Mobile GR for a resolution.

- (1) Street name signs shall be maintained within the construction area for the duration of the project. Street name signs shall be visible from all intersection corners. If the existing street name sign and support are to be removed, and there is no alternate support available, the Contractor shall erect a separate post (provided by the City). The Contractor shall pick up the post and any required hardware from the City Sign Shop. The cost for this work shall be included in **Detour Signing (estimated __ days)**.
- D. **Detours.** Unless otherwise specified, the Contractor shall furnish, place, and maintain all necessary signs, barricades, and other appurtenances necessary for detouring traffic, including placing and maintaining signs, lights, barricades, temporary pavement markings, flag persons, etc., for the entire duration of the project. Detour signing shall be as shown on the Drawings, Special Provisions, Typical, and, or if not shown, in accordance with the current edition of the Michigan Manual of Uniform Traffic Control Devices.
- E. **Temporary Facilities.** All signs and barricades used for traffic control devices shall be reflectorized in accordance with MDOT and MMUTCD standards and shall be new or in like new condition. Items damaged during construction shall be replaced immediately.
- (1) Installation of temporary parking restrictions (i.e. "No Parking" signs) must be approved by the City Traffic Safety prior to installation.
- (2) Any time that traffic will be operating over the new leveling course, or the new wearing course prior to the installation of the permanent pavement markings, on streets where pavement markings are required, the Contractor must temporarily mark the pavement. The temporary tabs to be placed shall be 4' x 4" at 50' intervals for both centerline and lane lines. Removable pavement markings shall be used on existing or new pavement areas for traffic control during construction stages. Painted pavement markings may be used on temporary roadway surfaces that will eventually be removed. All temporary marking work will be considered to be included with the paving items.
2. **Recessing Pavement Markings.**
- A. Install a recess (groove) in accordance with the pavement marking material manufacturer's installation instructions. Ensure all recessing configurations are in accordance with the MMUTCD, the MDOT Department Pavement Marking Standards and the City of Grand Rapids pavement marking standards.
- (1) Grooving Concrete and Hot Mix Asphalt Pavement. If there are no markings on the pavement, paint a temporary tracer line (with no beads) exactly where the permanent markings will be placed. Use these lines as a template for the grooving operation.
- (a) Use equipment and methods approved by the manufacturer of the pavement marking material to be recessed for forming grooves in pavement surfaces. Dry-cut the grooves in a single pass using stacked diamond cutting heads on self-vacuuming equipment capable of producing a finished groove ready for pavement marking material installation.
- (b) Ensure that the bottom of the groove has a fine corduroy finish. If a coarse tooth pattern results, increase the number of blades and decrease the spaces on the cutting head until the required finish is achieved.
- (2) Groove Dimensions. Ensure grooves for recessed pavement markings are in accordance with the following:

Table 8.1-1 Longitudinal Markings	
Groove Width	Material width +1 inch, ($\pm 1/8$ inch).
Grove Depth	As recommended by the manufacturer, (± 5 mils).
Groove Position	Center/Lane Lines: 2 inches from joint line, ($\pm 1/8$ inch). Edge Lines: On lane, 2-4 inches in from the joint line, ($\pm 1/8$ inch). Edge Lines for 14 foot paved lanes: as directed by the Engineer.

Table 8.1-2 Transverse Markings – Stop Bars, Crosswalks and Cross Hatching	
Groove Width	Material width +1 inch, ($\pm 1/8$ inch).
Grove Depth	As recommended by the manufacturer, (± 5 mils).
Groove Position	In the exact location where the transverse marking will be placed.

Table 8.1-3 Transverse Markings – Symbols and Legends	
Groove Width	Size of the complete symbol or legend plus the width to smoothly zero out the groove depth.
Grove Depth	As recommended by the manufacturer, (± 5 mils).
Groove Position	In the exact location where the transverse marking will be placed.

Table 8.1-4 Turning Guide Line Markings	
Groove Width	Material width +1 inch, ($\pm 1/8$ inch)
Grove Depth	As recommended by the manufacturer, (± 5 mils).
Groove Position	In the exact location where the turning guide line will be placed.

(3) **Placing Recessed Pavement Markings.** Place the pavement marking material in the grooves within 24 hours of the grooves being made. Ensure the grooves are clean and dry prior to placing pavement marking material. Locate the groove so the entire marking can be placed within the groove.

3. **Pavement Markings.**

A. Place in accordance with Section 811 of the current MDOT Standard Specifications for Construction.

4. **Traffic Loops.**

A. Detector Loop Assembly - The PVC Conduit must be cut to dimensions shown on the Drawings or as required by the Engineer. All parts shall be assembled to form a rigid frame. The Conduit may be preheated and bent as required. The angle of bending shall not exceed 45 degrees (see the detector loop assembly detail on the Drawings). The wire to be threaded into the detector loop and the lead-in conduit to the handhole shall be in one piece. Splices will NOT be permitted.

B. The total length of wire to be used shall be determined according to perimeter of the detector loop, number of turns or times around the detector loop and length of lead-in wire. A minimum of 4' of both wires is to be left in the handhole or cabinet. The following table shows the number of turns or times that the wire is to be threaded around each detector loop.

Table 8.1-5 Detector Loop	
Detector Loop Perimeter (ft)	Number of Turns or Times Around Each Detector Loop
12 - 20	4
20 - 45	3

- C. All loops shall be wired in a clockwise direction and tagged to indicate start and finish. Loops shall also be numbered in the handhole or cabinet to facilitate splicing with alternate polarity connections. The color of the wire for each detector loop shall be different from the color for the other detector loops in order to be recognizable when all the wires are pulled into the handhole. The Contractor shall notify the Engineer prior to installation of the prewired loops to have them tested and approved by Traffic Safety. The Contractor will be responsible for delivering the loops to Traffic Safety for testing and for picking them up again afterwards. The detector loops shall not be installed until they have been approved.
- (1) Installation of Prewired Detector Loops.
- The assembled prewired detector loops shall be installed as shown on the Drawings.
 - The lead-in wire from each pair of loops shall be threaded through a single conduit to the handhole or as shown on the Drawings. After wire has been pulled to the handhole or cabinet, there shall be 4 feet of wire left to make necessary arrangements for traffic equipment connection. The lead-in conduit shall be placed perpendicular to centerline of the road. The loops shall be installed in the gravel base as shown on the "Detector Loop Installation Detail" on the Drawings. The sand cushion shall be considered incidental. The handholes shall be placed where shown on the Drawings or as required by the Engineer and shall be adjusted to the final grade of parkway or sidewalk. The ends of lead-in conduit in the handhole shall be carefully sealed with duct seal or silicone rubber to prevent water from entering the conduit. After the detector loops and lead-in conduit are in place, they must be tested and approved again by Traffic Safety prior to the placing of any backfill or paving.
 - Care shall be taken by the Contractor when pulling the wire through the conduit so as not to damage the wire in any way such as by excessive pulling tension or scoring of the sheath on conduit's edges. Any defective wire shall be replaced by the Contractor, at his own expense.
- (2) Acceptance Tests.
- The resistance to ground of the detector loop and its lead-in shall be a minimum of 1.0 Meg. OHMS under condition of weather or moisture. In the absence of circuit grounds, a temporary ground may be provided by a driven ground rod.
 - Each detector loop shall be tested for continuity at the handhole. This resistance shall not exceed 1.5 OHMS.
5. **Bollards.** Provide Grade 3500 concrete for the bollard foundation in accordance with [Section 6.1](#). Ensure that the bollard is plumb and reinforcement has been placed. Compact concrete during and immediately after placing using the required tool. After concrete is set, remove any forms or forming tubes to six inches below grade and prior to placing any adjacent concrete and expansion material.
- d. **Measurement and Payment.** The completed Work as measured for maintaining traffic, detour signing, and pavement marking will be paid for on the basis of the Contract Unit Prices for the following contract items, Pay Items (City Standard). The price shall include all labor, equipment and material for performing the work complete unless otherwise provided in the Provisions or in the Bid Form.

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
8.1.001	Maintaining Traf, estimated __ days	Lump Sum
8.1.002	Detour Signing, estimated __ days	Lump Sum
8.1.003	Temp Neighborhood Sign	Each
8.1.004	Traf detector loop installation	Lump Sum
8.1.005	Speed Hump, Det P-20	Each
8.1.006	Speed Cushion, Det P-20A	Each
8.1.007	Speed Table, Det P-20B	Each
8.1.008	Bollard, Det M-1	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
8.1.101	Pavt Mrkg, Waterborne, __ inch, (color)	Foot
8.1.102	Pavt Mrkg, Waterborne, 2nd Application __ inch, (color)	Foot
8.1.103	Pavt Mrkg, Wet Reflective Waterborne, 2nd Application __ inch, (color)	Foot
8.1.104	Pavt Mrkg, Thermopl, __ inch, (color)	Foot
8.1.105	Pavt Mrkg, Thermopl, __ inch, Crosswalk	Foot
8.1.106	Pavt Mrkg, Thermopl, __ inch, Stop Bar	Foot
8.1.107	Pavt Mrkg, Thermopl, __ inch, Cross Hatching, (color)	Foot
8.1.108	Pavt Mrkg, Polyurea, __ inch, Crosswalk	Foot
8.1.109	Pavt Mrkg, Polyurea, __ inch, Stop Bar	Foot
8.1.110	Pavt Mrkg, Polyurea, __ inch, Cross Hatching, (color)	Foot
8.1.111	Pavt Mrkg, Polyurea, __ inch, (color)	Foot
8.1.112	Pavt Mrkg, Polyurea, (legend)	Each
8.1.113	Pavt Mrkg, Polyurea, (symbol)	Each
8.1.114	Pavt Mrkg, Preformed Thermopl, (symbol)	Each
8.1.115	Pavt Mrkg, Preformed Thermopl, (legend)	Each
8.1.116	Pavt Mrkg, Preformed Thermopl, __ inch, Crosswalk	Foot
8.1.117	Pavt Mrkg, Preformed Thermopl, __ inch, Stop Bar	Foot
8.1.118	Pavt Mrkg, Preformed Thermopl, __ inch, Cross Hatching, (color)	Foot
8.1.119	Pavt Mrkg, Wet Reflective (binder), __ inch, (color)	Foot
8.1.120	Pavt Mrkg, (binder), For On-St Parking, __ inch, White	Foot
8.1.121	Pavt Mrkg, (binder), __ inch, Solid Thru Guide Line, (color)	Foot
8.1.122	Pavt Mrkg, (binder), __ inch, Solid Turning Guide Line, (color)	Foot
8.1.123	Pavt Mrkg, (material), __ inch, Dotted Thru Guide Line, (color)	Foot
8.1.124	Rem Curing Compound, for Spec Mrkg	Square Foot
8.1.125	Rem Curing Compound, for Longit Mrkg, __ inch	Foot
8.1.126	Rem Spec Mrkg	Square Foot
8.1.127	Rem Raised Pavt Marker	Each
8.1.128	Recessing Pavt Mrkg, Longit	Foot
8.1.129	Recessing Pavt Mrkg, Transv	Square Foot
8.1.130	Recessing Pavt Mrkg, Guide Line	Foot
8.1.131	Scarification, for Polyurea Spec Mrkg	Square Foot

1. Maintaining Traffic.

- A. Maintaining traffic will be paid for on the basis of a lump sum price, which shall include furnishing and maintaining lights, barricades, signs, flags, flag persons, temporary pavement marking, and other items of work as identified in this section for the duration of the project.

- B. Detour signing will be paid on the basis of a lump sum price, which shall include payment in full for furnishing and placing signs, barricades, and other devices, maintaining them throughout the life of the project, and removing them at project completion.
 - C. In the event that the Contractor fails to adequately place and/or maintain traffic control devices for Maintaining Traffic or Detour Signing, a specified sum will be deducted from the amount due under each of these items for each day the traffic control devices are inadequate. This specified sum is herein defined as the Lump Sum Price Bid in the Bid Form divided by the estimated number of days said traffic devices will be necessary, as set forth in the Bid Form. Under no circumstances shall the daily specified sum deduction be less than \$100. The estimated number of days set forth in the Bid Form is only for the purpose of calculating any daily specified sums to be deducted as set forth above and does not reflect the actual number of days said traffic devices are necessary. The Contractor shall be required to maintain traffic and detours as set forth herein for the entire duration of the project, regardless of the estimated number of days noted in the Bid Form and shall be paid the Lump Sum Price Bid for the same, less any deduction(s) for the number of days said traffic control devices were not adequately placed or maintained.
2. **Temp Neighborhood Signs** shall include the cost to install, maintain, and relocate temporary signs as directed by the Engineer.
 3. **Count Detector and Traffic Loop Installation. Count Detector Loop Installation and Traf Detector Loop Installation** which includes assembling and installing the pre-wired detector loops and lead-in conduits and installing the conduits for the detector loops as shown on the Drawings will be measured as a unit and paid for at the contract lump sum unit price each. The cost for handhole(s) will be measured and paid for separately under the appropriate item in the Bid Form.
 4. **Speed Hump, Det P-20, Speed Cushion, Det P-20A and Speed Table Det P-20B** shall include all labor, equipment, and materials and all other work required as shown in the Standard Details for a complete job.
 5. **Bollard.** The unit price for **Bollard, Det M-1** shall be payment in full for furnishing all equipment, labor, materials including steel pipe, galvanizing, concrete fill, concrete base, and paint and all other work required for a complete job to place the bollard.

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DIVISION 8 - MISCELLANEOUS

SECTION 8.2

PRECONSTRUCTION DOCUMENTATION

- a. **Description.** This work shall include completing preconstruction documentation to record the condition of existing facilities adjacent to the right-of-way prior to demolition and construction, monitoring existing facilities to determine if construction activities are having adverse effects, and all work necessary to return facilities to their preconstruction condition at the conclusion of the project.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [8.2 of the Specified Products Index \(SPI\)](#).
 - 1. **Crack monitors.** [\(SPI 8.2.A\)](#) Crack monitors shall be capable of measuring crack displacement and rotation to the nearest 1/32 inch (1 millimeter). Monitoring points shall be steel pins/nails projected securely into the concrete or other appropriate devices.
 - 2. Materials needed to return existing facilities to their preconstruction condition shall be new, quality products, and shall match the preconstruction properties of the existing component. Contractor shall submit material choices, including samples and manufacturer's literature, as applicable, to the Engineer for approval a minimum of 7 days prior to incorporating any materials into an existing facility.
- c. **Construction.**
 - 1. **Preconstruction Documentation.** The preconstruction documentation shall be conducted by the Contractor and witnessed by the Engineer immediately following the award of the Contract and prior to beginning any work. The Contractor shall employ a professional firm acceptable to the City and actively engaged in preconstruction color audio-video recording.
 - A. The preconstruction documentation shall include all surface features within the zone of construction influence including existing driveways, sidewalks, parkways, curbs, ditches, streets, landscaping, trees, culverts, retaining walls, fences, visible utilities, bridge piers, abutments, slope paving and all buildings. Documentation shall also include all existing cracks, steps, porches, and all possible areas of concern from various angles on existing buildings that could be affected by the construction. At a minimum, the preconstruction documentation shall include portions of all buildings and structures that are within 30 feet of the street right of way and within 50 feet of any buildings shown to be removed on the drawings. The preconstruction documentation may include, but not necessarily be limited to, areaways, basements of buildings, building interiors and building exteriors. Preconstruction documentation shall include an assessment of existing structural conditions and documentation of all existing cracks and structural defects.
 - B. The preconstruction documentation shall be recorded in the form of preconstruction video in DVD format, pictures, and field notes. At a minimum, three copies of the preconstruction documentation shall be furnished to the Engineer prior to starting construction. The Contractor shall effectively coordinate with private property owners for work performed on private property.

2. **Equipment.** Video recording and camera equipment used to record the condition of existing facilities shall be in proper working condition at the time of preconstruction documentation. Flash Drives, CDs, DVDs, or other media used to record the preconstruction documentation images shall be good quality, new materials.
 - A. **Cameras.** Cameras shall be high quality 3 chip color video camera, optical stabilization. 20X minimum optical magnification and shall be capable of producing NTSC 525 lines resolution/60 fields/30 frames per second and minimum illumination capabilities of at least 3-lux. Video recordings shall be time and date stamped on screen, include 2 simultaneous audio tracks (track 1 for SMPTE time code corresponding with number visible on screen and included on computer printout, track 2 with narrative commentary).
3. **Crack Monitors and Settlement Markers.** Crack monitors and settlement markers shall be set at locations specified by the Engineer after the preconstruction documentation is complete and prior to beginning any work. The Engineer may, at any time after work has begun, require the Contractor to place additional crack monitors and/or settlement markers.
 - A. Crack monitor and settlement marker readings shall be done by the Contractor according to the following schedule:
 - (1) Obtain monitor and/or marker reading one week before commencement of construction
 - (2) Obtain monitor and/or marker reading at maximum two-hour intervals during construction, or at increased frequency should conditions dictate, within 50 feet of a monitor or marker.
 - B. Settlement marker readings shall be optical or laser level having an accuracy of +/- 0.01 feet. The Contractor shall record and submit all monitor and marker readings daily to the Engineer.
 - C. If structural movement (0.125 inch) of existing facilities occurs, the Contractor shall stop all construction activities and shall notify the Engineer immediately. The Contractor shall immediately submit and implement an engineered corrective action plan to repair all damages resulting from such structural movement and install measures to prevent further damage from subsequent Contractor activities.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard).

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
8.2.001	Preconstruction Documentation.....	Lump Sum
8.2.002	Monitoring, crack monitor.....	Each
8.2.003	Monitoring, settlement marker	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Preconstruction Documentation** includes recording the condition of existing facilities adjacent to the project, providing required documentation to the Engineer, development and implementation of any necessary action plan(s), and the repair or replacement of any building or structure damaged during construction.
2. **Monitoring, crack monitor and Monitoring, settlement marker** includes the placement and monitoring of crack monitors and settlement markers as specified in the Bid Form. Contractor will be paid 80 percent of line item once crack and settlement monitors are placed and monitored during construction and will be paid the last 20 percent after crack and settlement monitors are removed after construction activities have ceased unless otherwise instructed by the engineer.

DIVISION 8 - MISCELLANEOUS

SECTION 8.3

TREE PROTECTION

- a. **Description.** This work consists of furnishing and/or installing the items described below, and includes; but is not limited to, all the necessary labor, materials, tools, and equipment necessary to result in a finished installation.
1. **Protection of Trees.** Contractor shall protect existing trees and other vegetation identified in the Drawings to remain in place. Prohibited practices include breaking of branches, scraping of bark, or unauthorized cutting; nailing or bolting into trees or plants; use of trees or plants as temporary support (i.e. for cables); unauthorized filling, excavating, trenching or augering within the parkway root zone; compaction/driving over the parkway root zone; (see definitions that follow), storage of any materials or vehicles within the parkway root zone; dumping of construction waste or materials (including liquids); unauthorized removal or relocation of woody plants; removal of tree protection barricades or construction fencing prior to completion of project.
 2. Compaction within the parkway root zone is the increasing of the soil density caused by heavy equipment, storage of materials or concentrated foot traffic which significantly alters the soil conditions from that which was present prior to construction.
 3. The parkway root zone of a tree is one and a half the distance of plant crown drip line outward from the stem, along undisturbed grade. Should placement of concrete be specified or authorized by the Owner within the root zone, a sulfur application will be applied by the Contractor. Trees to receive sulfur shall be identified by the City Forester or appointed representative.
 4. The parkway is defined as the area between the curb and sidewalk.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [8.3 of the Specified Products Index \(SPI\)](#).
1. **Sulfur.** Elemental sulfur, 90 percent sulfur derived from elemental sulfur, 10 percent bentonite.
- c. **Construction.**
1. **Tree Root Removal.** Should it be necessary to cut, and remove any tree roots affecting the sidewalk, this work will be performed by the Contractor.
 - A. Roots that are less than four inches in diameter may be removed by the Contractor using the following process:
 - (1) Roots are excavated to just outside the limits of sidewalk excavation.
 - (2) Roots must be cleanly cut cross-sectionally using a carbide tip saw, blade, or axe prior to removal.
 - (3) The Contractor shall not use machinery forks to rip roots up prior to cutting. The use of stump grinders to grind root material to the necessary grade is acceptable after a cross-sectional clean cut has been performed. MISS DIG shall be contacted prior to any stump grinder use in the right of way.
 - (4) All tools and methods used are to be approved by the Engineer.
 - B. Roots that interfere with the grade of the sidewalk shall be removed to a depth of 4 inches below the bottom of the sidewalk.
 - C. Roots greater than 4 inches in diameter will require approval from the City Forester or appointed representative prior to cutting and removal.
 - D. If it is determined by the Forester or designee that the necessary removal of the roots will jeopardize the stability or life expectancy of the tree, alternative methods may be considered including bridging the sidewalk over the root bed or tree removal. Tree removal

will not be part of this contract and will be the responsibility of the Grand Rapids Forestry Department.

2. **Sulfur Application.** Anywhere there is visible evidence of heaving in sidewalk and/or curb due to tree roots the Contractor shall saw cut root (as described above) and, prior to placing concrete and after final grading, shall place granular sulfur pellets on the grade of any sidewalk square within area of a tree trunk or any sidewalk that has roots directly under the soil or as directed by the Engineer. The sulfur shall be distributed as a root deterrent at a rate of 0.2 pounds per square foot (3.2 oz).
3. **Tree Damage.**
 - A. The Contractor shall be responsible for any expense resulting from damage to trees or property caused by their negligence.
 - B. Damage to City trees as a result of Contractor actions shall be determined by the City Forester or appointed representative. The Forester or designee shall evaluate damage and establish proportional replacement value as shown in Table 8.3-1, regardless of the current disposition of the plant.

Table 8.3-1 Value Schedule for Trees	
Caliper Diameter Size (in)	Value (\$)
1 - 6	Replace in kind
6 or greater	150.00 per diameter inch
DBH is tree trunk diameter at breast height or 4.5 feet above grade	

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard).

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
8.3.001	Protect Tree, Det M-2	Each
8.3.002	Sulfur Application	Square Foot
8.3.003	Root Pruning	Lump Sum

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
	None	

1. **Protect Tree, [Det M-2](#)** shall include the construction, maintenance, and removal of the tree protection structure, and all other measures used to protect the tree. Any trimming done to facilitate the Contractor's operations is also included in this item. **Protect Tree, [Det M-2](#)** shall also include all materials, labor and equipment necessary to conduct Contractor's operations in such a manner as to prevent damage to protected trees.

DIVISION 8 - MISCELLANEOUS

SECTION 8.4

LAWN RESTORATION

- a. **Description.** This work shall consist of furnishing, hauling, and spreading prepared soil, finish grading and preparing the seed bed and seed, fertilizer, and mulch materials on all turf areas disturbed by construction activity. All work shall be performed in accordance with the Michigan Department of Transportation (MDOT) Standard Specifications for Construction and Standard Plan R-100 Series, except as modified herein.
- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [8.4 of the Specific Products Index \(SPI\)](#).
1. **Topsoil.** Topsoil shall meet the following requirements:
 - A. Fertile, friable, screened, sandy loam soil, containing a minimum of 4 percent and maximum of 12 percent of organic matter as determined by the loss on Ignition Test, AOAC, a PH of 5.5 – 8.0 in accordance with ASTM G51, with not more than 50 percent clay and not more than 58 percent sand as determined in accordance with ASTM D5268.
 - B. At least 90 percent of the material shall pass the No. 10 sieve and shall be free of refuse or all material toxic to plant growth free of subsoil and stumps roots, brush or similar objects larger than 1 inch diameter and all stones larger than ½ inch diameter.
 - C. Ordinary sods and herbaceous growth like grass, need not be removed, but shall be thoroughly broken up and intermixed with soil during handling operations.
 - D. **Topsoil Source.** Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes. Topsoil shall be of uniform quality, free from hard clods, stiff clay, hard pan, sod, partially disintegrated stone and other materials considered as undesirable in good topsoil.
 - E. **Topsoil Analysis.** Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil. Report suitability of topsoil for lawn growth. Quantities of nitrogen, phosphorus, and potash nutrients and soil amendments in accordance with Section 917 of the MDOT Standard Specifications for Construction to be added to produce satisfactory topsoil.
 2. **Fertilizer.** Provide and apply Class B chemical nutrient fertilizer per MDOT Section 917 and as indicated by soil report.
 3. **Seed Mixture.** MDOT THM
 4. **Mulch Blanket.** ([SPI 8.4.A](#))
- c. **Construction.** All work shall be performed in accordance with Section 816 of the MDOT Standard Specifications for Construction and as specified herein.
1. **Topsoiling and Chemical Fertilizer Nutrient.** In accordance with MDOT Standard Specifications for Construction.
 2. **Seeding.** Application rate for seeding and mulching will be varied from the rate shown in the MDOT Standard Specifications as follows:
 - A. Seeding shall be done by the hydroseeding method unless otherwise approved by the Engineer. The application shall be as follows:
 - (1) Hydro Mulch shall be placed at a minimum of 2000 pounds per acre. The hydro mulch shall contain a minimum of 220 pounds of THM seed mixture and 84 pounds of each of the nutrients (12-12-12) per acre. The mulch shall consist of virgin wood fibers or an approved equal material. Wood fiber shall have a moisture content of not less than 7 percent or more than 13 percent, shall be no less than 98.4 percent organic matter, shall have a PH not less than 4.3 nor more than 5.3, shall be dyed green to aid in visual

metering during application, and shall be mixed and applied in accordance with standard accepted procedures.

- (2) When seeding is done by the seed, fertilizer and mulch method, the application shall be as follows:
 - (a) THM seed at 150 pounds per acre, chemical fertilizer at 350 pounds per acre and mulch at 3000 pounds per acre.
- (3) Once seed, fertilizer and mulch method is complete, contractor shall place erosion control (mulch) blankets on areas as shown on the Drawings. Where blankets are shown, also required will be the 6 inch wood pegs, or approved equal, with 24 inch spacing in order to hold the blankets in place.
- (4) **Initial Watering.** The Contractor shall water all seeded areas in accordance with the table below for a minimum 21 continuous days. Each watering event shall be a minimum of 3 continuous loops. Each loop being defined as watering both sides of the project at least one time. Deviation from this schedule shall only be allowed at the direction of the Engineer. Watering shall be slow and steady, as to allow for a significant soak of the soil. Amount of water shall total a minimum of 2 inches of water per week. Contractor shall ensure that watering is evenly distributed and gentle enough to ensure erosion does not occur.

Table 8.4-1 Watering (Events)			
	Mon. - Fri.	Sat.	Sun.
Mar. - May	2	1	-
Jun. – Aug.	3	2	-
Sept. – Nov.	2	1	-
Minimum 21 continuous days after seeding.			

- B. Begin this work as soon as possible after final grading of the areas designated for turf establishment but no later than the maximum time frames stated in Section 208 of the MDOT Standard Specifications for Construction.
 - C. Prior to placing prepared soil, shape compact and assure all areas to be seeded are weed free. Place prepared soil to a minimum depth of 4 inches, to meet proposed finished grade. Remove any stones greater than or equal to 1 inch in diameter. If the area being restored requires more than the minimum depth of prepared soil to meet finished grade, this additional depth must be filled using prepared soil or, at the Contractor's option, embankment. Furnishing and placing this additional material will not be paid separately but shall be included in the item **Turf Establishment, Turf Establishment, As Needed Watering** or the item **Roadway Grading**.
 - D. Asphalt Emulsion will not be permitted to hold the mulch in place. Seeding shall normally be placed prior to October 10. Extension of this time shall be at the discretion of the Engineer.
 - E. Before delivering any prepared soil to the site, the Contractor shall provide the topsoil analysis report, including the recommended soil amendments to be added to produce prepared soil, to the Engineer for review and acceptance.
 - F. The Engineer shall make visual inspection of the prepared soil delivered to the site and may elect to have the soil tested to verify compliance with requirements. One test will be at the Project's expense. If the prepared soil does not meet requirements additional tests will be at the Contractor's expense.
 - G. It shall be the responsibility of the Contractor to produce a healthy, uniform, close stand of grass, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 square feet and bare spots not exceeding 5 by 5 inches.
3. **Reseeding.** Seeded areas that do not show uniform germination as determined by the Engineer within 3 weeks of installation shall be reseeded. Parts of the seeded area that fail to

show uniform development as determined by the Engineer shall be reseeded and such reseeding shall continue until the contractor produces a uniform close stand of grass, free of weeds. Reseeding shall be done on areas flatter than a 1:4 slope using the hydroseeding method. Sloped areas steeper than a 1:4 slope shall be reseeded with mulch blanket at the Contractor's expense.

4. **Weed Control.** If the Engineer deems it necessary, the contractor must apply weed treatment within 3 days of being notified by the Engineer. The Contractor shall not apply weed treatment until after the third mowing of the lawn.
 - A. All costs associated with reseeding, weed killing, or other work required to establish acceptable turf shall be the responsibility of the contractor unless otherwise approved by the Engineer.
5. **Maintenance Period.** Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - A. Damage to seeded areas resulting from erosion or the Contractors operations shall be repaired by the Contractor until the lawn areas are acceptable.
 - B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - C. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
 - D. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height: 2 inches
 - E. The Contractor's responsibility to maintain the turf shall end when the Engineer is satisfied the above requirements have been met and a good stand of weed-free grass has been established and mowed three times. However, any failure on the part of the property owner to properly care for the restored lawn area prior to the Contractor achieving an acceptable lawn of weed-free grass shall in no way relieve the Contractor of his responsibility as set forth above.
6. **Final inspection and acceptance** of the seeded areas will be made at the conclusion of the maintenance period.

- d. **Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard).

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
8.4.001	Turf Establishment	Square Yard
8.4.002	Turf Establishment, As Needed Watering.....	Square Yard
8.4.003	Turf Watering	Each
8.4.004	Weed Control	Each
8.4.005	Mulch Blanket	Square Yard

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
8.4.101	Sodding	Square Yard

1. The completed work as measure for **Turf Establishment** will be measured in square yards of prepared soil placed and paid for at the contract unit price for the following pay item which shall be payment in full for all labor, equipment and materials to complete the specified work. **Turf Establishment** shall include specified Initial Watering. **Turf Establishment, As Needed Watering** will be measured and paid the same as **Turf Establishment** and includes the same material and specified work and requirements but does not include the specified Initial Watering.
2. **Turf Watering** will be measured in units as shown on the Bid Form (Each). After Initial Watering specified in [c.2.A.4](#), watering of turf establishment shall occur at minimum of twice per week for 2 months and also as directed by the Engineer after turf establishment has been placed. Amount of water shall total a minimum of 1.5 inches of water per week, combined natural rain water and contractor watering. Also included in the price for **Turf Watering** shall be the distribution of a letter to all residents at the time of seeding that states, at minimum, the following: Top soil, grass seed, and fertilizer were placed on (date), the minimum watering requirements that the contractor will be doing and the time frame, and it will be the responsibility of the home owner to water and maintain the grass after that time period. **Turf Watering** shall be paid for each time the contractor shall conduct said work and shall be payment in full for all labor, equipment, materials and all other work required for a complete job.
3. **Weed Control** will be measured in units as shown on the Bid Form (Each). Weed Control, whether weed killer spray or weed trimming/cutting with motorized weed eater, shall be paid be each time the contractor shall conduct said work and shall be completed as directed by the Engineer. Payment shall be in full for all labor, equipment, materials and all other work required for a complete job.
4. The completed work as measure for **Mulch Blankets** shall be measured in square yards of blankets placed and paid for at the contract unit price for the following pay item which shall be payment in full for placement and removal of blankets including all labor, equipment and materials to complete the specified work. This item shall be placed as noted on the plans or as direct by the Engineer.

DIVISION 8 - MISCELLANEOUS

SECTION 8.5

TREES AND LANDSCAPING

- a. **Description.** The work in this Section consists of furnishing all labor, materials, and equipment required to provide and install trees, shrubs, ground cover, plants and steel landscape edging. The work shall be done in accordance with Section 815 of the Michigan Department of Transportation (MDOT) Standard Specifications for Construction, the Drawings, project Special Provisions, and as directed by the Engineer.

1. **Definitions.**

- A. **Balled and Burlapped Stock.** Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.
- B. **Balled and Potted Stock.** Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
- C. **Bare-Root Stock.** Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.
- D. **Container-Grown Stock.** Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.
- E. **Manufactured Topsoil.** Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. **Planting Soil Mix.** Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

- b. **Materials.** Provide materials in accordance with the following specifications. Products shall be in accordance with part [8.5 of the Specified Products Index \(SPI\)](#).

1. **General.**

- A. The Contractor shall provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, **American Standard for Nursery Stock**.
 - B. Provide healthy, field-grown perennial plants from a commercial nursery, of species and variety shown or listed. Plants must be grown in the container size specified for a minimum of 1 year.
2. **Tree and Shrub Measurements.** Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
3. **Observation.** The Engineer may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. The Engineer retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

4. **Delivery, Storage and Handling.** Do not prune trees and shrubs before delivery, except as approved by Engineer. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery. Handle planting stock by root ball. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material. Do not remove container-grown stock from containers before time of planting. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.
5. **Tree and Shrub Material.** Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - A. Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Engineer, with a proportionate increase in size of roots or balls.
 - B. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.
 - C. **Shade and Flowering Trees.** Shade trees shall be single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required. Provide balled and burlapped trees. Branching height of trees shall not be less than 5 feet for the following genera; Tilia, Acer, Gleditsia, Zelkova and Ulmus.
 - (1) Small upright trees shall be single stem trees branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1. Provide balled and burlapped trees. Branching height of trees shall not be less than 4 feet for the genus Syringa.
6. **Deciduous Shrubs.** Provide balled and burlapped deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
7. **Ground Cover Plants.** Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1. Plants must be grown in the container size specified for a minimum of 1 year.
8. **Inorganic Soil Amendments**
 - A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent. Lime shall be Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
 - B. Aluminum Sulfate: Commercial grade, unadulterated.
 - C. Perlite: Horticultural perlite, soil amendment grade.
 - D. Sand: Clean, washed, natural or manufactured, free of toxic materials.
9. **Organic Soil Amendments.**
 - A. **Compost.** Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Compost shall have an organic matter content of 50 to 60 percent by dry weight.
 - B. **Feedstock.** Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
 - C. **Peat.** Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
 - D. **Wood Derivatives.** Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials. In lieu of

decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 pounds of ammonium nitrate or 0.25 pounds of ammonium sulfate per cubic foot of loose sawdust or ground bark.

- E. **Manure.** Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

10. **Fertilizer.**

- A. **Bonemeal.** Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. **Superphosphate.** Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. **Commercial Fertilizer.** Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - (1) **Composition.** 1 lb/1000 square feet of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

- 11. **Mulch.** Mulch shall be organic mulch, free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of shredded tree bark which has been stripped and shredded from saw logs by means of a de-barking machine. The material must readily pass through a conventional mulch blower. Wood chips will not be allowed.

- 12. **Antidesiccant.** Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

13. **Prepared Soil.**

- A. Mix topsoil with the following soil amendments and fertilizers in the following quantities:
 - (1) Ratio of Topsoil to Loose Peat and Sand by Volume: 4 parts by volume of topsoil to 1 part of granulated peat and 1 part sand.
 - (2) Lime: As specified to meet the pH range of 5.5 to 7.
 - (3) Weight of Slow-Release Fertilizer per 1000 square feet: 10 pounds.
 - (4) Compost to achieve 6 percent organic matter.

14. **Mycorrhizal Inoculant.** [\(SPI 8.5.A\)](#)

- c. **Construction.** Proceed with planting only when existing and forecasted weather conditions permit. Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Engineer. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
3. Loosen subgrade of planting beds to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off site. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix. Delay mixing fertilizer with planting soil mix if planting will not proceed within a few days. Mix lime with dry soil before mixing fertilizer.
4. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after natural settlement and till into existing soil. Do not spread if planting soil mix or subgrade is frozen, muddy, or excessively wet.

5. **Planting.** Finish grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.
 - A. Excavate tree and shrub pits as detailed on drawings. Notify Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations or if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits. Fill excavations with water and allow to percolate away before positioning trees and shrubs.
 - B. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
 - C. Apply 3 inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.
 - D. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Engineer, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.
 - E. Newly planted trees shall not have branches that encroach on the path of travel on the sidewalk or street, including street parking. Trees shall be of such stock so that when planted no branches are lower than seven (7) feet above the pedestrian right-of-way, ten (10) feet above a bike lane or parking spot(s), or sixteen (16) feet above a vehicular right-of-way. All trees shall be of such stock so as to have one vertically growing stem/trunk and meet the ANSI A300 standard for nursery stock.
 - F. Prune dead limbs from existing trees where shown on the plans. This work shall be considered incidental and included in pay items for planting trees.
 - G. Set out and space ground cover and plants as indicated. Dig holes large enough to allow spreading of roots and backfill with planting soil. Work planting soil mix around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
 - H. Mulch backfilled surfaces of planting beds and other areas indicated with 3-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.
 - I. During exterior planting, keep adjacent paving and construction clean and work area in an orderly condition. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.
 - J. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off site.
6. **Workmanship.**
 - A. Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for incidents that are beyond Contractor's control.
 - B. Warranty Period for Trees: One year from date of Substantial Completion.
 - C. Maintain trees and plants as required during warranty period to maintain health of plant, satisfactory growth, and clearance over pedestrian, bicycle, and vehicular rights-of-way. Replace immediately unless required to plant in the succeeding planting season. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

D. Watering and Cultivating, as specified in MDOT Standard Specifications for Construction, Section 815, and Project Special Provisions.

- d. Measurement and Payment.** The completed work as measured for items in this Section will be paid for at the Contract Unit Prices for the following contract items, Pay Item (City Standard).

Pay Item (MDOT Standard) are items of work from the current Michigan Department of Transportation Standard Specifications for Construction, and when utilized in the Bid Form will be as specified, constructed and measured and paid for at the Contract Unit Price per the current MDOT Standard Specifications for Construction.

Ref. ID	Pay Item (City Standard)	Pay Unit
8.5.001	(Botanical Name)	Each

Ref. ID	Pay Item (MDOT Standard)	Pay Unit
8.5.101	Site Preparation, Max. (dollar)	Lump Sum
8.5.102	Watering and Cultivating, First Season, Min (dollar)	Lump Sum
8.5.103	Watering and Cultivating, 2nd Season, Min (dollar)	Lump Sum

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DIVISION 8 - MISCELLANEOUS

SECTION 8.6

DESIGN AND INSPECTION BY CONSULTING ENGINEERS

- a. **Description.** For projects outside the City of Grand Rapids involving the construction of sanitary sewer and water main facilities for inclusion in the Grand Rapids System and approved by the City Manager, or designee, the construction engineering and inspection may be performed by a private consulting firm. This specification defines the conditions and procedures under which such engineering and inspection is to be performed.
- b. **Requirements Prior to Construction.**
1. Prior to the start of construction under this specification, the private engineering consultant, on behalf of a private developer or a municipality with the Grand Rapids sanitary sewer and water service areas shall submit the following:
 - A. An approved Preliminary Utility Plan (PUP).
 - B. An approved construction drawing set and, if applicable, special specifications associated with the project. The drawing set is to be signed by the City Engineer following City Commission approval and acceptance of applicable project documents.
 - C. Approved and signed construction agreement (projects funded by private developer) or construction letter agreement (projects funded by municipality). This document is to be approved by the City Commission.
 - D. Any other required approved and signed documents related to the project (public utility easement, oversizing agreement, payback agreement, financing agreement, etc.). Documents are to be accepted or approved by the City Commission.
 - E. Proof of ownership of the property being developed (private developers only).
 - F. Document signee authorization (e.g. articles of organization – private developers only).
 - G. Letter of credit or performance bond in amount of engineer's estimate for all public sanitary sewer and water main work related to the project.
 - H. Engineering services deposit with associated municipality, in accordance with project construction agreement (private development projects only).
 - I. Liability insurance certificate from project general contractor with the City of Grand Rapids included as "additionally insured".
 - J. Payment of applicable front foot charges related to the project (private development projects only.).
 - K. Receipt of applicable EGLE permit(s).
 - L. Completion of a pre-construction meeting.
- c. **Service Connections Prior to Final Acceptance (In-Service).**
1. On certain projects, the City Engineer may allow service connections to water mains and sanitary sewers prior to final acceptance of the utilities. When such early service connections are desired, the municipality, or designee, the developer (when applicable) and consultant shall provide the City Engineer with the following:
 - A. **Water Main.**
 - (1) In-service request letter from the responsible registered professional engineer, on behalf of the municipality.
 - (2) Evidence of satisfactory pressure and chlorination tests performed by the City of Grand Rapids Water System or other qualified persons or firms which may be approved by the City Engineer on a project-by-project basis.
 - (3) Final approved as-built information provided by the Consultant, including the construction drawings in electronic format (PDF) and geospatial data. Geospatial data shall include triangulation of all water main features in electronic format (SHP or DXF)

(NAD 1983 State Plane Michigan South FIPS 2113 (Intl Feet)). (Final as-built drawing set Mylars may be requested at this time).

- (4) Manufacturer's certification for all water pipe, fire hydrants, and valves stating that these materials have been manufactured in accordance with all applicable specifications.
- (5) Properly issued and recorded tap permits when applicable.
- (6) A certification by the responsible registered engineer that the water main is adequate for service and that the construction has been completed in accordance with the approved Drawings and City Standard Construction Specifications. (Projects inspected by private consulting firm only.)

B. Sanitary Sewer.

- (1) In-service request letter from the responsible registered professional engineer, on behalf of the municipality (can be combined with water main in-service request).
 - (2) Evidence of satisfactory air pressure tests.
 - (3) Evidence of a satisfactory video inspection by the developer's (private development) or municipality's consultant engineering firm as approved by the City Engineer.
 - (4) Final approved as-built information provided by the Consultant, including the construction drawings in electronic format (PDF) and geospatial data. Geospatial data shall include triangulation of all sanitary sewer features in electronic format (SHP or DXF) (NAD 1983 State Plane Michigan South FIPS 2113 (Intl Feet)). (Final as-built drawing set Mylars may be requested at this time).
 - (5) Test results signed by a qualified testing engineer showing that sewer pipe has been manufactured and tested in accordance with all applicable specifications and in accordance with [Section 4.1](#) of these specifications, but at no cost to the City. All sewer pipe delivered to the project shall be clearly marked by the Manufacturer or consulting firm undertaking the testing prior to installation.
 - (6) A certification by the responsible registered engineer that the sanitary sewer is adequate for service and that the construction has been completed in accordance with the approved Drawings and City Standard Construction Specifications.
2. An In-service letter is issued by the City Engineer's Office when above applicable requirements are met. Once the In-service letter is received by the City Development Center, contractor payment for connection fees can be paid and the appropriate plumbing inspector can be scheduled for service connection approval. An In-service letter is not required when new sanitary sewer laterals and water services are connected to existing sanitary sewers and water mains.

d. Requirements for Final Acceptance.

1. Prior to the final acceptance of the project (sanitary sewer and water main) by the City of Grand Rapids for incorporation in its sanitary or water systems, the responsible registered professional engineer shall furnish the City Engineer with the following prior to being granted final acceptance no later than six months after service connections (In-service) had been allowed:
 - A. Final approved as-built drawing set on Mylar, in accordance with the construction (letter) agreement. It is preferred that this submittal is made at the time of the request for in-service.
 - B. A statement by the Consultant providing the project construction inspection service, by or on behalf of the Project Inspector, that the project has been constructed in accordance with the Drawings, as approved by the City Engineer, and the Standard Construction Specifications herein, including the raising of all castings to final grade and the completion of all outstanding punch-list items.
 - C. A maintenance bond in accordance with the construction agreement (private development projects only).
 - D. A final total cost of all sanitary sewer work and a final total cost of all water main work.

DIVISION 8 - MISCELLANEOUS

SECTION 8.7

TRENCH CUTS AND RESTORATION IN PUBLIC STREETS

- a. **Description.** This specification applies to the work of all parties who cut utility trenches in streets within the City of Grand Rapids. It shall include City Departments and contractors employed by City Departments, public utilities, contractors, and any other entities or individuals who excavate in public right of way. The term **Contractor** used in this Section refers to those engaged in these activities. The purpose of this Section is the temporary and permanent repair of said trenches.
1. In accordance to City Ordinance Chapter 15 Section 4.13, no permit to make any opening or excavation in or under a paved street shall be granted to any person within a period of 2 years after the completion of any paving or resurfacing thereof. If a street opening is necessary as a public safety measure, the City Engineer may suspend the operation of this Ordinance as to such street opening.
- b. **Materials.**
1. **Backfill and Subbase.** Backfill shall conform to [Section 2.5](#), and subbase shall conform to [Section 3.1](#).
 2. **Aggregate Base.** Aggregate base shall conform to [Section 3.2](#).
 3. **Concrete.** Concrete used under this specification shall conform to [Section 6.1](#) and [Section 6.2](#), except as specified herein.
 4. **HMA.** Materials and placement of HMA pavement, base courses and temporary patches shall conform to [Section 5.1](#), except as specified herein.
 5. **Cold Patch.** Cold patch materials shall be CP-3 or CP-5 as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
- c. **Construction.**
1. **Preparation of Trench Area Prior to Restoration.**
 - A. When existing pavement has been removed and prior to restoration, the pavement shall be neatly trimmed to a minimum depth of 3 inches. HMA pavements may be trimmed by sawcutting or other approved methods. Concrete pavement trimming shall be done by sawcutting. If trim lines are not neat, additional trimming must be done and the Contractor shall do so at no additional cost. Full depth sawcutting, where called for, will be paid for as a separate item, as specified in [Section 2.3](#).
 - B. Any areas of pavement, sidewalk, or curb and gutter which are undermined during excavation shall be removed and replaced at the Contractor's cost.
 - C. If it is impractical at the time of excavation to place hot HMA material, the backfill must be placed as specified and temporary pavement placed as described in this Section.
 2. **Restoration.**
 - A. Restoration shall be as specified below. However, temporary repairs utilizing cold patch of a thickness as required by the Engineer over a 6 inch aggregate base may be used if approved by the Engineer for periods of up to 72 hours, prior to the placement of the permanent trench repair.
 - B. **Sidewalks, Sidewalk Ramps, Driveways and Approaches and Alley Pavement.** In accordance with [Section 6.4](#).
 - (1) **Cross Slope.** Cross slope shall be 1.5% +/- .5% (or max 2%) on all new sidewalks unless otherwise approved by the Engineer's Office.
 - (2) **Drive Approaches.** Removal and replacement of a drive approach shall include adjacent curb and gutter replacement unless otherwise approved by the Engineer's Office.

- C. **State Trunklines.** In accordance with MDOT permit requirements, or at a minimum as follows. Restoration of pavement areas, where there is an existing HMA surface with a concrete base, shall consist of eight inches of concrete pavement and 1-1/2 inches of HMA leveling course and 1-1/2 inches of HMA top course.
 - (1) Restoration of pavement areas, where there is an existing HMA surface with a gravel base or HMA base, shall consist of seven inches of HMA base course and 1-1/2 inches of HMA leveling course and 1-1/2 inches of top course. All trench edges shall receive Hot-Pour Joint Sealant in accordance with Section 914 of the current MDOT Standard Specifications for Construction.
 - (2) Restoration of pavement areas, where there is an existing concrete surface, shall consist of 9 inches of concrete pavement. All concrete repairs shall be in accordance with Section 603 and 1006 of the current MDOT Standard Specifications for Construction and MDOT Standard Plan R-44.
- D. **Major Streets.** Restoration of pavement areas, where there is an existing HMA surface on the street, shall consist of 7 inches of HMA base course, 1-1/2 inches of HMA leveling course and 1-1/2 inches of HMA top course. All trench edges shall receive Hot-Pour Joint Sealant in accordance with Section 914 of the current MDOT Standard Specifications for Construction.
 - (1) Restoration of pavement areas, where there is an existing concrete surface, shall consist of eight inches of concrete pavement. All concrete repairs shall be in accordance with Section 603 and 1006 of the current MDOT Standard Specifications for Construction and MDOT Standard Plan R-44.
 - (2) Restoration shall include restoration of pavement markings to match existing.
- E. **Local Streets.** Restoration of pavement areas, where there is an existing HMA surface on a concrete base or black base, shall consist of 5 inches of HMA base course and 1-1/2 inches of HMA leveling course and 1-1/2 inches of HMA top course.
 - (1) Restoration of pavement areas, where there is an existing HMA surface on an aggregate base, shall consist of 8 inches of aggregate base and 1-1/2 inches of HMA leveling course and 1-1/2 inches of HMA top course. The Contractor may substitute 5 inches of HMA base for eight inches of aggregate base if they choose. All trench edges shall receive Hot-Pour Joint Sealant in accordance with Section 914 of the current MDOT Standard Specifications for Construction.
 - (2) Restoration of pavement areas, where there is an existing concrete surface, shall consist of 6 inches of concrete pavement. All concrete repairs shall be in accordance with Section 603 and 1006 of the current MDOT Standard Specifications for Construction and MDOT Standard Plan R-44.
 - (3) Restoration shall include restoration of pavement markings to match existing.
- F. **Brick Streets.** As directed by the City Engineer, certain streets due to historical significance, must have bricks replaced. Where the brick is to be replaced, the restoration shall consist of 6 inches of concrete base, 1 inch of sand and brick pavement in accordance with [Section 6.6](#). The Contractor shall salvage and reuse any bricks available to make the repair. If additional bricks are required, Contractor shall furnish them at no additional cost. Should the street not require the replacement of brick as approved by the Engineer, the Contractor shall remove the loose brick and make repairs as specified previously.
- 3. **Correction of Deficiencies.** The permanent patch placed by the Contractor shall be guaranteed for a period of 18 months. During this period should deficiencies appear the Contractor shall be responsible to make repairs as outlined. Such deficiencies shall include, but not be limited to, settled or raised pavement, deterioration of material, or separation of joints. The Contractor shall meet with the Engineer to decide upon a corrective method of repair. This method may be:
 - A. a total removal and replacement of the patched area and recompaction of the backfill, sub-base and base, if necessary;
 - B. providing additional material and use of an infra-red method to reheat the whole patch and recompact the area; or
 - C. use of the infra-red method, or other method approved by the Engineer, to mend joints with the adjacent pavement.

The Contractor shall make repairs in a timely manner. Should weather limitations be in force at the time, the Contractor shall make temporary repairs and be expected to make permanent repairs when weather permits, regardless of whether the 18 month guarantee period has expired at that point.

4. **Weather Limitations.** Should the Contractor desire to cut a trench between November 15 and April 15, they will be required to make temporary repairs to the pavement as follows, unless otherwise approved by the Engineer:
 - A. **Major Streets and Trunklines.** On major streets and State Trunklines, the Contractor shall prepare sub-base as outlined and in lieu of the base and surface courses place a temporary section consisting of 8 inches aggregate and 6 inches concrete with the concrete placed flush with the adjacent pavement. This section shall then be removed, and a permanent patch installed by June 1, or earlier if weather permits.
 - B. **Local Streets.** On local streets, the Contractor shall prepare the subbase and in lieu of the base and surface courses, the Contractor may place a temporary section consisting of 6 inches of aggregate base and 6 inches of concrete with the concrete placed flush with the adjacent pavement. This temporary section shall then be removed, and a permanent patch installed by June 1, or earlier if weather permits. If approved by the Engineer, temporary repairs consisting of 6 inches aggregate base and 3 inches of cold patch may be used on local streets.
 - (1) The Contractor shall periodically inspect and maintain the temporary repairs.
5. **Other Requirements.** The following items shall be provided as required in the Standard Specifications.
 - A. Insurance.
 - B. Performance and Lien Bonds.
 - C. Prequalification of Contractor.
 - D. Notification and Coordination with City Engineer prior to Start of Work.
 - E. Soil Erosion Control and Sedimentation Control.
 - F. Inspection by the City Engineer.
 - G. Public Safety, Convenience, and Maintaining Traffic.
 - H. Protection of Existing Utilities.
 - I. Material certifications/testing reports for subbase and aggregate base.
 - J. HMA Density test reports and/or Concrete compression test reports.

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PAY ITEM INDEX

ITEM DESCRIPTION	UNIT	SECTION
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A

Abandon and Fill Underground Utility, __ inch Dia.	Foot	2.3
Abandon Valve Chamber and Place Valve Box, Det P-23A	Each	2.3
Adj existing __ inch water serv	Each	4.3
Aggregate Base, __ inch.....	Square Yard	3.2
Aggregate Base, LM	Cubic Yard	3.2
Aggregate Surface Cse.....	Cubic Yard, Ton	3.2
Aggregate Surface Cse, __ inch	Square Yard	3.2
Air relief valve and chamber on __ inch forcemain, Det S-18	Each	4.4
Alley basin, __ foot dia, Det S-7	Each	4.5
Areaway, Rem.....	Cubic Yard	2.3
Arrestor, Distribution Class 10KV	Each	4.7

B

Backfill, Swamp	Cubic Yard	2.4
Basin Connection, C76 Cl __, __ inch	Foot	4.2
Basin Connection, DI Cl __, __ inch	Foot	4.2
Bend, __ Degree, __ inch	Each	4.3
Bend, __ Degree, __ inch, forcemain	Each	4.4
Blowoff tee with plug, __ inch, on __ inch forcemain	Each	4.4
Bollard, Det M-1	Each	8.1
Bore and Jack __ inch dia Steel Casing Pipe, Wall Thickness __ inch, including __ inch (carrier pipe)	Foot	2.7
(Botanical Name)	Each	8.5
Bracket arm on wood pole, __ foot, Det E-075	Each	4.8
Brick Pavt	Square Yard	6.6
Brick Pavt, Conc Header	Foot	6.6
Brick Pavt, Conc or Mortar Shim	Cubic Yard	6.6
Brick Pavt, Rem and Salv Brick Pavers, Full Depth	Square Yard	2.3
Brick Pavt, Rem, Full Depth	Square Yard	2.3

ITEM DESCRIPTION	UNIT	SECTION
Brick Pavt, Repr	Square Yard	6.6
Brick Pavt, Salvd Pavers	Square Yard	6.6
Bulkhead, __ inch.....	Each	6.1
Bulkhead, reinf, Det __	Each	7.1
Bulkhead, Rem, 24 inch or larger	Each	2.3
Bulkhead, Rem, 6 inch to 23 inch	Each	2.3
Butterfly Valve and box, __ inch	Each	4.3

C

Cable sec pedestal.....	Each	4.9
Catch basin casting, Adj.....	Each	4.5
Catch basin casting, Furn	Each	4.5
Catch basin, __ foot dia, Det ____	Each	4.5
Cement.....	Ton	6.1
Chamber or Pit, Rebuild	Vertical Foot	4.6
Chamber or Pit, Rebuild with flattop, Det S-10	Each	4.6
Chamber, Blowoff Assembly, Det W-18	Each	4.6
Coldmill HMA Pavt __ inch.....	Square Yard	2.3
Conc Base Cse, Nonreinf, modified, __ inch	Square Yard	6.2
Conc Pavt, Nonreinf, modified, __ inch.....	Square Yard	6.2
Conc Alley and Approach, Rem	Square Foot	2.3
Conc Curb and Gutter, Rem	Foot	2.3
Conc Encased Conduit, __ , __ in, schedule 40 PVC	Foot	4.9
Conc Pavt Base, Rem.....	Square Yard	2.3
Conc Pavt, Reinf, Rem.....	Square Yard	2.3
Conc Sidewalk, Driveway and Approach, Rem	Square Foot	2.3
Conc Sidewalk, Grinding, __ inch to __ inch	Foot	2.3
Contaminated Material, Storage, Handling and Disposal	Dollars	2.6
Core and Boot __ inch Sanitary Sewer into Sewer or Mh	Each	4.1
Core and Boot __ inch Storm Sewer into Sewer or Mh	Each	4.2
Core and Seal __ inch Sanitary Sewer into Sewer or Mh.....	Each	4.1
Core and Seal __ inch Storm Sewer into Sewer or Mh	Each	4.2
Cross arm, double, 3-1/2 inch by 4-1/2 inch by __ foot	Each	4.7
Cross arm, single, 3-1/2 inch by 4-1/2 inch by __ foot.....	Each	4.7
Curb and Gutter, (width) by (thickness) inch pan, Det P-5	Foot	6.3

ITEM DESCRIPTION	UNIT	SECTION
Curb box in Pavt, Det P-23C	Each	4.6
Curb box on water serv, __ inch	Each	4.3
Curb box, Adj	Each	4.6
Curb box, Furn	Each	4.6
Curb Ramp Opening, Conc.....	Foot	6.4
Curb Ramp, Conc, __ inch.....	Square Foot	6.4
Curb Stop and box on water serv, __ inch.....	Each	4.3
Curb, (width) by (height) inch, Det P-5A	Foot	6.3
Cutout, 200A with __A T fuse	Each	4.7

D

Detectable Warning Surface	Foot	6.4
Detour Signing, estimated ____ days	Lump Sum	8.1
DB Conduit, __ , __ inch, schedule __ PVC	Foot	4.9
Ditch Basin, __ foot dia, Det S-8	Each	4.5
Driveway, Nonreinf Conc, __ inch.....	Square Yard	6.4
Drop connection, High Speed, Det S-1B , on __ inch Sanitary Sewer	Each	4.5
Drop connection, Det S-1A , on __ inch Sanitary Sewer	Each	4.5
Drop connection, Det S-1A , on __ inch Sanitary Sewer, add depth over 15 foot.....	Foot	4.5
Drop inlet, Det S-6	Each	4.5
Drop Mh, Det S-6A	Each	4.5
Dust Control	Lump Sum	2.2

E

Elbow, 15 kV, Prim Cable	Each	4.7
Embankment, CIP	Cubic Yard	2.4
Embankment, LM	Cubic Yard	2.4
Excavation, Earth	Cubic Yard	2.4
Excavation, Peat	Cubic Yard	2.4
Excavation, Rock	Cubic Yard	2.4

ITEM DESCRIPTION	UNIT	SECTION
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F

Fiberglass light pole, 14-foot	Each	4.8
Fiberglass light pole, 28-foot mounting height and 8-foot mast arm.....	Each	4.8
Fiberglass light pole, 35-foot mounting height and 10-foot mast arm.....	Each	4.8
Fire hydrant, rem	Each	4.3
Fire hydrant, rem and salv	Each	4.3
Fitting, Oversized	Dollars	4.3
Forcemain, (Material), __ inch	Foot	4.4
Forcemain, Discharge Mh, Det S-22	Each	4.4
Four-way cross, __ inch by __ inch	Each	4.3

G

Ground Assembly for Wood Pole, Det E-205	Each	4.7
Guy installation for wood pole, Det E-250 , __ K rating, ____ foot		
Lead including fiberglass guy strain insulation	Each	4.7
Guy installation pole to pole, __ K rating, including fiberglass		
guy strain insulation	Each	4.7

H

Hand Patching.....	Ton	5.1
Hh, Polymer, 17-inch by 30-inch	Each	4.9
Hh, Precast Conc, 24-inch round by 36-inch deep	Each	4.9
Hh, Precast Conc, 36-inch round by 42-inch deep	Each	4.9
HMA, Approach	Ton	5.1
HMA Driveway, Rem	Square Foot	2.3
HMA Pavt, Rem, Full Depth, Outside Roadway	Square Yard	2.3
HMA, (type), High Stress	Ton	5.1
HMA, 13A	Ton	5.1
HMA, 2C	Ton	5.1
HMA, 2E __	Ton	5.1
HMA, 36A	Ton	5.1
HMA, 3C	Ton	5.1
HMA, 3E __	Ton	5.1

ITEM DESCRIPTION	UNIT	SECTION
HMA, 4C	Ton	5.1
HMA, 4E ____	Ton	5.1
HMA, 5E ____	Ton	5.1
Hydrant Extension, ____ inch	Each	4.3
Hydrant, 5 inch	Each	4.3

I

Infiltration basin, ____ foot dia, ____ foot sump, Det S-5	Each	4.5
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J

Joint, Contraction (type)	Foot	6.2
Joint, Contraction (type), Intersection	Foot	6.2
Joint, Expansion, (type)	Foot	6.2
Joint, Expansion, (type), Intersection	Foot	6.2
Joint, Plane-of-Weakness	Foot	6.2
Joint, Plane-of-Weakness, Intersection	Foot	6.2
Junction Chamber, reinf, Det ____	Each	7.1

L

Light pole Fdn, ____-inch dia	Each	4.8
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M

Maintain Sanitary Sewer Serv	Lump Sum	4.1
Maintain Storm Sewer Serv	Lump Sum	4.2
Maintaining Traf, estimated ____ days	Lump Sum	8.1
Mh casting, Adj	Each	4.5
Mh casting, Furn	Each	4.5
Mh casting, oversized, Adj	Each	4.5
Mh casting, oversized, Furn	Each	4.5
Mh or Catch basin, Rebuild	Vertical Foot	4.5
Mh or Catch basin, Rebuild with flattop, Det S-10	Each	4.5
Mh, Air Vent, Det W-17	Each	4.6

ITEM DESCRIPTION	UNIT	SECTION
Mh, Hardware Package, for __ feet by __ feet by __ feet	Each	4.9
Mh, Precast Conc, __ feet by __ feet by __ feet	Each	4.9
Mh, Valve Chamber, or Catch Basin, Rem	Each	2.3
Median Island End Treatment, Det P-5D	Each	6.3
Meter Pit, Det W-11	Each	4.6
Meter Pit, Rem	Each	2.3
Mobilization, Max (dollar)	Lump Sum	1.3
Monitoring, crack monitor	Each	8.2
Monitoring, settlement marker	Each	8.2
Mulch Blanket	Square Yard	8.4

O

Obstruction Rem, Bore and Jack, 18 inch to 36 inch	Each	2.7
Obstruction Rem, Bore and Jack, 36 inch or larger	Each	2.7
Obstruction Rem, Bore and Jack, Less than 18 inch	Each	2.7
One wire rack, bolted	Each	4.7
Ornamental alum light pole, 24-foot	Each	4.8
Ornamental alum double arm light pole, 24-foot	Each	4.8
Overhead Prim Line /C, __ ACSR	Foot	4.7
Overhead Prim Neutral /C, __ ACSR	Foot	4.7
Overhead Sec /C, #1/0 triplex	Foot	4.7
Overhead Sec /C, #4 triplex	Foot	4.7

P

Pavt, Rem, Full Depth	Square Yard	2.3
Pavt Mrkg, (binder), __ inch, Solid Thru Guide Line, (color)	Foot	8.1
Pavt Mrkg, (binder), __ inch, Solid Turning Guide Line, (color)	Foot	8.1
Pavt Mrkg, (binder), For On-St Parking, __ inch, White	Foot	8.1
Pavt Mrkg, (material), __ inch, Dotted Thru Guide Line, (color)	Foot	8.1
Pavt Mrkg, Polyurea, (legend)	Each	8.1
Pavt Mrkg, Polyurea, (symbol)	Each	8.1
Pavt Mrkg, Polyurea, __ inch, (color)	Foot	8.1
Pavt Mrkg, Polyurea, __ inch, Cross Hatching, (color)	Foot	8.1
Pavt Mrkg, Polyurea, __ inch, Crosswalk	Foot	8.1
Pavt Mrkg, Polyurea, __ inch, Stop Bar	Foot	8.1

ITEM DESCRIPTION	UNIT	SECTION
Pavt Mrkg, Preformed Thermopl, (legend)	Each	8.1
Pavt Mrkg, Preformed Thermopl, (symbol)	Each	8.1
Pavt Mrkg, Preformed Thermopl, __ inch, Cross Hatching, (color)	Foot	8.1
Pavt Mrkg, Preformed Thermopl, __ inch, Crosswalk	Foot	8.1
Pavt Mrkg, Preformed Thermopl, __ inch, Stop Bar	Foot	8.1
Pavt Mrkg, Thermopl, __ inch, (color)	Foot	8.1
Pavt Mrkg, Thermopl, __ inch, Cross Hatching, (color)	Foot	8.1
Pavt Mrkg, Thermopl, __ inch, Crosswalk	Foot	8.1
Pavt Mrkg, Thermopl, __ inch, Stop Bar	Foot	8.1
Pavt Mrkg, Waterborne, __ inch, (color)	Foot	8.1
Pavt Mrkg, Waterborne, 2nd Application __ inch, (color)	Foot	8.1
Pavt Mrkg, Wet Reflective (binder), __ inch, (color)	Foot	8.1
Pavt Mrkg, Wet Reflective Waterborne, 2nd Application __ inch, (color)	Foot	8.1
Plug, __ inch	Each	4.3
Plug, __ inch, forcemain.....	Each	4.4
Preconstruction Documentation	Lump Sum	8.2
Protect Tree, Det M-2	Each	8.3

R

Recessing Pavt Mrkg, Guide Line	Foot	8.1
Recessing Pavt Mrkg, Longit	Foot	8.1
Recessing Pavt Mrkg, Transv	Square Foot	8.1
Reconnect existing __ inch copper water serv	Each	4.3
Reconnect Existing Sanitary Sewer Lateral.....	Each	4.1
Reducer, __ inch by __ inch.....	Each	4.3
Reducer, __ inch by __ inch, forcemain.....	Each	4.4
Rem Curing Compound, for Longit Mrkg, __ inch	Foot	8.1
Rem Curing Compound, for Spec Mrkg	Square Foot	8.1
Rem Raised Pavt Marker	Each	8.1
Rem Spec Mrkg	Square Foot	8.1
Roadway Grading	Station	2.4
Roll Curb and Gutter, (width) by (thickness) inch pan, Det P-5B	Foot	6.3
Root Pruning	Lump Sum	8.3

ITEM DESCRIPTION	UNIT	SECTION
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S

Sanitary Mh, __ foot dia, Det __	Each	4.5
Sanitary Mh, __ foot dia, Det __, add depth over 15 foot	Foot	4.5
Sanitary Sewer Lateral, C700X, __ inch	Foot	4.1
Sanitary Sewer Lateral, D2680, __ inch	Foot	4.1
Sanitary Sewer Lateral, DI CI __, __ inch	Foot	4.1
Sanitary Sewer Lateral, Extra Strength, __ inch	Foot	4.1
Sanitary Sewer Lateral, SDR __, __ inch	Foot	4.1
Sanitary Sewer, C700X, __ inch	Foot	4.1
Sanitary Sewer, C76 CI __, __ inch	Foot	4.1
Sanitary Sewer, D2680, __ inch	Foot	4.1
Sanitary Sewer, DI CI __, Epoxy Lined, __ inch	Foot	4.1
Sanitary Sewer, DI CI __, __ inch	Foot	4.1
Sanitary Sewer, F949, __ inch	Foot	4.1
Saw Cut, Full Depth	Foot	2.3
Scarification, for Polyurea Spec Mrkg	Square Foot	8.1
Sec cable spreader bolted to pole	Each	4.7
Sidewalk guy installation for wood pole, Det E-255 , __ K rating		
__ foot Lead including fiberglass guy strain insulation	Each	4.7
Sidewalk Ramp, ADA curb	Foot	6.4
Sidewalk, Conc, __ inch	Square Foot	6.4
Sign, Rem and Salv	Each	2.3
Site Preparation, Max. (dollar)	Lump Sum	8.5
Sleeve, __ inch	Each	4.3
Sleeve, __ inch, forcemain	Each	4.4
Sodding	Square Yard	8.4
Soil Erosion and Sedimentation Control, Install	Lump Sum	2.2
Soil Erosion and Sedimentation Control, Maintain	Lump Sum	2.2
Soil Erosion and Sedimentation Control, Remove	Lump Sum	2.2
Soil Erosion and Sedimentation Control Plan	Lump Sum	2.2
Speed Cushion, Det P-20A	Each	8.1
Speed Hump, Det P-20	Each	8.1
Speed Table, Det P-20B	Each	8.1
Splice, 15 kV, Prim Cable	Each	4.7
Steel pin and insulator	Each	4.7

ITEM DESCRIPTION	UNIT	SECTION
Storm Mh, __ foot dia, Det ____	Each	4.5
Storm Mh, __ foot dia, Det ____, add depth over 15 foot	Foot	4.5
Storm Sewer Lateral, C76 CI __, __ inch	Foot	4.2
Storm Sewer Lateral, D2680, __ inch	Foot	4.2
Storm Sewer Lateral, DI CI __, __ inch	Foot	4.2
Storm Sewer Lateral, SDR __, __ inch	Foot	4.2
Storm Sewer, C76 CI __, __ inch	Foot	4.2
Storm Sewer, DI CI __, __ inch	Foot	4.2
Storm Water Operator's Inspection	Each	2.2
St Light Type __	Each	4.8
Stump, Rem 19 inch to 36 inch	Each	2.1
Stump, Rem 37 inch or Larger	Each	2.1
Stump, Rem 6 inch to 18 inch	Each	2.1
Subbase, CIP	Cubic Yard	3.1
Subbase, LM	Cubic Yard	3.1
Subgrade Undercutting, Type __	Cubic Yard	2.4
Sulfur Application	Square Foot	8.3
Suspension, dead end with epoxilator and clamp	Each	4.7
Suspension, dead end, with 20-inch extension strap, epoxilator, and clamp	Each	4.7

T

Tap for water serv, including corporation stop and collar, __ inch	Each	4.3
Tap for water serv, including corporation stop, __ inch	Each	4.3
Tapered Fluted fiberglass post top light pole	Each	4.8
Tapping sleeve, valve and box __ inch by __ inch by __ inch	Each	4.3
Tee on __ inch Storm Sewer, __ inch	Each	4.2
Tee, __ inch by __ inch by __ inch	Each	4.3
Tee, __ inch by __ inch by __ inch, forcemain	Each	4.4
Tee/wye on __ inch Sanitary Sewer, __ inch	Each	4.1
Temp Gravel Pavt	Ton	3.2
Temp HMA Pavt	Ton	5.1
Temp Neighborhood Sign	Each	8.1
Terminator, 15 kV, Prim Cable	Each	4.7
Thimble eye nut, bolted	Each	4.7

ITEM DESCRIPTION	UNIT	SECTION
Thrust block, Det ____	Each	4.3
Traf detector loop installation	Lump Sum	8.1
Transformer, Pad Mtd, Single Phase, ____ kV, ____/____ V Sec	Each	4.7
Transformer, Pad Mtd, Three Phase, ____ kV, ____/____ V Sec	Each	4.7
Transformer, Pole Mtd, Single Phase, ____ kV, ____/____ V Sec	Each	4.7
Tree, Rem, 19 inch to 36 inch	Each	2.1
Tree, Rem, 37 inch or Larger	Each	2.1
Tree, Rem, 6 inch to 18 inch	Each	2.1
Turf Establishment	Square Yard	8.4
Turf Establishment, As Needed Watering	Square Yard	8.4
Turf Watering	Each	8.4
Two Pole Fusible Weather Proof Disconnect Switch ____ amperes	Each	4.7

U

Underdrain, Subbase, ____ inch	Foot	4.2
Underground Prim Line /C, ____ 1C-#2/0 CU 15 kV	Foot	4.7
Underground Prim Neutral, #2 CU, 600 V	Foot	4.7
Underground Sec /C, ____ -# ____ CU U.S.E.	Foot	4.7
Unsuitable Soil, Rem and Replacement, with ____	Cubic Yard	2.5

V

Valley Gutter, (width) by (thickness) inch, Det P-5C	Foot	6.3
Valve and box, ____ inch	Each	4.3
Valve and box, ____ inch, forcemain	Each	4.4
Valve box, Adj	Each	4.6
Valve box, Furn	Each	4.6
Valve chamber, with Butterfly Valve, ____ inch, Det W-2	Each	4.6
Valve chamber, with Butterfly Valve, ____ inch, Det W-2A	Each	4.6
Valve chamber, with Gate Valve, ____ inch, Det W-1	Each	4.6
Video Private Property Sewer Lateral	Dollars	4.1
Video Sewer	Foot	4.1

W

Wall, reinf, Det ____	Foot	7.1
Water Main Construction, Plumbing Allowance	Dollars	4.3

ITEM DESCRIPTION	UNIT	SECTION
Water Main, __ inch	Foot	4.3
Water Serv, __ inch.....	Foot	4.3
Water Serv, __ inch, Curb Box to Main.....	Foot	4.3
Water Serv, __ inch, Curb Box to Meter	Each	4.3
Water Serv, __ inch, Curb Box to Meter, over __ feet.....	Each	4.3
Water Serv, Exploratory Investigation.....	Each	4.3
Watering and Cultivating, First Season, Min (dollar)	Lump Sum	8.5
Watering and Cultivating, 2nd Season, Min (dollar)	Lump Sum	8.5
Weed Control	Each	8.4
Wood pole, __ foot, Class _____, set Det E-200	Each	4.7

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STANDARD DETAILS INDEX

DESIGN DATA

L-1	Legend
L-2	Legend
D-1	Typical Crown for Various Roadways
D-2	Schematic Utility Cross Section for New Street

ELECTRICAL

E-010	14-foot Round Tapered Fiberglass Pole
E-015	35-foot Fiberglass Light Pole with Mast Arm
E-020	Reserved
E-030.1	Ornamental Extruded Aluminum Pole
E-030.2	Ornamental Light Pole Wiring
E-031.1	Ornamental Extruded Aluminum Pole with Receptacle
E-031.2	Ornamental Light Pole Wiring with Receptacle
E-035.1	Ornamental Extruded Aluminum Double Short-Arm Pole
E-036.1	Ornamental Extruded Aluminum Double Long-Arm Pole
E-036.2	Ornamental Light Pole Wiring
E-040	Reserved
E-045.1	16-foot Tapered, Fluted, Foundation Mounted Reinforced Fiberglass Pole
E-045.2	Light Pole Wiring
E-050	Light Pole Foundation
E-055	Spread Concrete Pole Foundation
E-062	18-inch Diameter Light Pole Foundation
E-065	24-inch Diameter Light Pole Foundation
E-066	36-inch Diameter Light Pole Foundation
E-075	Long Bracket Street Light Installation
E-099	Power Pedestal
E-099a	Power Receptacle
E-130	Traffic Signal Wood Pole Mount

ELECTRICAL (cont.)

<u>E-200</u>	Typical Pole Setting
<u>E-205</u>	Ground Assembly for Wood Pole
<u>E-210</u>	Pole Mount Transformer
<u>E-215</u>	Vault Mount Transformer
<u>E-245</u>	Deadend Crossarms
<u>E-250</u>	Down Guy
<u>E-255</u>	Sidewalk Down Guy
<u>E-330</u>	Primary Conductor Tag
<u>E-360</u>	Primary Riser
<u>E-365</u>	(1) 2-inch Secondary, and (1) 4-inch Primary Riser
<u>E-370</u>	(1) 2-inch Secondary Riser
<u>E-400</u>	4-inch Schedule 40 PVC Concrete Encased Conduit
<u>E-435</u>	Encased Conduit Termination at A Manhole
<u>E-438</u>	New Duct Window for Existing Manholes & Vaults
<u>E-440</u>	Temporary Terminal of Concrete Encased Conduit
<u>E-445</u>	Temporary End of Concrete Pour
<u>E-460</u>	4-inch Schedule 40 PVC Direct Buried Conduits
<u>E-484</u>	4-inch Duct w/ (1) 1.25-inch and (1) 4 cell and (1) 7 cell microduct
<u>E-486</u>	4-inch Duct w/ (2) 1.25-inch and (2) 1-inch innerducts
<u>E-500.1</u>	Transformer Vault, Six Panel
<u>E-500.2</u>	Transformer Vault, Six Panel
<u>E-500.3</u>	Transformer Vault Sidewalk Grating
<u>E-500.4</u>	Transformer Vault Hatch Frame
<u>E-501</u>	Accessible 10 Ft. Transformer Vault

ELECTRICAL (cont.)

<u>E-501.1</u>	Accessible 10 Ft. Transformer Vault Specification
<u>E-503</u>	6'x8'x7' Electrical Panel Manhole
<u>E-504</u>	6'x8'x12' Electrical Panel Manhole
<u>E-505</u>	6'x8'x7' Precast Concrete Manhole
<u>E-507</u>	Electrical Manhole Midsection
<u>E-508</u>	Transformer Cable Vault
<u>E-515</u>	4'x4'x4' Precast Concrete Cable Handhole
<u>E-520</u>	8'x8'x7' Electrical Six Panel Manhole
<u>E-525</u>	8'x8'x7' Electrical Precast Concrete Manhole
<u>E-526</u>	29" Manhole Frame and Cover
<u>E-528</u>	8'x8'x8' Electrical Concrete Block Manhole
<u>E-530</u>	36-inch Cable Handhole and Cover
<u>E-535</u>	22-inch Diameter X 36-inch Precast Concrete Handhole
<u>E-536</u>	22-inch Handhole Frame and Cover
<u>E-540</u>	17-inch x 30-inch Polymer Concrete Handhole W/ Cover
<u>E-550</u>	13-inch x 24-inch Flared-Wall Polymer Concrete Handhole W/ Cover
<u>E-560</u>	Cable Wiring Pedestal

PAVING AND CONCRETE

<u>P-1</u>	Pavement Half Section for Standard Residential Street
<u>P-2</u>	Radius Driveway Return and Approach and Sidewalk
<u>P-2A</u>	Radius Alley Return and Approach and Sidewalk
<u>P-3</u>	Combined Driveway Approach and Sidewalk
<u>P-3A</u>	Dub-Down Driveway Approach
<u>P-4</u>	Combined Dub-down Alley Approach and Sidewalk
<u>P-4A</u>	Standard Dub-down Alley Approach
<u>P-5</u>	Standard Curb and Gutter
<u>P-5A</u>	Straight Curb
<u>P-5B</u>	Roll Curb and Gutter
<u>P-5C</u>	Valley Gutter
<u>P-5D</u>	Median and Island End Treatment

PAVING AND CONCRETE (cont.)

P-6	Subbase Underdrain
P-7	Special Underdrain
P-8	Catch Basin Casting Setting
P-9	Sidewalk Ramp in Reinforced Concrete Over Areaways
P-10	Cul-de-sac for 60 Ft. Right-of-Way – 30 Ft. and 50 Ft. Radii
P-11	Cul-de-sac for 60 Ft. Right-of-Way – 50 Ft. and 50 Ft. Radii
P-12	Cul-de-sac for 50 Ft. Right-of-Way – 50 Ft. and 50 Ft. Radii
P-13	Cul-de-sac for 66 Ft. Right-of-Way – 50 Ft. and 50 Ft. Radii
P-14	Unsymmetrical Cul-de-sac for 60 Ft. Right-of-Way – 30 Ft. and 50 Ft. Radii
P-15	Unsymmetrical Cul-de-sac for 50 Ft. Right-of-Way – 10 Ft. and 40 Ft. Radii
P-16	Cul-de-sac for 66 Ft. Right-of-Way – 50 Ft. and 50 Ft. Radii
P-17	Alley Pavement
P-18	Concrete Retaining Wall (Maximum 3 Feet High)
P-19	Concrete Steps
P-20	Speed Hump
P-20A	Speed Cushion
P-20B	Speed Table
P-21	Bulb-Out
P-22	Adjustment of Manhole Casting
P-23	Adjustment of Valve Box Casting
P-23A	Abandonment Valve Chamber and Place Valve Box
P-23B	Clean and Remove Manhole, Valve Chamber or Catch Basin
P-23C	Curb Box in Pavement

SEWER

S-1	Standard Precast Manhole
S-1A	Drop Connection
S-1B	High Speed Drop Inlet to Manhole
S-1C	Standard Precast Manhole over Existing Sewer
S-2	Brick or Block Manhole
S-2A	Manhole for Large Diameter Sewer
S-2B	Standard Manhole on Existing Sewer

SEWER (cont.)

<u>S-3</u>	Standard Precast Catch Basin in Standard or Roll Curb
<u>S-4</u>	Standard Precast Double Catch Basin
<u>S-5</u>	Standard Infiltration Basin
<u>S-6</u>	Standard Drop Inlet to Catch Basin or Manhole
<u>S-6A</u>	Standard Drop Manhole to Catch Basin or Manhole
<u>S-7</u>	Standard Precast Alley Basin
<u>S-8</u>	Ditch Basin
<u>S-9</u>	Sewer Cleanout
<u>S-10</u>	Manhole or Catch Basin, Rebuild
<u>S-11</u>	Lamp Hole
<u>S-12</u>	Tile Bleeder in Storm Manhole or Catch Basin
<u>S-13</u>	26-inch Manhole Casting
<u>S-13A</u>	35-inch Manhole Casting
<u>S-14</u>	Manhole Casting Bolt-Down Cover
<u>S-15</u>	Unsuitable Soil, Removal and Replacement
<u>S-16</u>	Buried Sewer Connection
<u>S-17</u>	Main Line Sewer Lateral Riser
<u>S-18</u>	Forcemain Air Relief Valve and Chamber
<u>S-19</u>	Forcemain Cleanout Detail
<u>S-20</u>	Sewer Saddle of 12-inch Diameter or Less Sewer
<u>S-21</u>	Watertight Manhole Insert
<u>S-22</u>	Forcemain Discharge Manhole

WATER

<u>W-1</u>	Valve Chamber for 16-inch to 36-inch Gate Valve
<u>W-2</u>	Valve Chamber for 16-inch, 20-inch and 24-inch Butterfly Valve
<u>W-2A</u>	Valve Chamber for 30-inch and 36-inch Butterfly Valve
<u>W-3</u>	Chamber for 6-inch and 8-inch Double Check Valve Assembly
<u>W-4</u>	Hydrant Assembly Installation
<u>W-5</u>	Chamber for Compound and Turbo Meters (3" and Larger Meters)
<u>W-6</u>	Valve Box Installation for Gate Valve
<u>W-6A</u>	Valve Box Installation for Butterfly Valve

WATER (cont.)

<u>W-7</u>	Thrust Block Details for Cast and Ductile Iron Pipe
<u>W-8</u>	Encasement Details for Concrete Pipe
<u>W-9</u>	Water Main Location Outside of Roadway Areas
<u>W-10</u>	Water Main Offset
<u>W-11</u>	Precast Meter Pit for 2-inch or Smaller Meter (Outside of Roadway)
<u>W-12</u>	Regulating Valve and Chamber
<u>W-12A</u>	Regulating Valve and Chamber Vent Stack and Float Switch
<u>W-13</u>	Testing and Chlorination
<u>W-14</u>	Hydrant Location for Roadway Shoulders Requiring Fill
<u>W-15</u>	Joint Restraint Requirements and Tie-Rod Detail
<u>W-16</u>	Water Main Insulation for Shallow Depth Utility Crossings
<u>W-17</u>	Air Vent Manhole
<u>W-18</u>	Blowoff Assembly Chamber

MISCELLANEOUS

<u>M-1</u>	Standard Bollard
<u>M-2</u>	Tree Protection
<u>M-3</u>	Special Utility Bedding

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	PLATTED LOT LINE CONNECTED OWNERSHIP OF PLATTED LINES
	PROPERTY LINE BY METES AND BOUNDS
	EXISTING R.O.W. WITH PROPERTY LINES
	SURVEY LINE AND/OR CL WITH STATIONING
	EXISTING SIDEWALK
	PROPOSED SIDEWALK
	EXISTING FACE OF STRAIGHT CURB OR EDGE OF PAVEMENT
	PROPOSED STRAIGHT CURB OR EDGE OF PAVEMENT
	EXISTING CURB & GUTTER
	PROPOSED CURB & GUTTER
	EXISTING FENCE
	RAILROAD
	EXISTING UTILITY POLE WITH GUY ANCHOR (C.P., M.B.T., ST.L.T., ETC.)
	PROPOSED UTILITY POLE WITH GUY ANCHOR (C.P., M.B.T., ST.L.T., ETC.)
	SHRUB
	PINE TREE
	TREE
	DIRECTION OF DRAINAGE
	TESTHOLE - SOIL BORING
	MONUMENT (SECTION CORNER. 1/4 & 1/8 LINES)
	BUILDING WITH ADDRESS

LEGEND

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L-1

***NOTE:**

EXISTING AND PROPOSED UTILITIES OF UP TO 42" WIDE ON 40 SCALE DRAWINGS SHALL BE SHOWN WITH A SINGLE LINE. UTILITIES LARGER THAN 42" SHALL BE DRAWN WITH A DOUBLE LINE SPACED THE SCALED WIDTH OF THE UTILITY.

* ————○———	EXISTING SANITARY OR COMBINED SEWER WITH MANHOLE
* ————●———	PROPOSED SANITARY OR COMBINED SEWER WITH MANHOLE
* - - - -○———	EXISTING STORM SEWER WITH MANHOLE
* - - - -●———	PROPOSED STORM SEWER WITH MANHOLE
▢	EXISTING G.R. BASIN
■	PROPOSED G.R. BASIN
⊗	EXISTING BEEHIVE BASIN
▤	EXISTING FLAT GRATE BASIN
■	PROPOSED FLAT GRATE BASIN
* ————	EXISTING WATER MAIN
* ————	PROPOSED WATER MAIN
* ————○———	EXISTING WATER SERVICE WITH CURB BOX
* ————●———	PROPOSED WATER SERVICE WITH CURB BOX
◇	EXISTING WATER MAIN VALVE AND BOX
◆	PROPOSED WATER MAIN VALVE AND BOX
⊙	EXISTING WATER MAIN VALVE IN CHAMBER
⊙	PROPOSED WATER MAIN VALVE IN CHAMBER
⊙	EXISTING FIRE HYDRANT
▲	PROPOSED FIRE HYDRANT
* ———— - - - ————	UTILITY CONDUIT — OWNERSHIP AS INDICATED (C.P., M.B.T., K.C., STEAM, ETC.)
* ———— - ————	EXISTING GAS MAIN
□	EXISTING ELECTRICAL HANDHOLE (C.P., ST.LT.)
■	PROPOSED ELECTRICAL HANDHOLE (C.P., ST.LT.)
■	EXISTING M.B.T. PEDESTAL
●	PROPOSED TAPERED FIBERGLASS POLE AND MAST ARM ST.LT. (E/8) (E/9)
●	PROPOSED ST. LIGHT (E-8)
⊙	PROPOSED FIBERGLASS POST ST.LT. (E-10)

LEGEND

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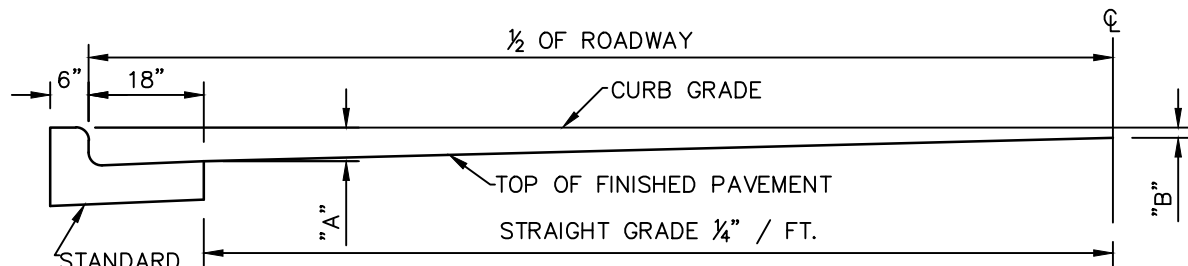
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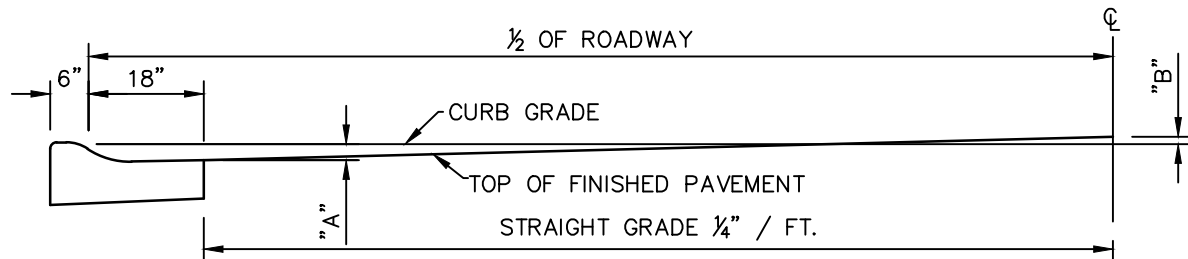
L-2



**TOP OF FINISHED PAVEMENT
MEASUREMENT FROM STANDARD CURB GRADE**
N.T.S.

ROADWAY WIDTH* (FT.)	PAVED WIDTH (FT.)	"A" PAVEMENT AT EDGE OF GUTTER		"B" AT CENTERLINE	
		FT.	IN.	FT.	IN.
30	27	-.42	-5	-.14	-1 5/8
36	33	-.42	-5	-.07	-7/8
40	37	-.42	-5	-.03	-3/8
44	41	-.42	-5	+.01	+1/8
47	44	-.42	-5	+.04	+1/2
48	45	-.42	-5	+.05	+5/8
52	49	-.42	-5	+.09	+1 1/8
54	51	-.42	-5	+.11	+1 3/8
56	53	-.42	-5	+.13	+1 5/8
57	54	-.42	-5	+.16	+1 7/8

*IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES



**TOP OF FINISHED PAVEMENT
MEASUREMENT FROM ROLL CURB GRADE**
N.T.S.

ROADWAY WIDTH* (FT.)	PAVED WIDTH (FT.)	"A" PAVEMENT AT EDGE OF GUTTER		"B" AT CENTERLINE	
		FT.	IN.	FT.	IN.
30	27	-.19	-2 1/4	+.09	+1 1/8
36	33	-.19	-2 1/4	+.16	+1 7/8

*IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

TYPICAL CROWN FOR VARIOUS WIDTH ROADWAYS

N.T.S.

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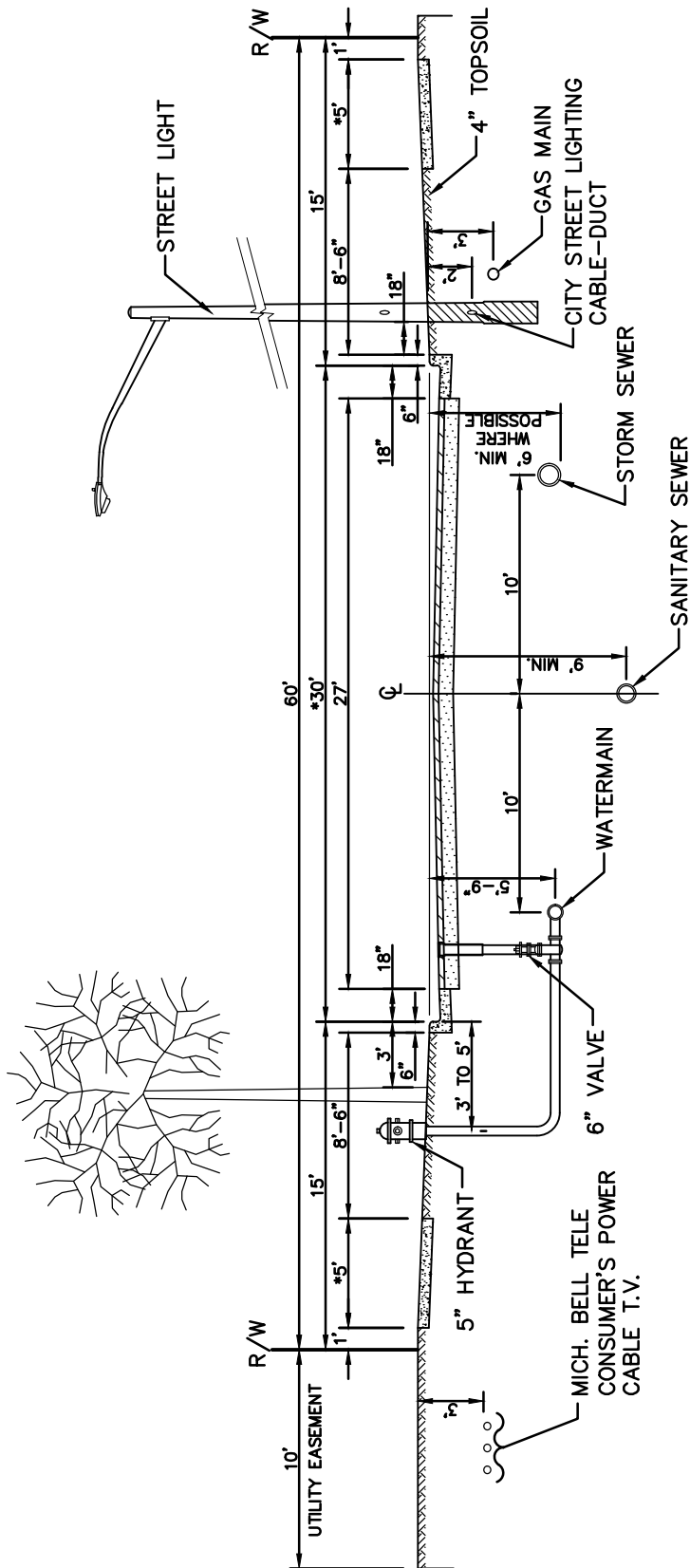
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D-1



NORTH OR EAST VIEW
N.T.S.

*IN ACCORDANCE WITH THE
VITAL STREETS GUIDELINES

SCHEMATIC UTILITY CROSS SECTION FOR NEW STREET

N.T.S.

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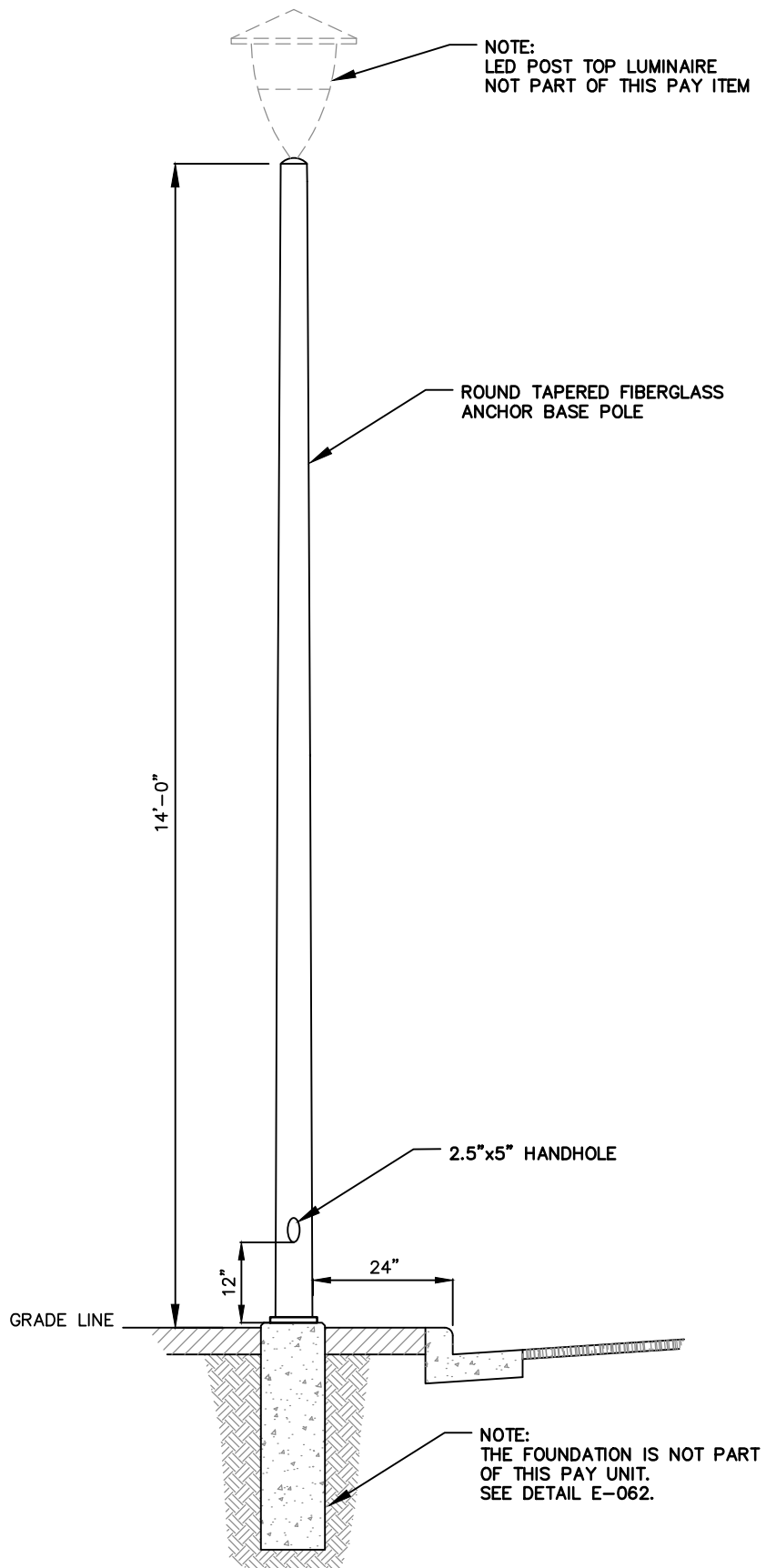
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D-2



14' ROUND TAPERED FIBERGLASS POLE

N.T.S.

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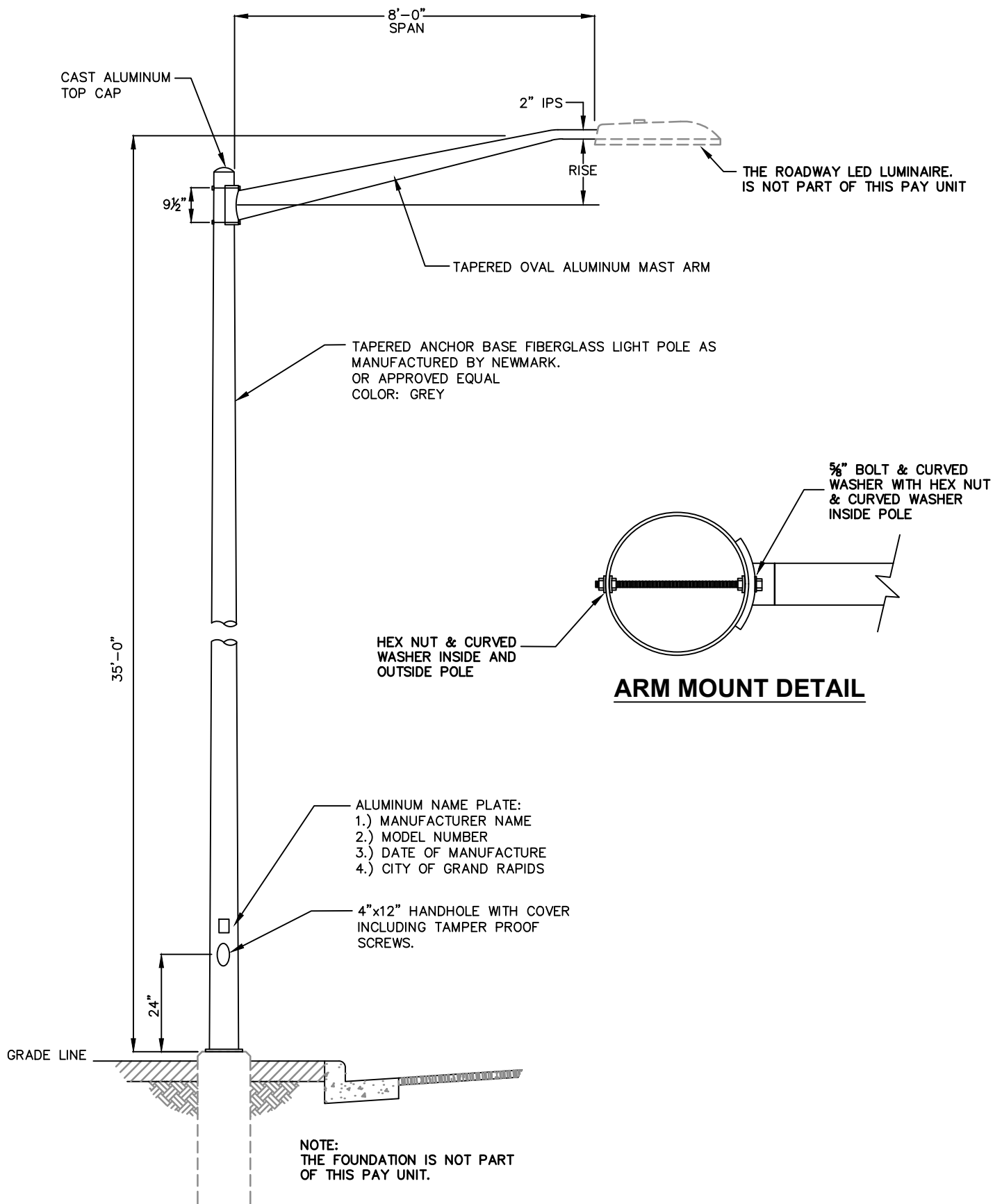
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E-010



35' FIBERGLASS LIGHT POLE WITH MAST ARM

N.T.S.

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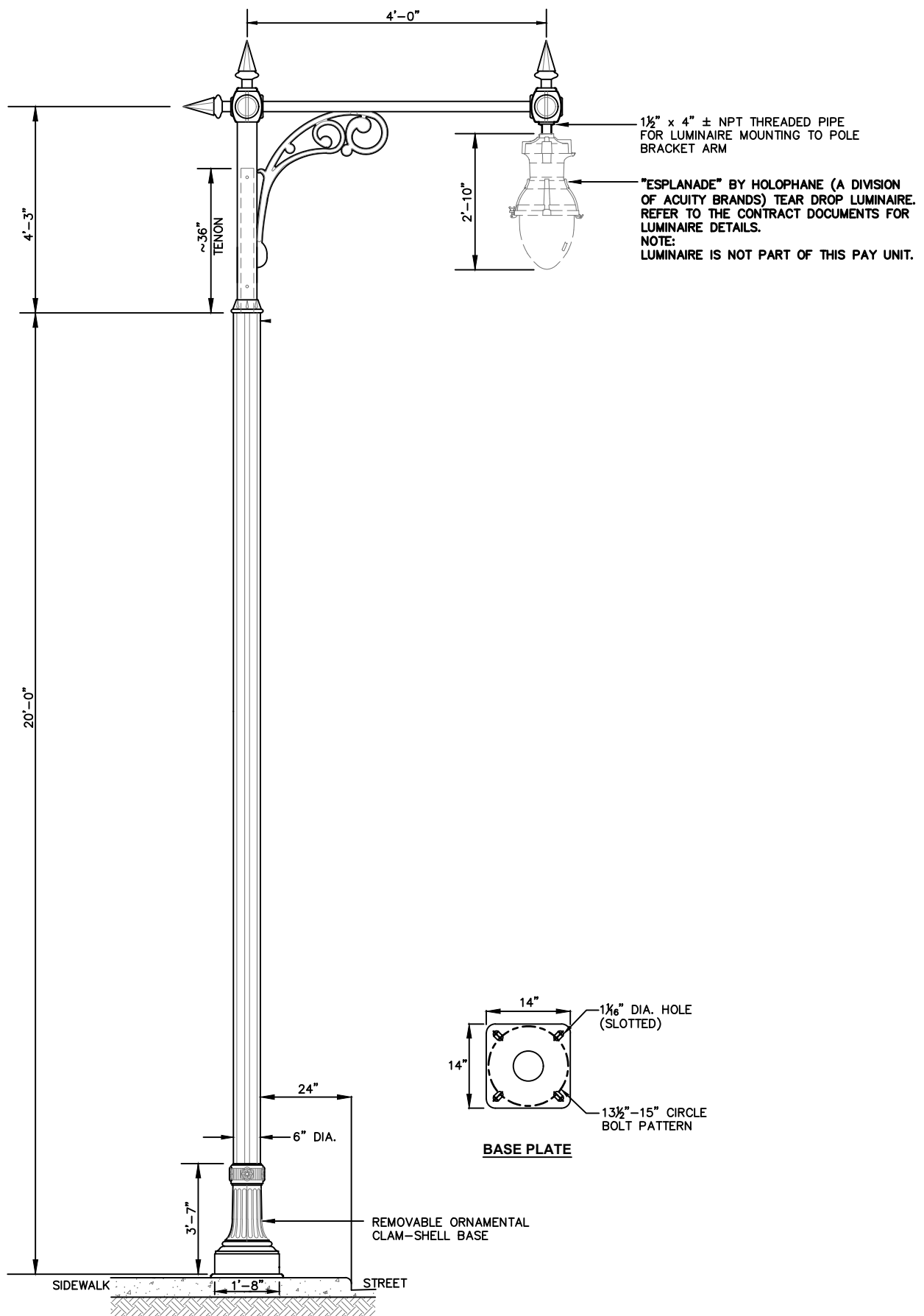
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E-015

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ORNAMENTAL EXTRUDED ALUMINUM POLE

N.T.S.

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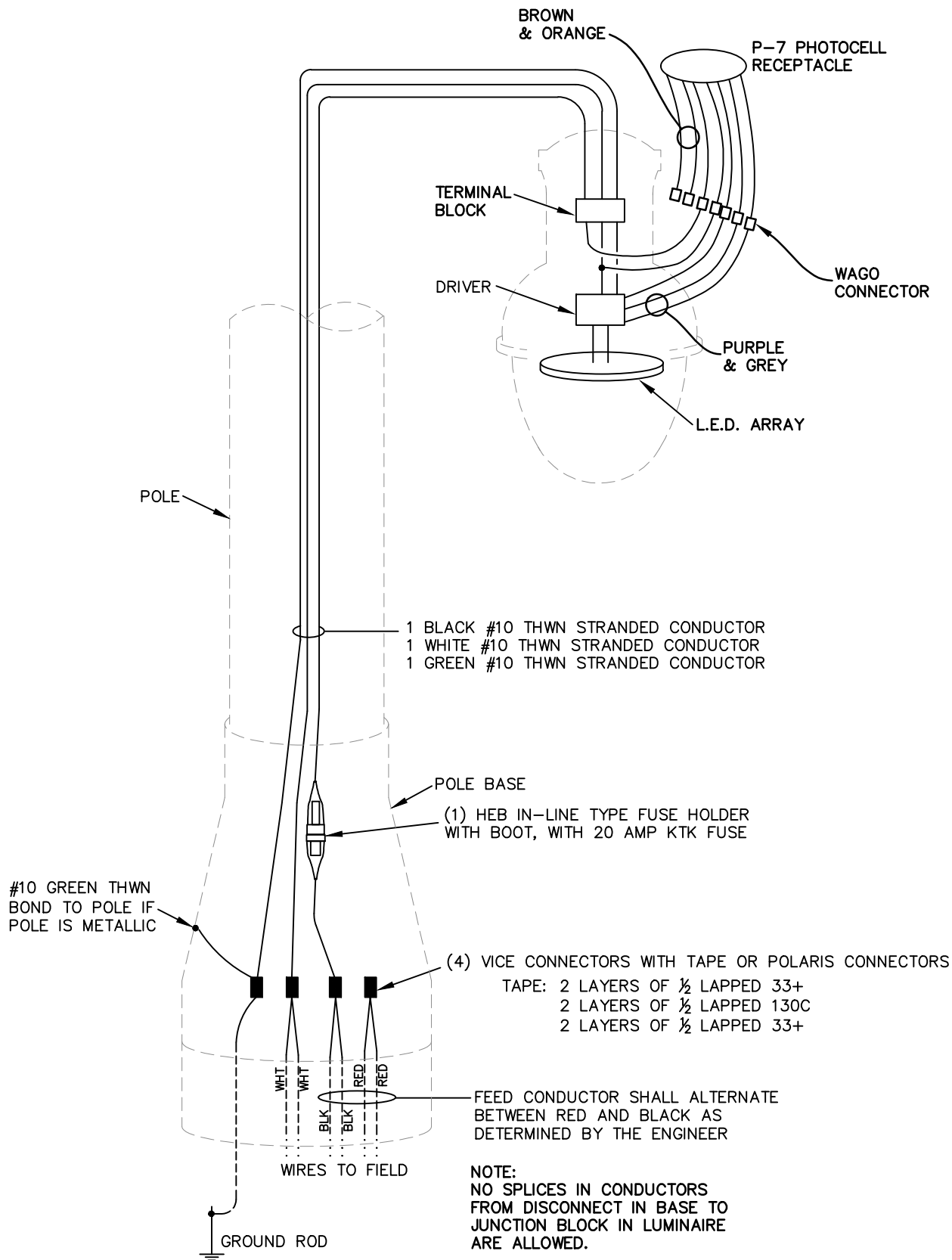
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E-030.1



ORNAMENTAL LIGHT POLE WIRING

N.T.S.

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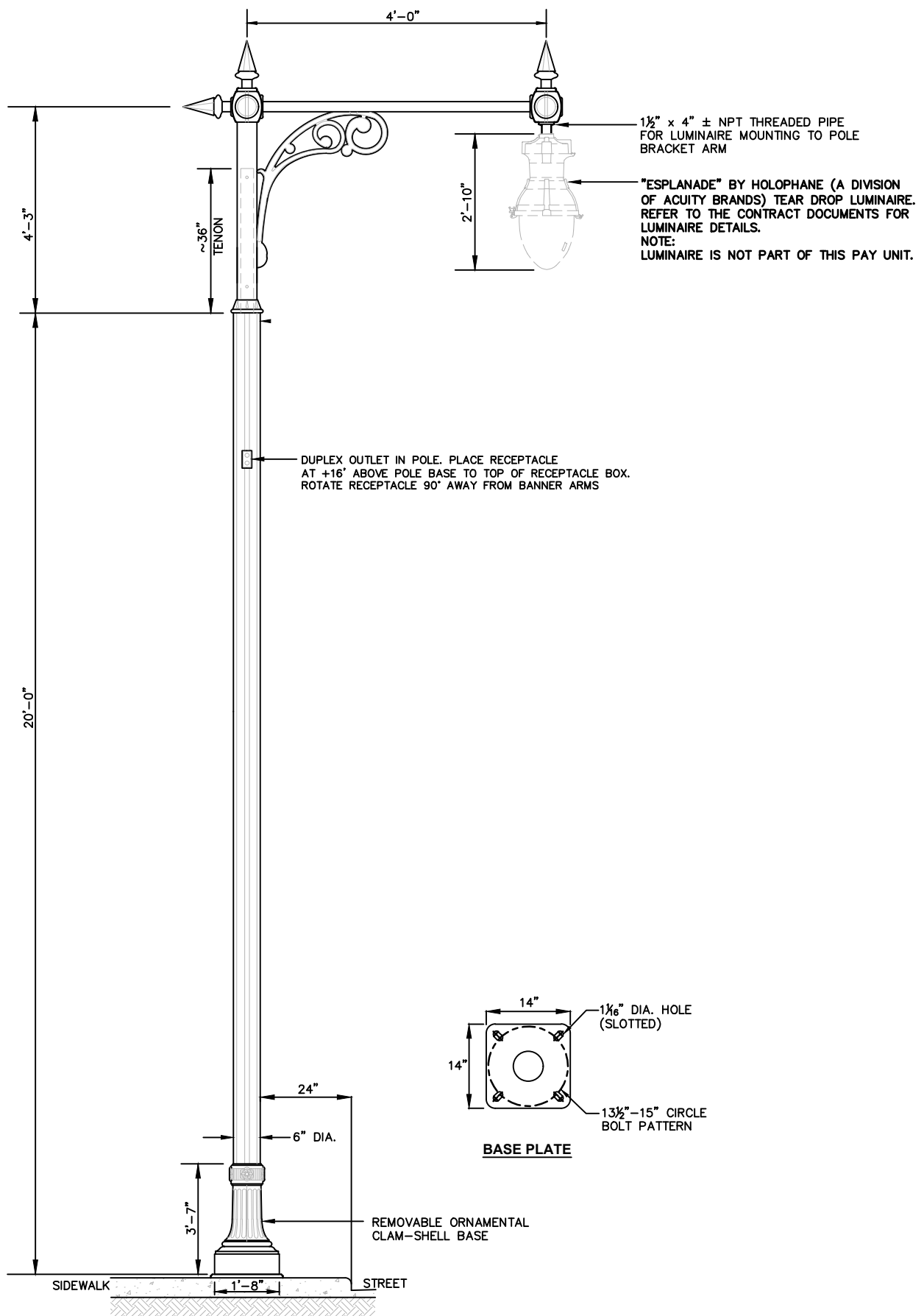
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E-030.2



ORNAMENTAL EXTRUDED ALUMINUM POLE WITH RECEPTACLE

N.T.S.

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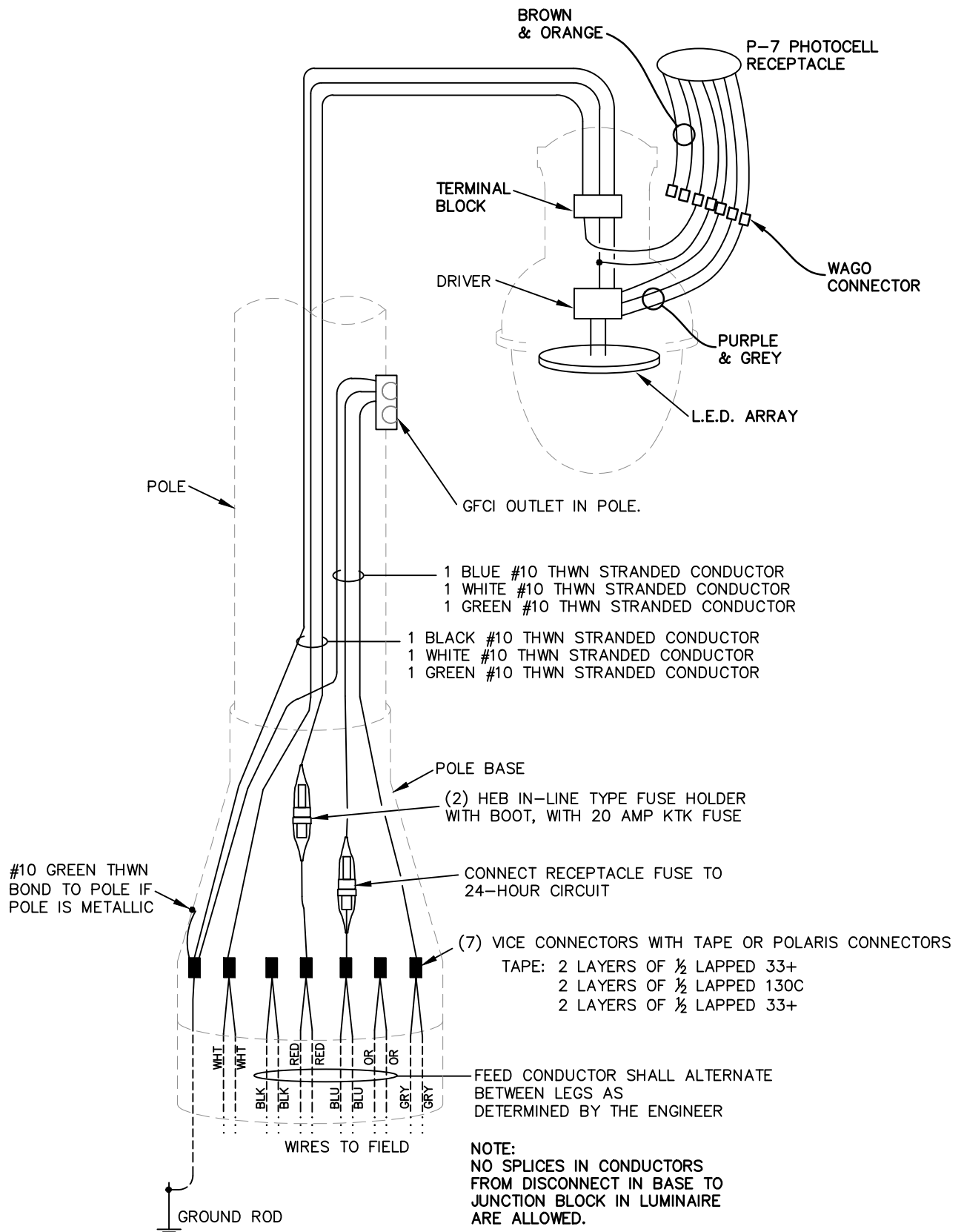
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ORNAMENTAL LIGHT POLE WIRING WITH RECEPTACLE

N.T.S.

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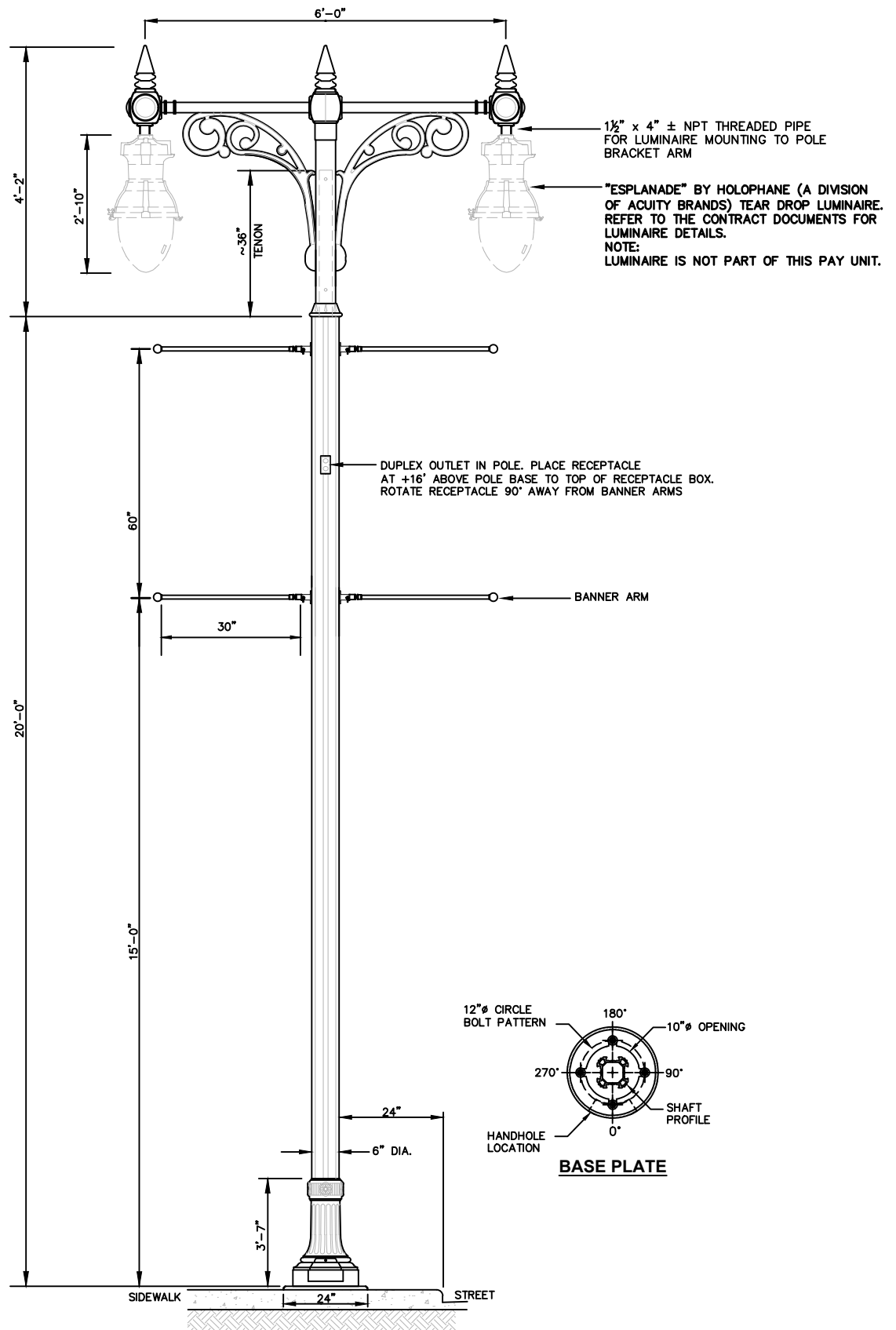
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**ORNAMENTAL EXTRUDED
ALUMINUM DOUBLE SHORT ARM POLE**

N.T.S.

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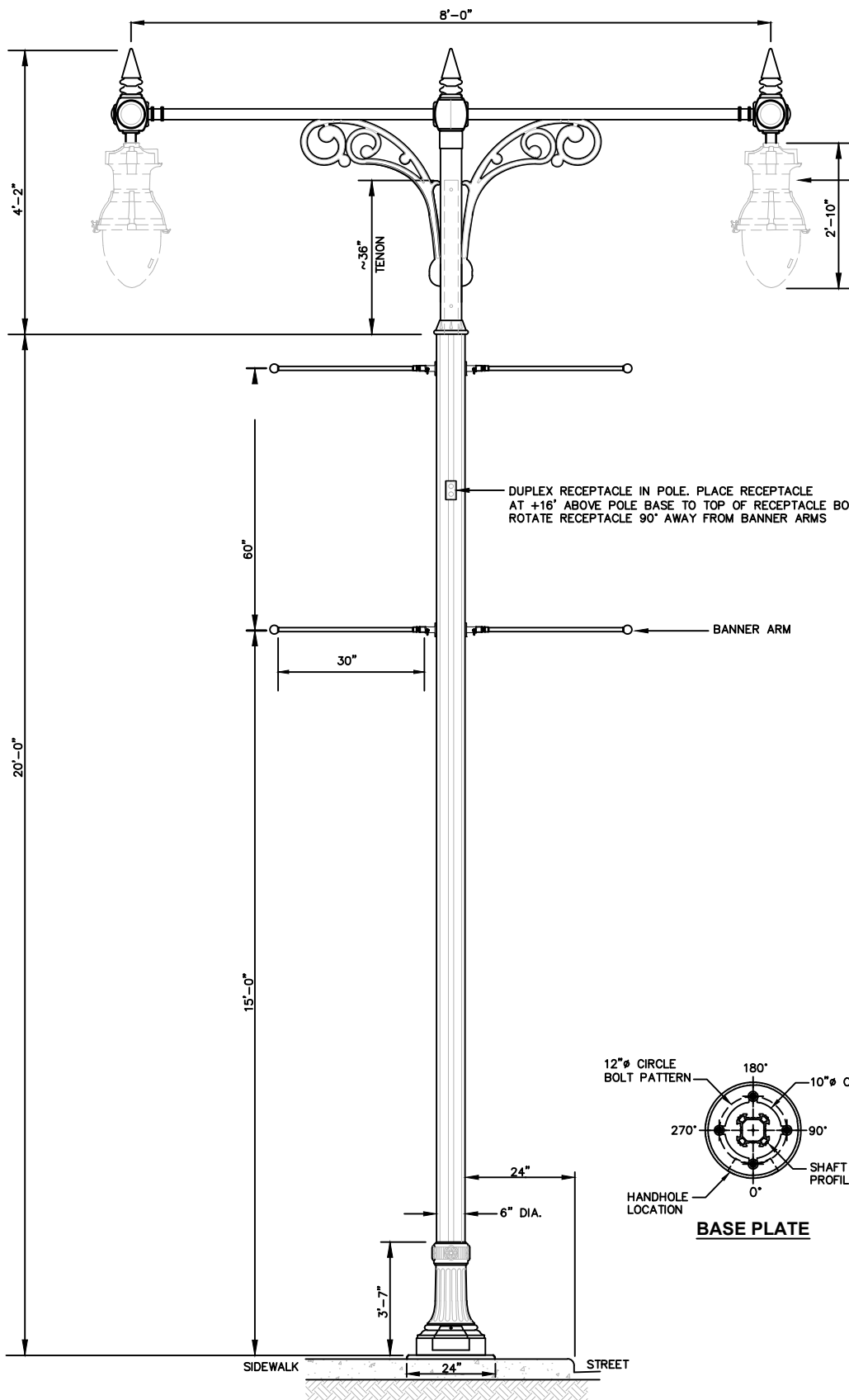
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E-035.1



"ESPLANADE" BY HOLOPHANE (A DIVISION OF ACUITY BRANDS) TEAR DROP LUMINAIRE. REFER TO THE CONTRACT DOCUMENTS FOR LUMINAIRE DETAILS.
NOTE:
LUMINAIRE IS NOT PART OF THIS PAY UNIT.

**ORNAMENTAL EXTRUDED
ALUMINUM LONG DOUBLE ARM POLE**
N.T.S.

APPROVED BY

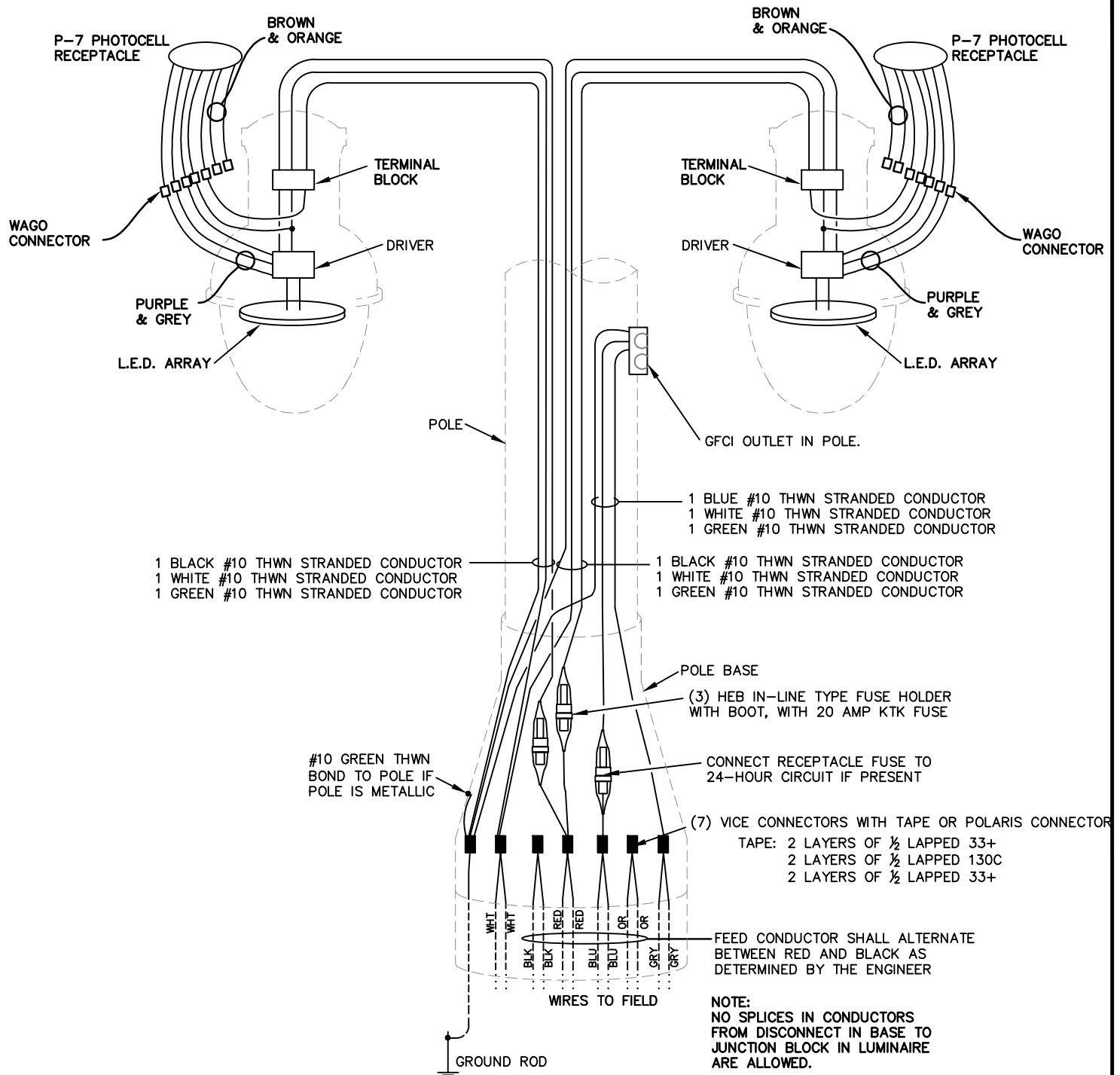
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E-036.2 ORNAMENTAL DOUBLE ARM LIGHT POLE WIRING

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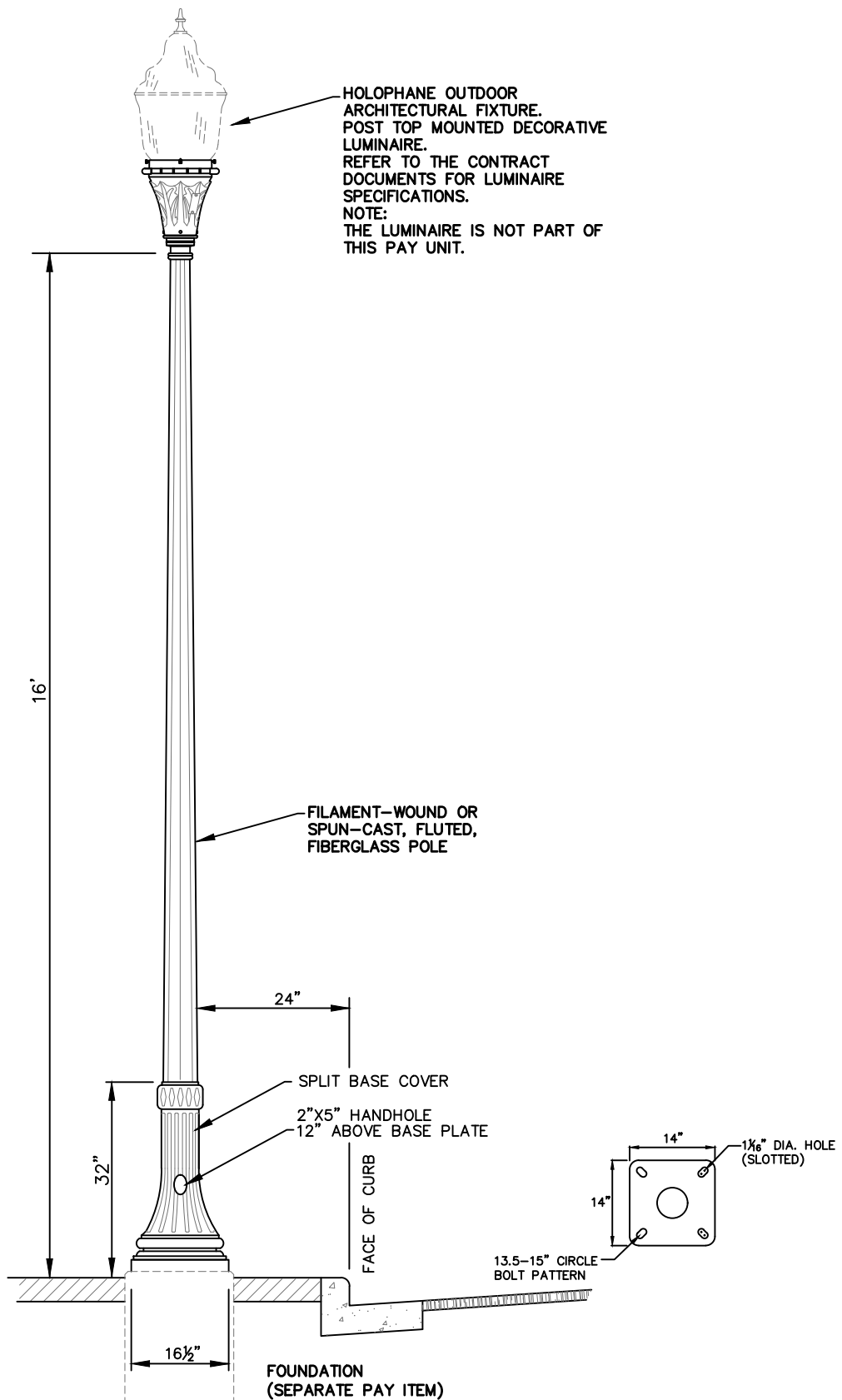
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**16' TAPERED, FLUTED, FOUNDATION MOUNTED,
REINFORCED FIBERGLASS POLE**

N.T.S.

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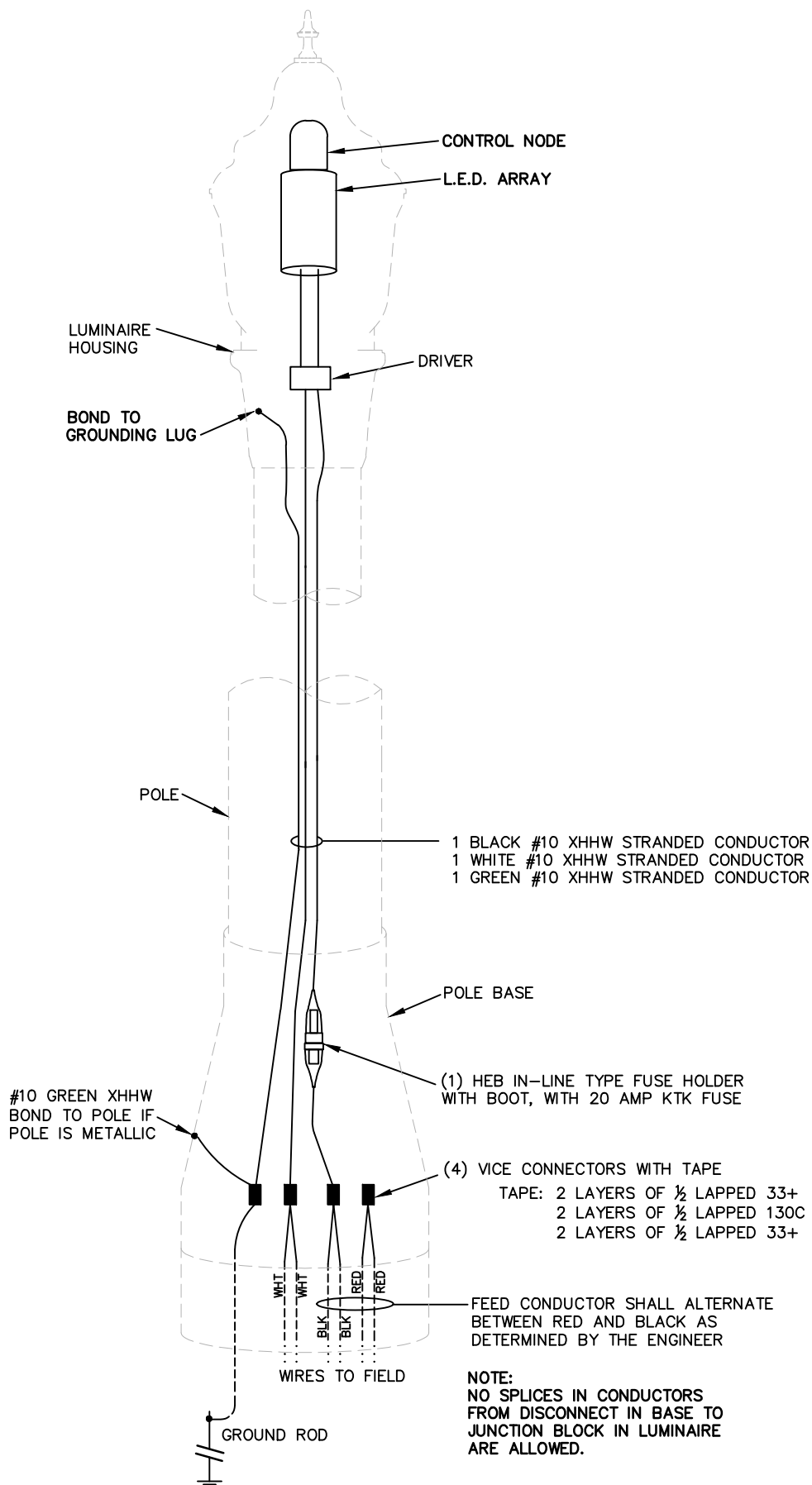
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LIGHT POLE WIRING

N.T.S.

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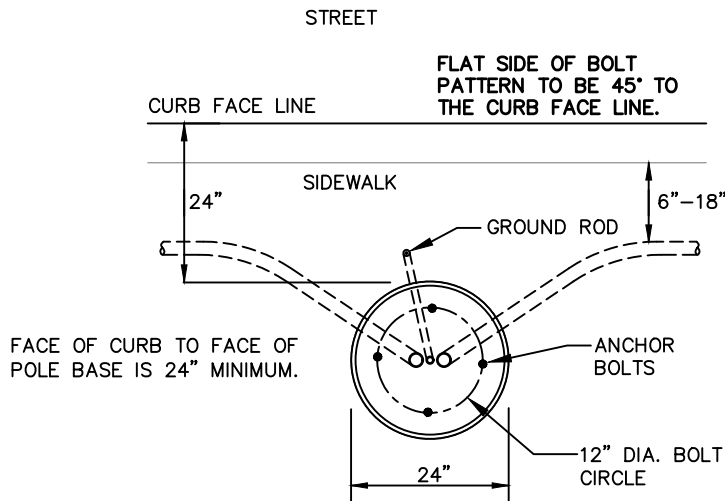
Tim B. Blum
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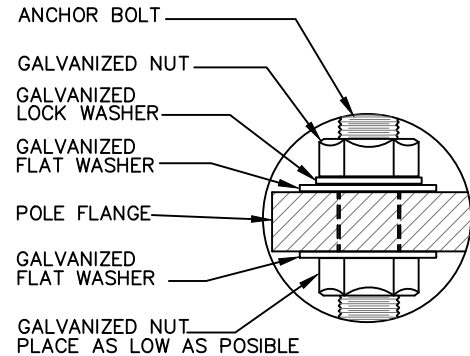
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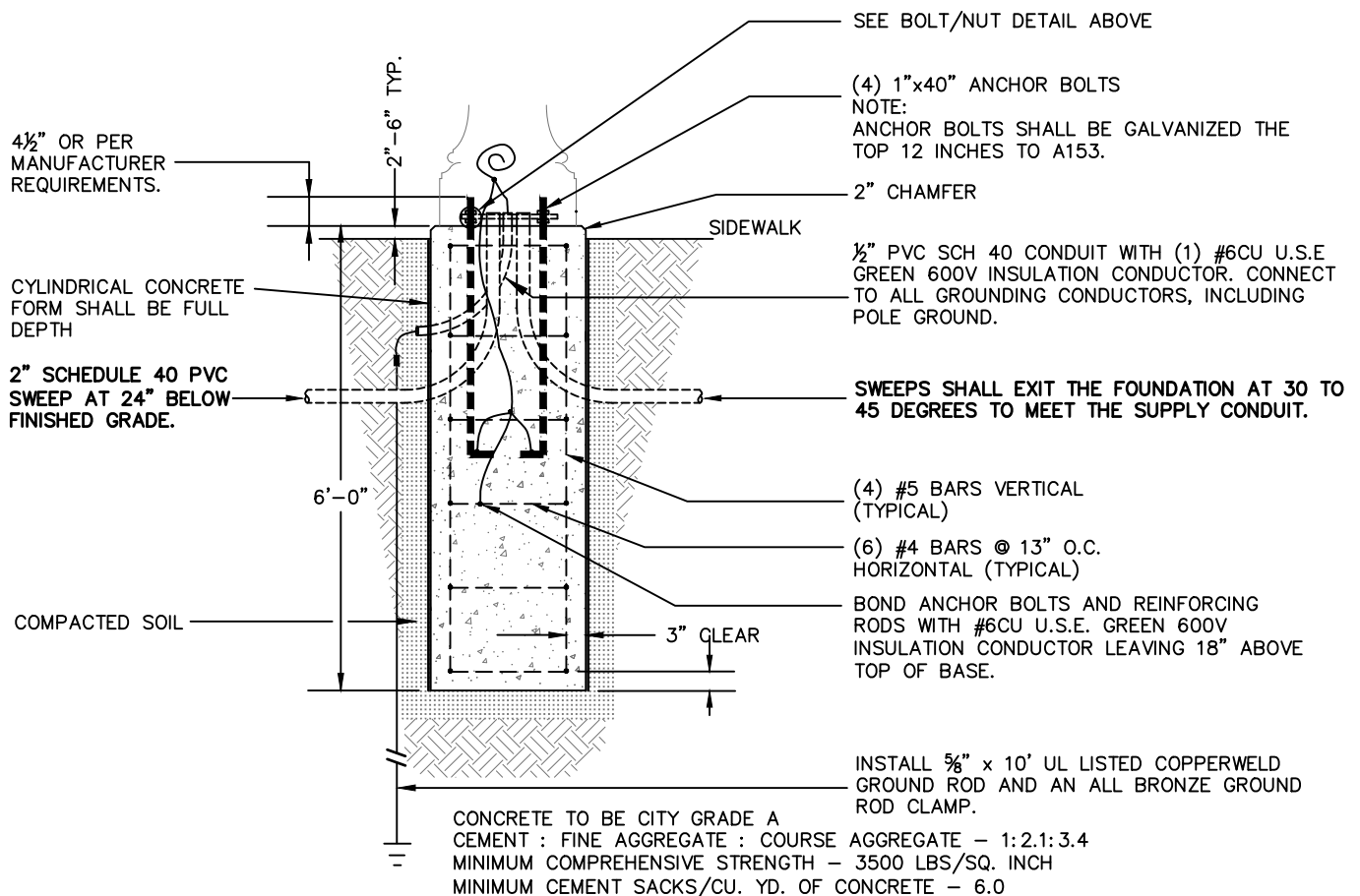
E-045.2



PLAN VIEW



BOLT/NUT DETAIL



SECTION VIEW

LIGHT POLE FOUNDATION

N.T.S.

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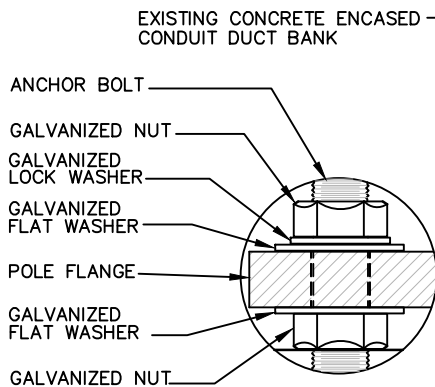
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E-050



NOTE: TORQUE NUTS TO
MANUFACTURER'S SPECIFICATIONS

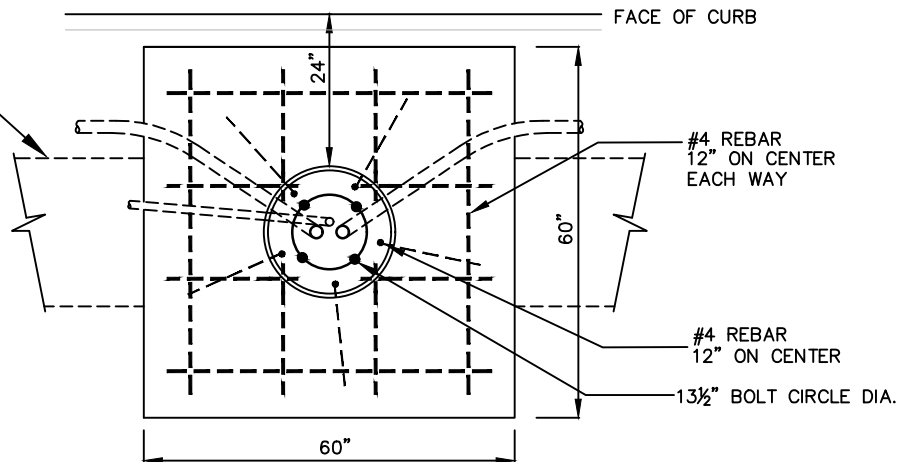
BOLT/NUT DETAIL

INSTALL $\frac{1}{2}$ " PVC CONDUIT WITH
#6CU U.S.E. GREEN GROUNDING
CONDUCTOR, LEAVING 24"
CONDUCTOR ABOVE THE BASE.

SEE BOLT/NUT DETAIL ABOVE

BOND #6CU U.S.E. GREEN
GROUNDING CONDUCTORS TO
ANCHOR BOLTS AND REINFORCING
RODS LEAVING 24" ABOVE BASE.

INSTALL $\frac{5}{8}$ " X 10'-0"
COPPERWELD GROUND
ROD, AND AN ALL BRONZE
GROUND ROD CLAMP.



PLAN VIEW

ANCHOR BOLT SPECIFICATIONS:

BOLT: 1" DIA. x 36" LONG, WITH A 4" HOOK

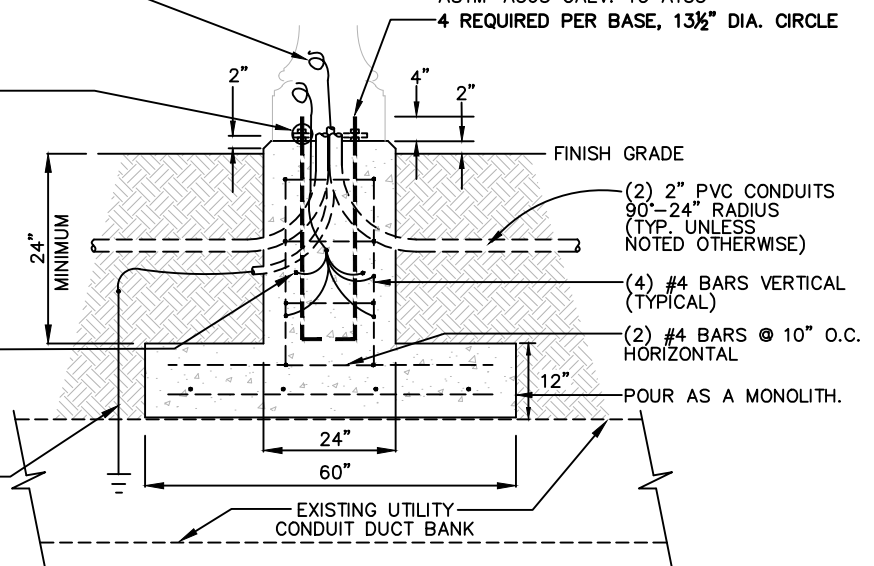
ASTM-A36 M55 GALVIZE TOP 12 INCHES TO A153

NUT: ASTM-A563 GRADE A GALV. TO A153

LOCKWASHER AND FLATWASHER

ASTM-A563 GALV. TO A153

4 REQUIRED PER BASE, 13 1/2" DIA. CIRCLE



SECTION VIEW

SPREAD CONCRETE POLE FOUNDATION

N.T.S.

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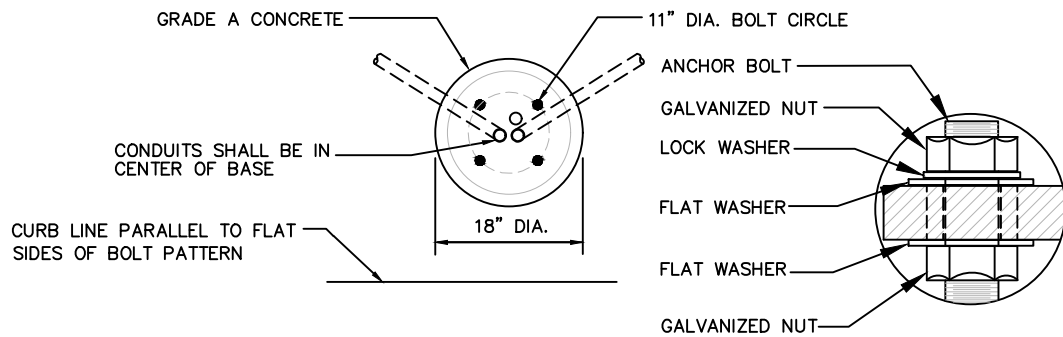
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E-055

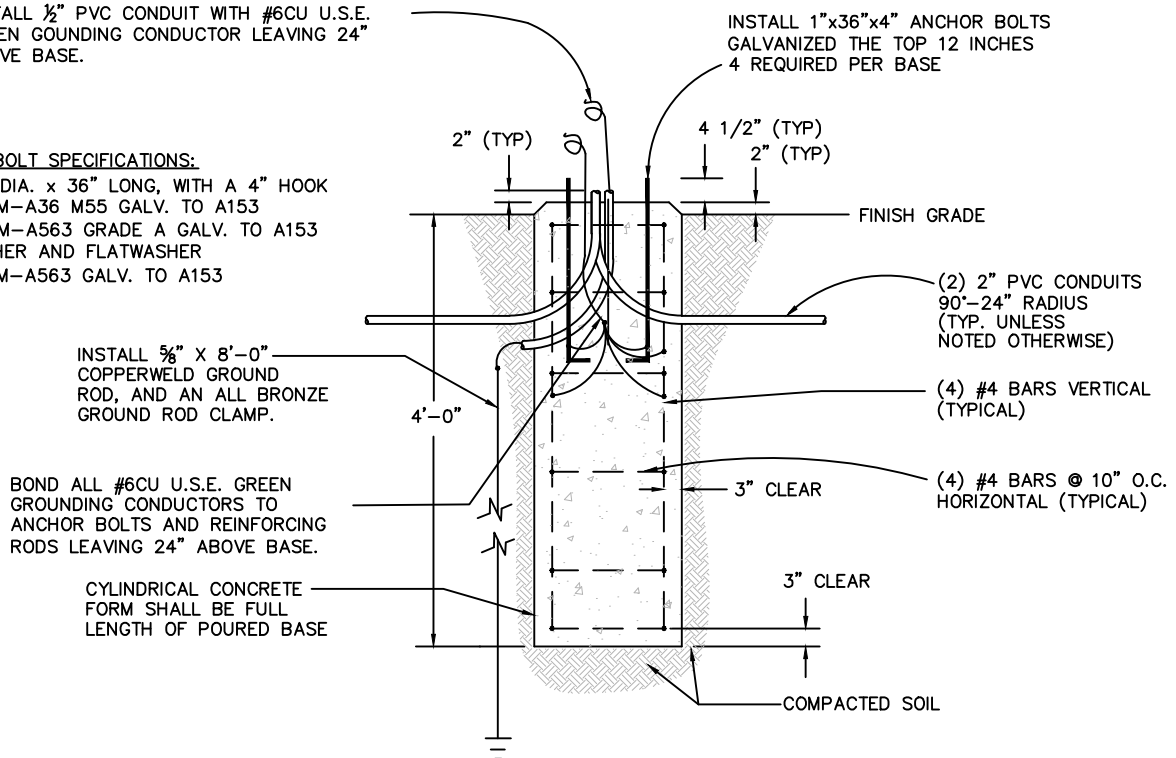


INSTALL $\frac{1}{2}$ " PVC CONDUIT WITH #6CU U.S.E. GREEN GROUNDING CONDUCTOR LEAVING 24" ABOVE BASE.

ANCHOR BOLT SPECIFICATIONS:

BOLT: 1" DIA. x 36" LONG, WITH A 4" HOOK
ASTM-A36 M55 GALV. TO A153
NUT: ASTM-A563 GRADE A GALV. TO A153
LOCKWASHER AND FLATWASHER
ASTM-A563 GALV. TO A153

INSTALL 1"x36"x4" ANCHOR BOLTS
GALVANIZED THE TOP 12 INCHES
4 REQUIRED PER BASE



18" DIAMETER LIGHT POLE FOUNDATION

N.T.S.

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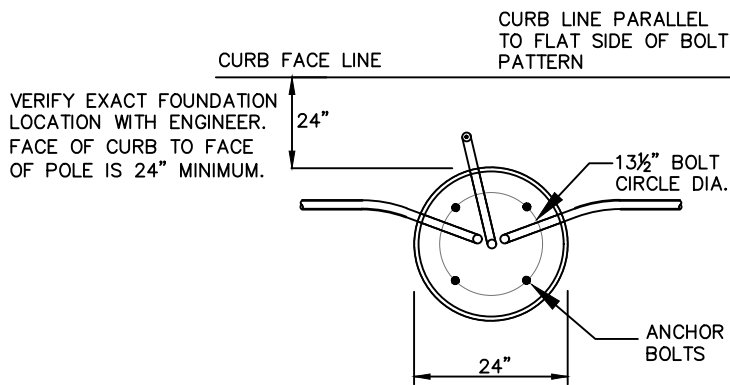
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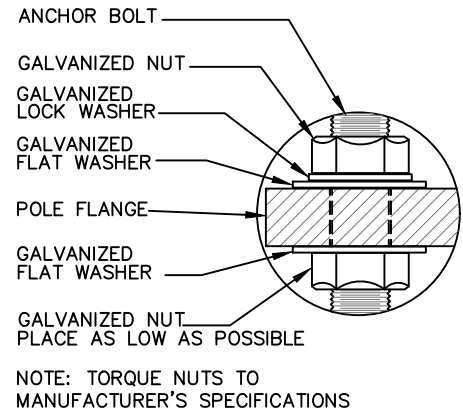
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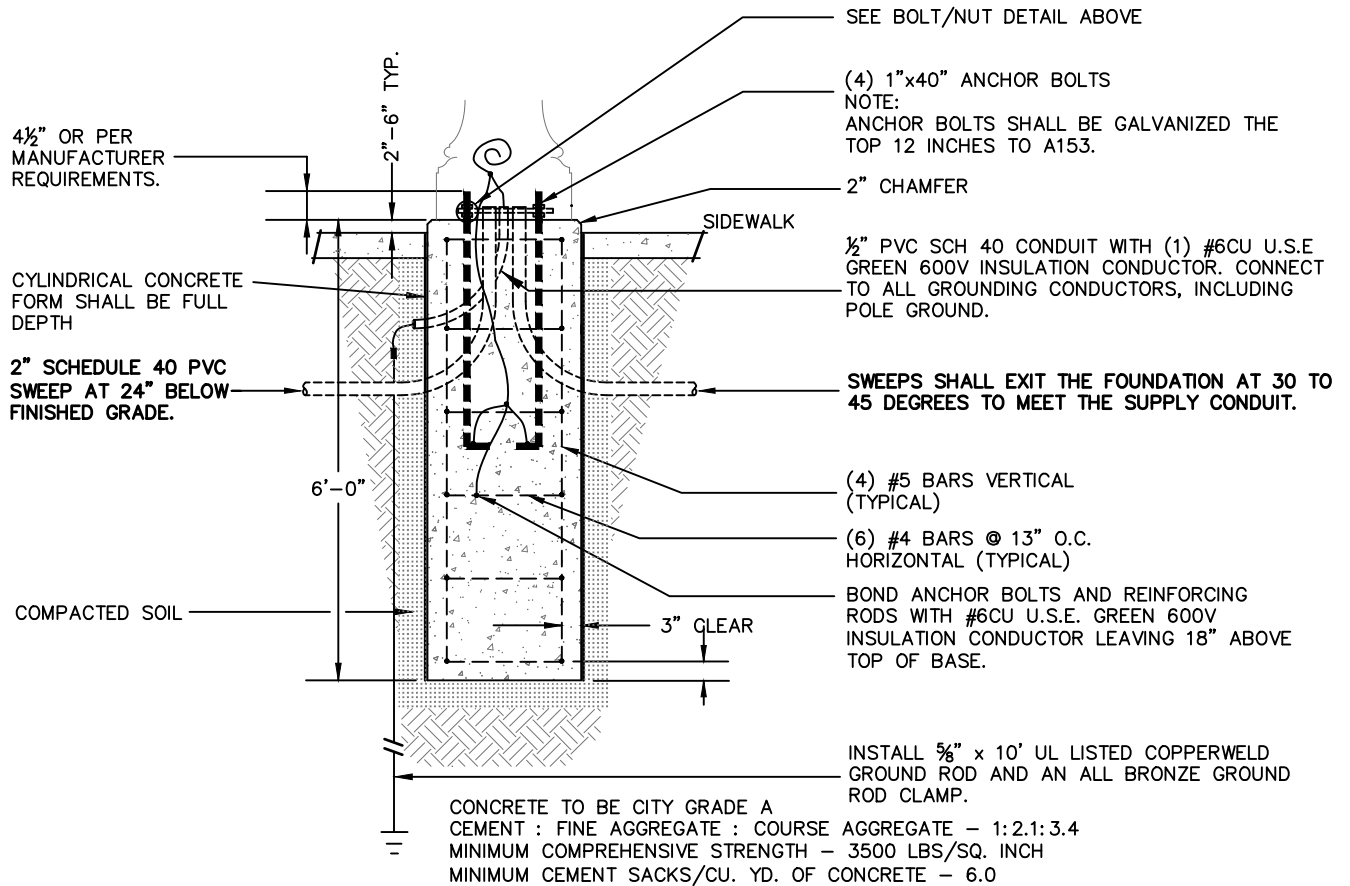
E-062



PLAN VIEW



BOLT/NUT DETAIL



SECTION VIEW

24" DIAMETER LIGHT POLE FOUNDATION

N.T.S.

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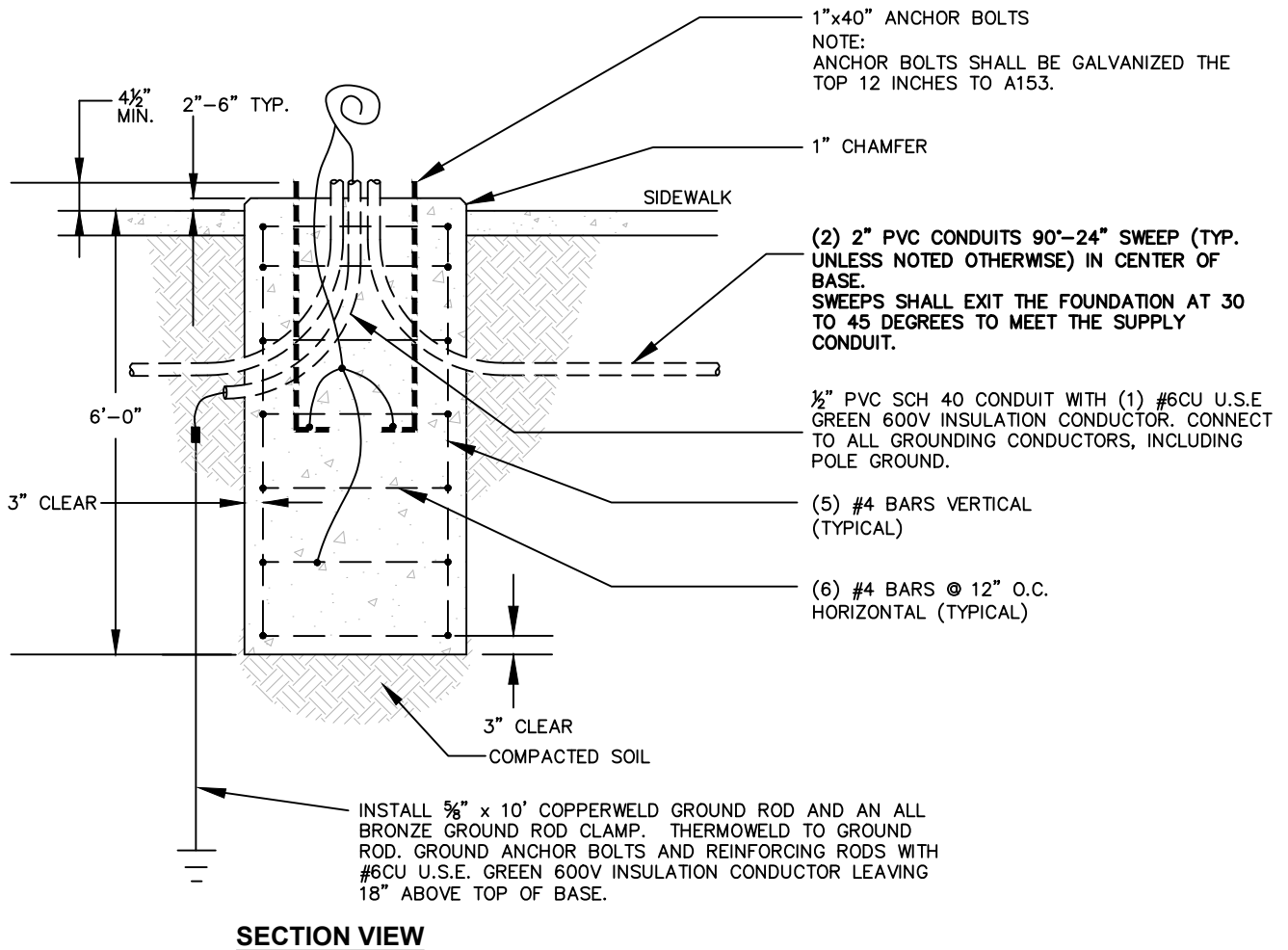
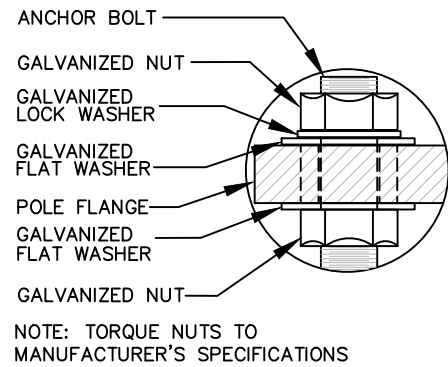
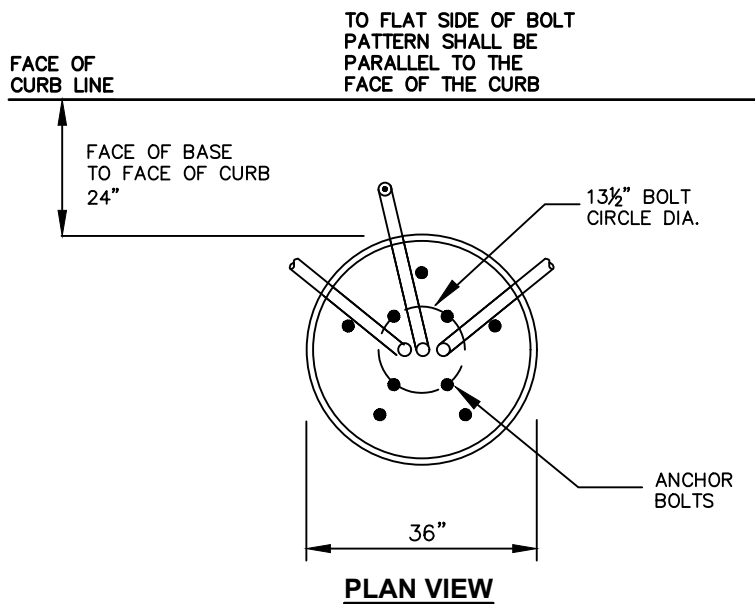
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CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

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Public Services
Engineering Department

E-065



36" DIAMETER LIGHT POLE FOUNDATION

N.T.S.

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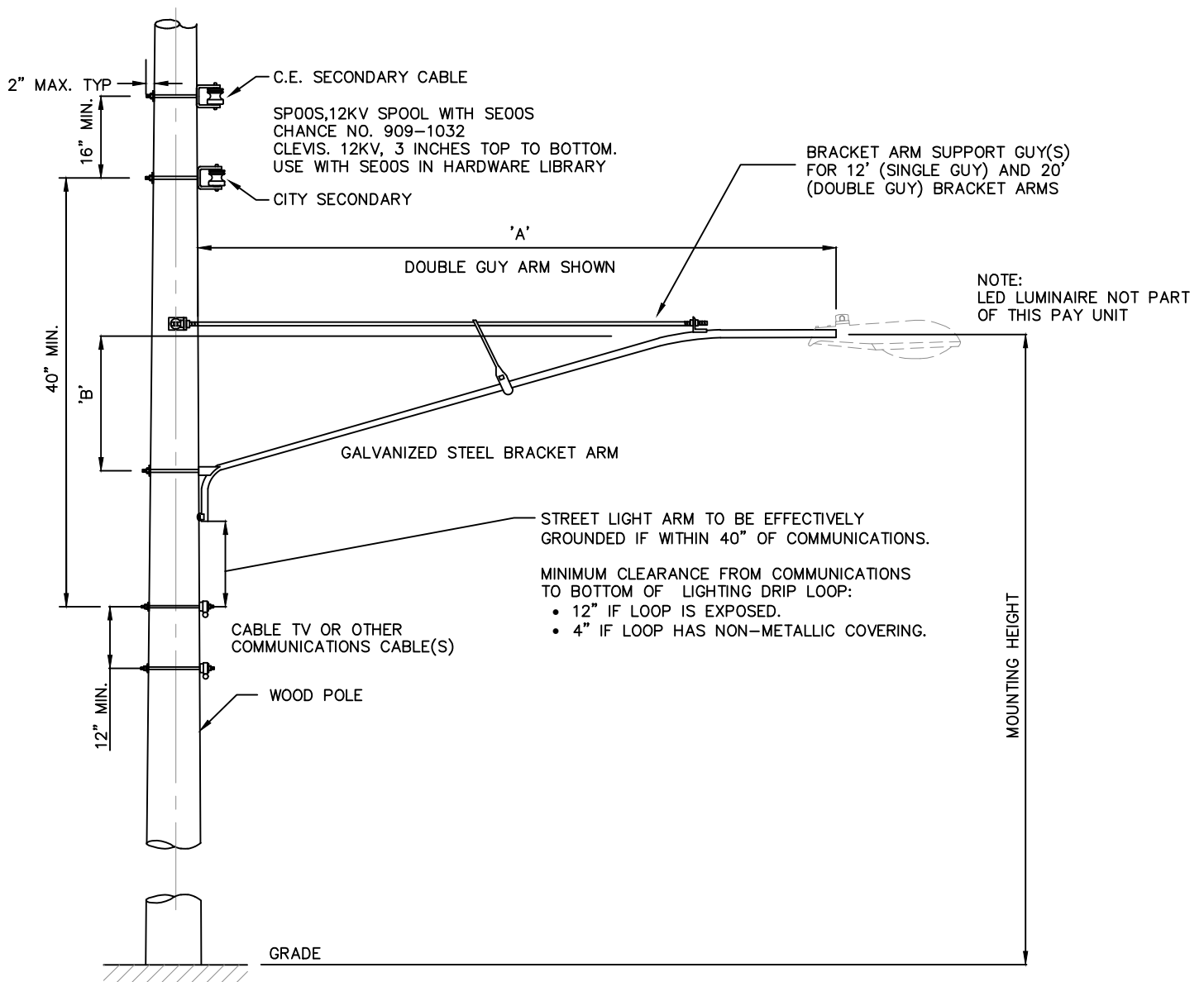
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E-066



BRACKET ARM TABLE			
LENGTH 'A' (FEET)	ARM DIA. (INCHES)	RISE "B" (INCHES)	ARM STYLE
8	2	29 $\frac{5}{8}$	CANTILEVER
12	2	40 $\frac{3}{8}$	SINGLE GUY
20	2	64	DOUBLE GUY

E-075 STREET LIGHT BRACKET INSTALLATION

N.T.S.

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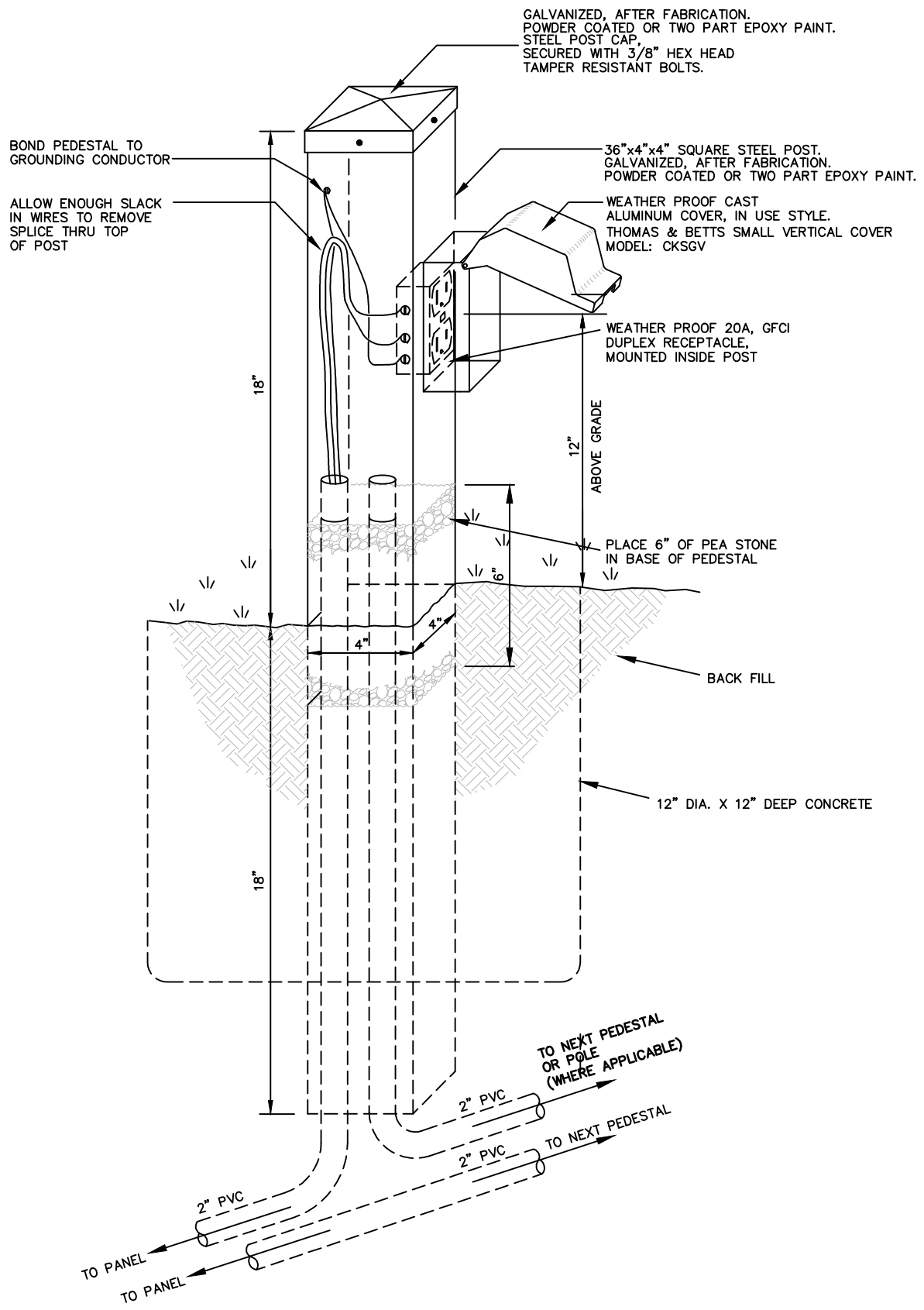
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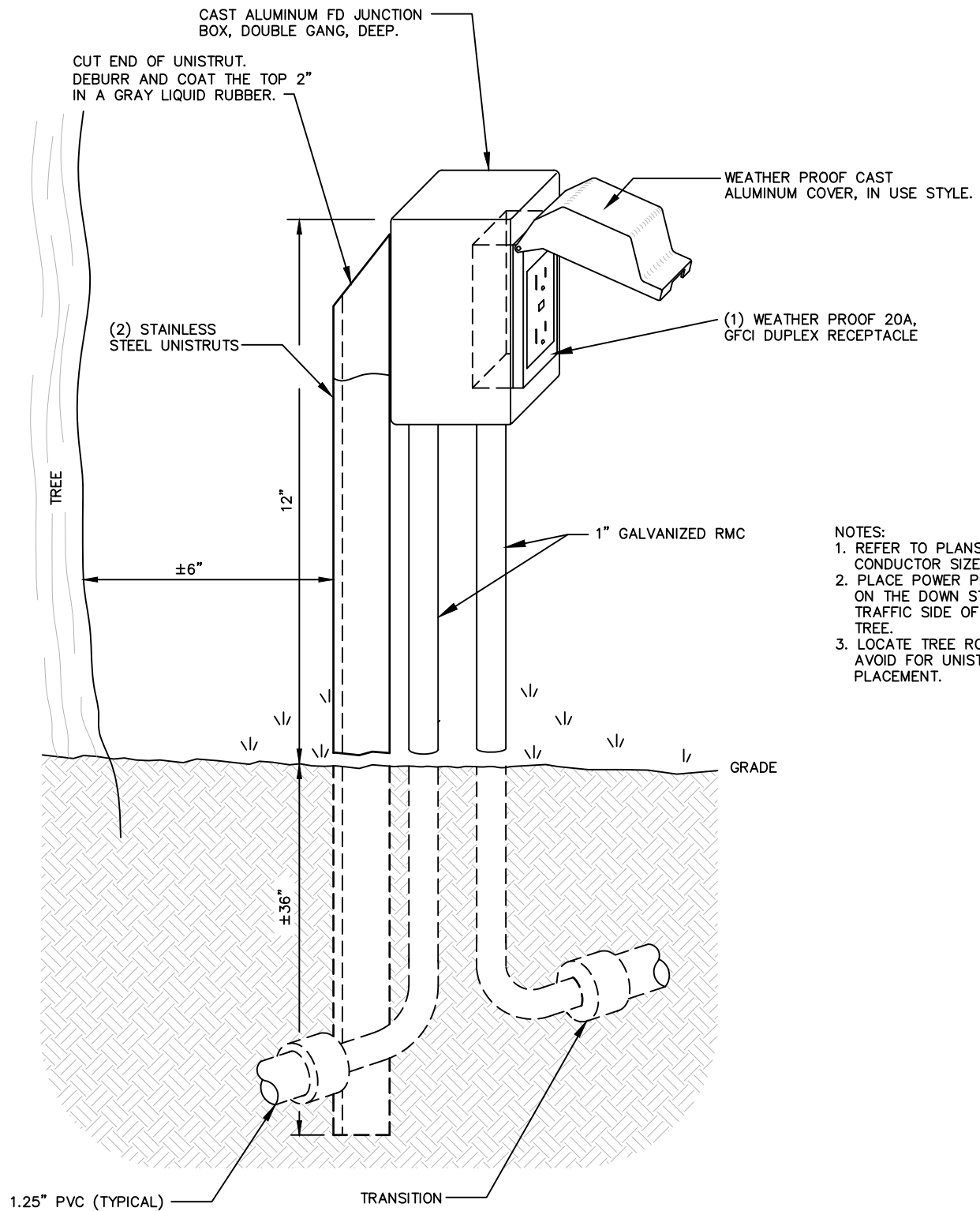
LAST REVISION DATE
12/20/2024

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E-075



POWER PEDESTAL
N.T.S.



- NOTES:
1. REFER TO PLANS FOR CONDUCTOR SIZE.
 2. PLACE POWER PEDESTAL ON THE DOWN STREAM TRAFFIC SIDE OF THE TREE.
 3. LOCATE TREE ROOTS AND AVOID FOR UNISTRUT PLACEMENT.

POWER RECEPTACLE

N.T.S.

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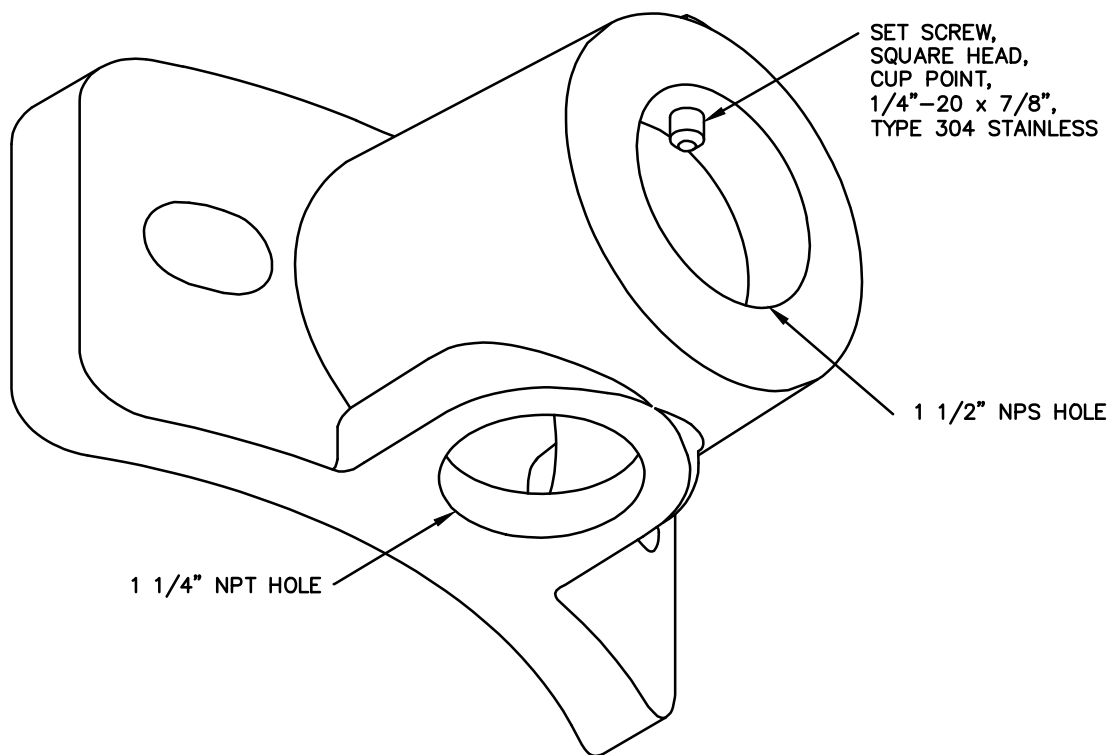
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E-099A



ALUMINUM HUB ASSEMBLY
WITH BLACK FINISH

TRAFFIC SIGNAL WOOD POLE MOUNT

N.T.S.

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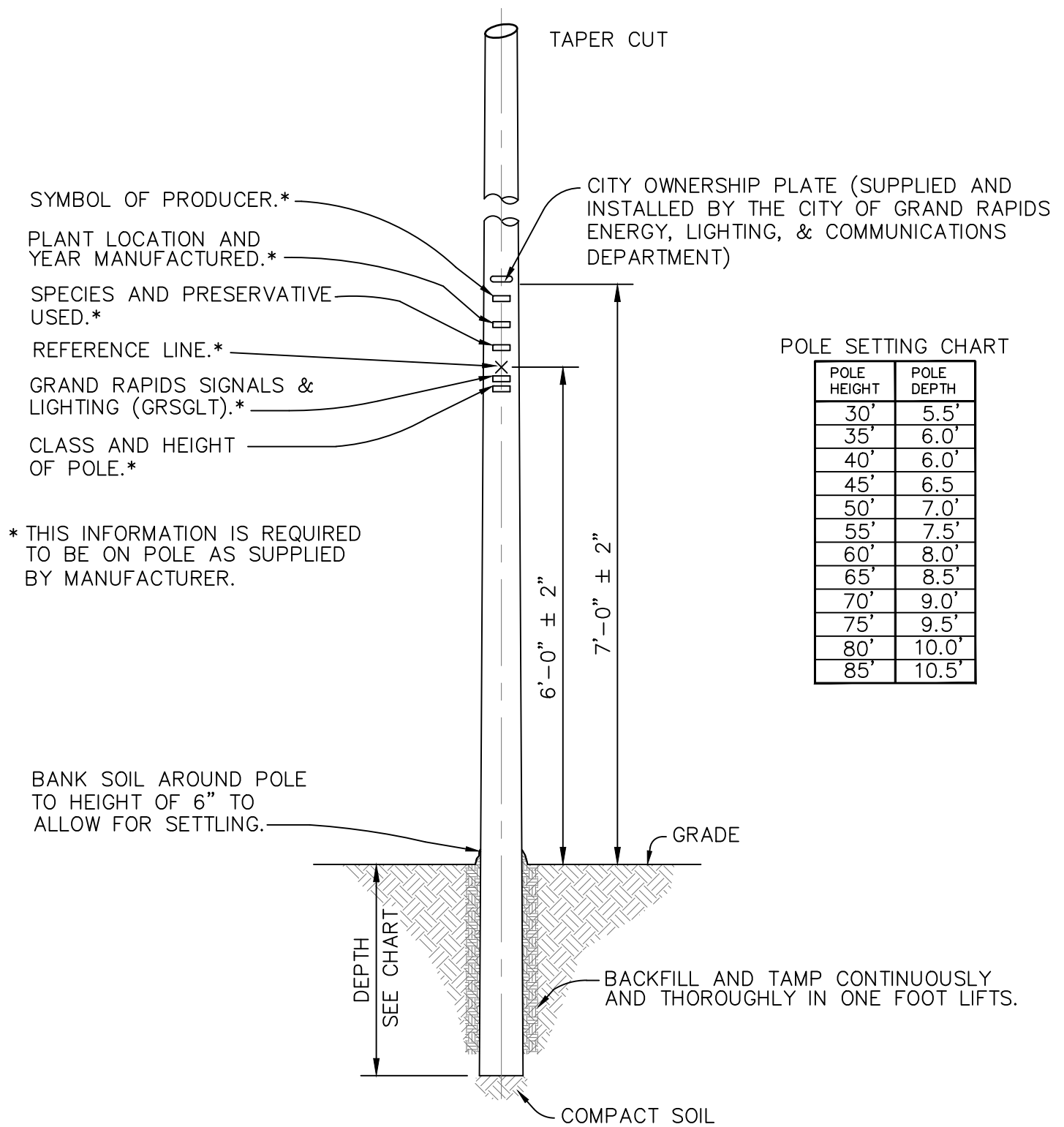
Tim B...
CITY ENGINEER

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E-130



POLE SETTING CHART

POLE HEIGHT	POLE DEPTH
30'	5.5'
35'	6.0'
40'	6.0'
45'	6.5'
50'	7.0'
55'	7.5'
60'	8.0'
65'	8.5'
70'	9.0'
75'	9.5'
80'	10.0'
85'	10.5'

TYPICAL POLE SETTING

N.T.S.

APPROVED BY

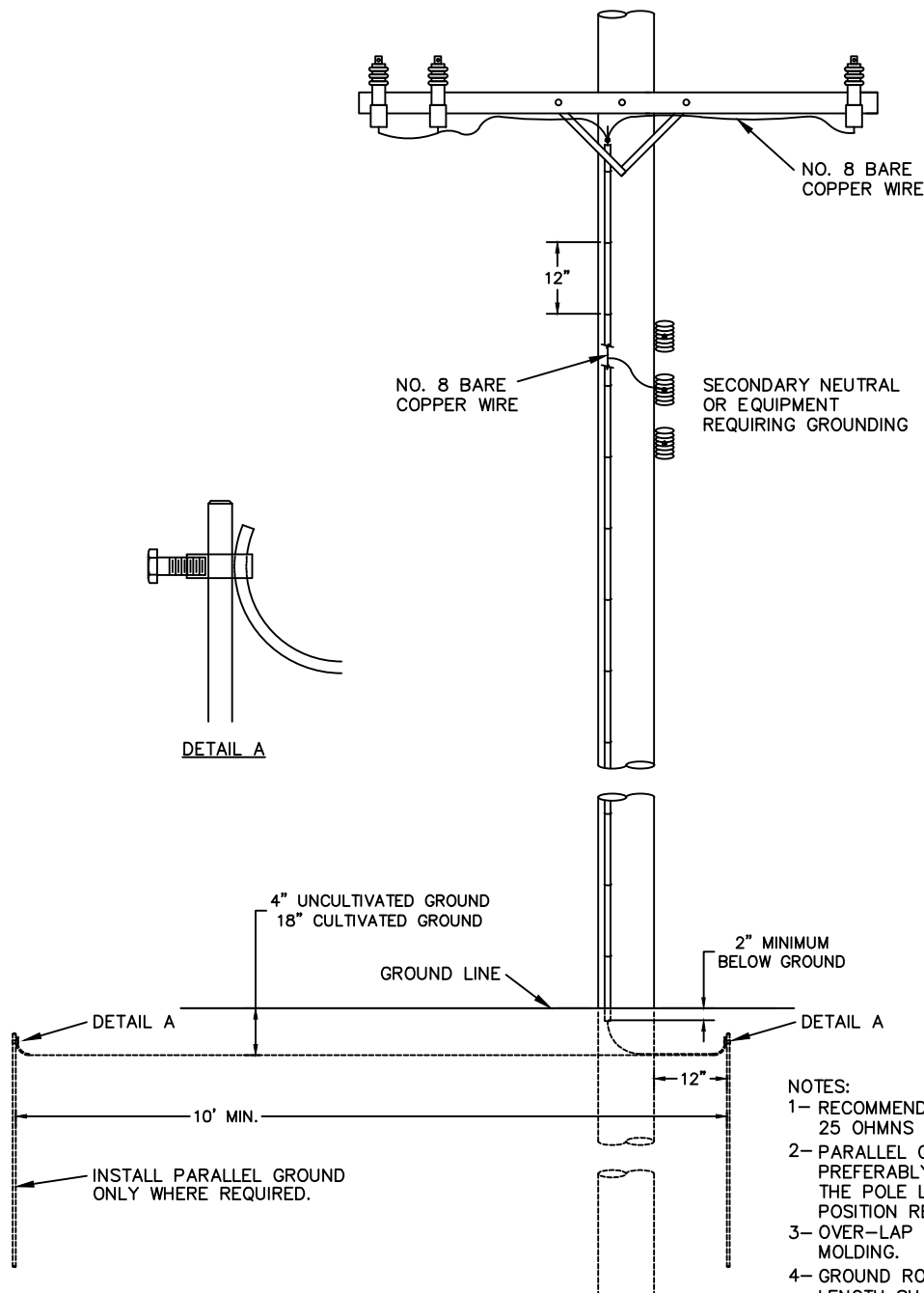
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11/13/2020

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E-200



NOTES:

- 1- RECOMMENDED RESISTANCE OF GROUND - 25 OHMS OR LESS
- 2- PARALLEL GROUND(S) SHALL BE LOCATED. PREFERABLY ALONG THE CENTER LINE OF THE POLE LEAD, OR IN ANY OTHER POSITION REQUIRED BY FIELD CONDITIONS.
- 3- OVER-LAP JOINTS BETWEEN SECTIONS OF MOLDING.
- 4- GROUND ROD SHALL BE 5/8" COPPERWELD. LENGTH SHALL BE AS NOTED.
 - a) 8' RODS SHALL BE OF THE SCREW CONNECTOR TYPE.
 - b) TRANSFORMER GROUND ROD INSTALLATION SHALL CONSIST OF NOT LESS THAN 2-8' RODS COUPLED TOGETHER AND DRIVEN INTO THE GROUND.
- 5- GROUND ROD CLAMP SHALL BE OF AN ALL BRONZE MATERIAL.

GROUND ASSEMBLY FOR WOOD POLE

N.T.S

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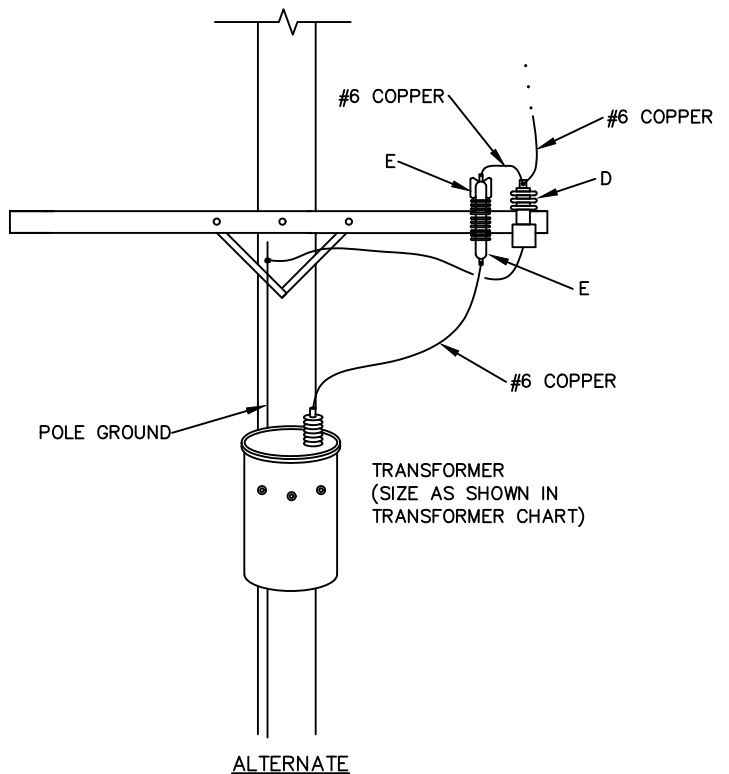
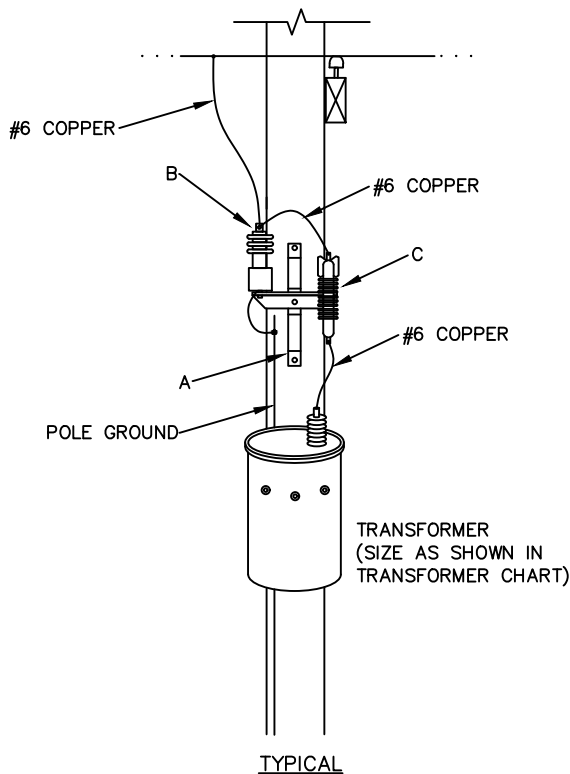
ORIGINAL APPROVAL DATE

4/27/1982

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E-205



ITEM	MATERIAL
A	MOUNTING BRACKET, ALUMA--FORM PART #51056
B	ARRESTOR, HUBBELL 2137097314
C	CUTOUT, 100A, HUBBELL CP730-114P *
D	ARRESTOR, HUBBELL 2137097324
E	CUTOUT, 100A, HUBBELL CP730-114PB *

* FUSES AS SHOWN IN TRANSFORMER CHART

POLE MOUNT TRANSFORMER CHART		
KVA	SECONDARY	FUSE
10	120/240	3H
15	120/240	3H
15	240/480	3H
25	120/240	5H
25	240/280	5H
37.5	240/480	8N
50	240/480	10N

POLE MOUNT TRANSFORMER

N.T.S

NEUTRAL CONNECTION NOT SHOWN -
CONNECT TO POLE GROUND USING #6 COPPER

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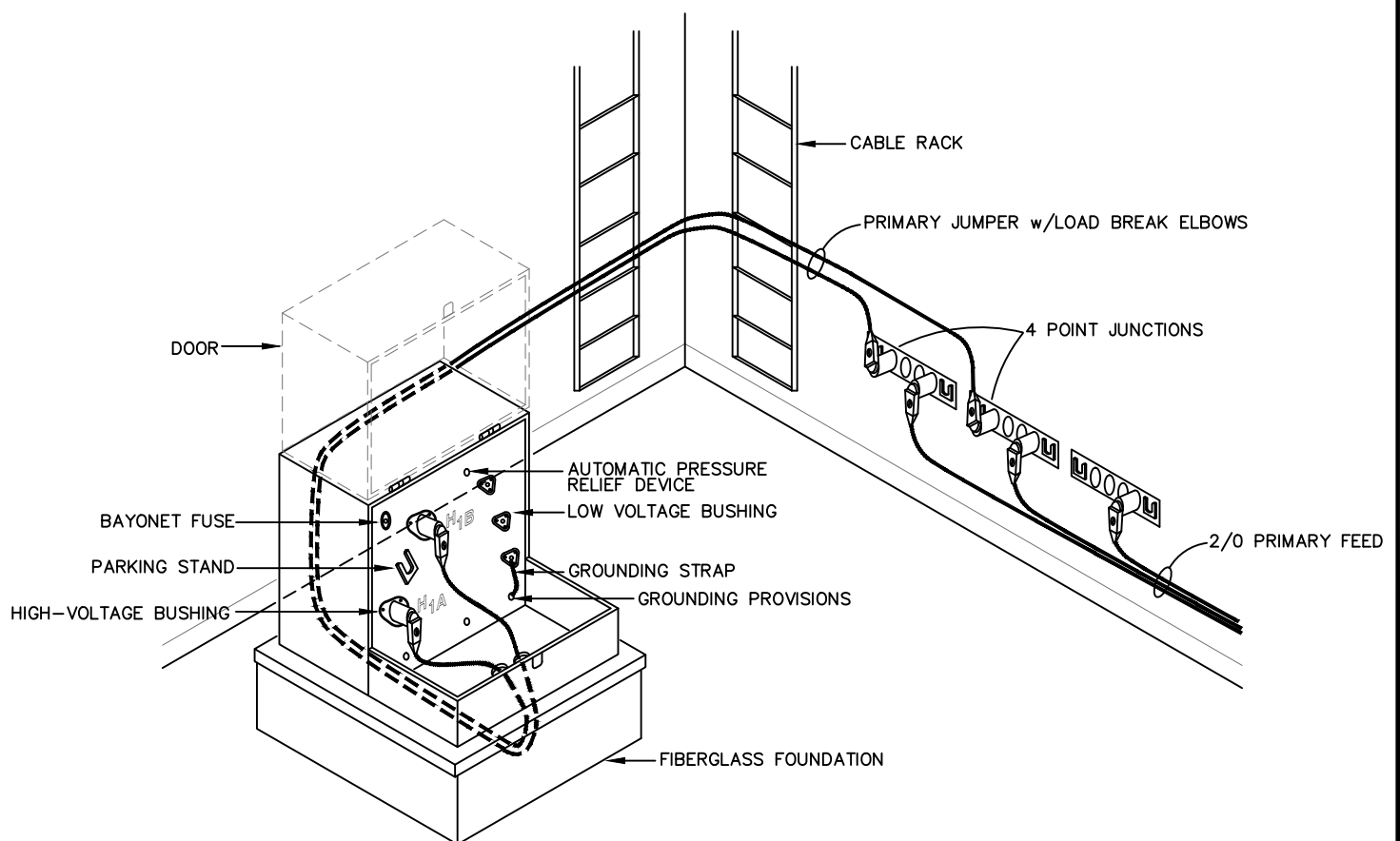
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E-210



VAULT MOUNT TRANSFORMER

N.T.S.

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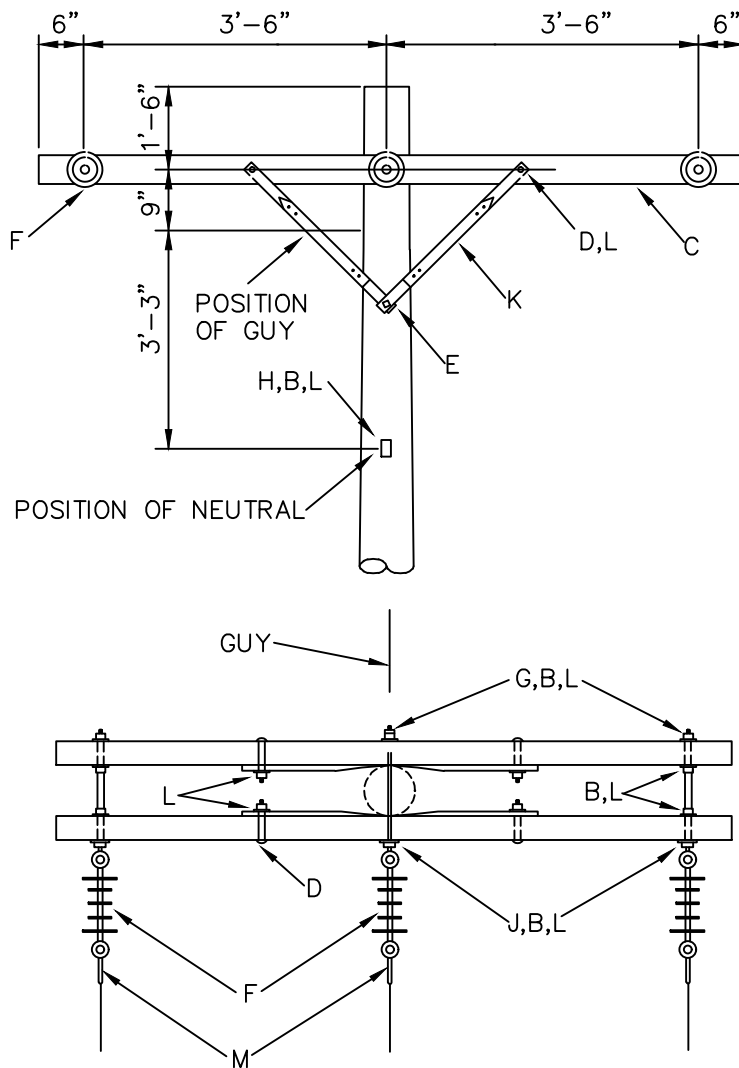
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E-215



PLAN VIEW

ITEM	MATERIAL
A	WASHER, SQUARE, 3" CURVED
B	WASHER, SQUARE, 2 1/4"
C	CROSSARM, 3 5/8" x 4 5/8" x 8'-0"
D	BOLT, CARRIAGE, 3/8" x 4 1/2"
E	SCREW, LAG, 1/2" x 4"
F	EPOXILATOR HUBBELL 4010150215
G	BOLT, DOUBLE ARMING, 5/8" x REQ'D. LENGTH
H	BOLT, EYE, 5/8" x REQ'D. LENGTH
J	NUT, EYE, 5/8"
K	BRACE, 28"
L	LOCKNUTS
M	DEADEND CLAMP, MACLEAN HDSO-57

NOTES:

1. DOUBLE ARMING EYE BOLT MAY BE USED INSTEAD OF DOUBLE ARMING BOLT, ITEM 'G' AND EYE NUT, ITEM 'J'.
2. OTHER NEUTRAL ASSEMBLIES MAY BE USED. ADJUST MATERIAL AS NEEDED.

DEADEND CROSSARMS

N.T.S

APPROVED BY

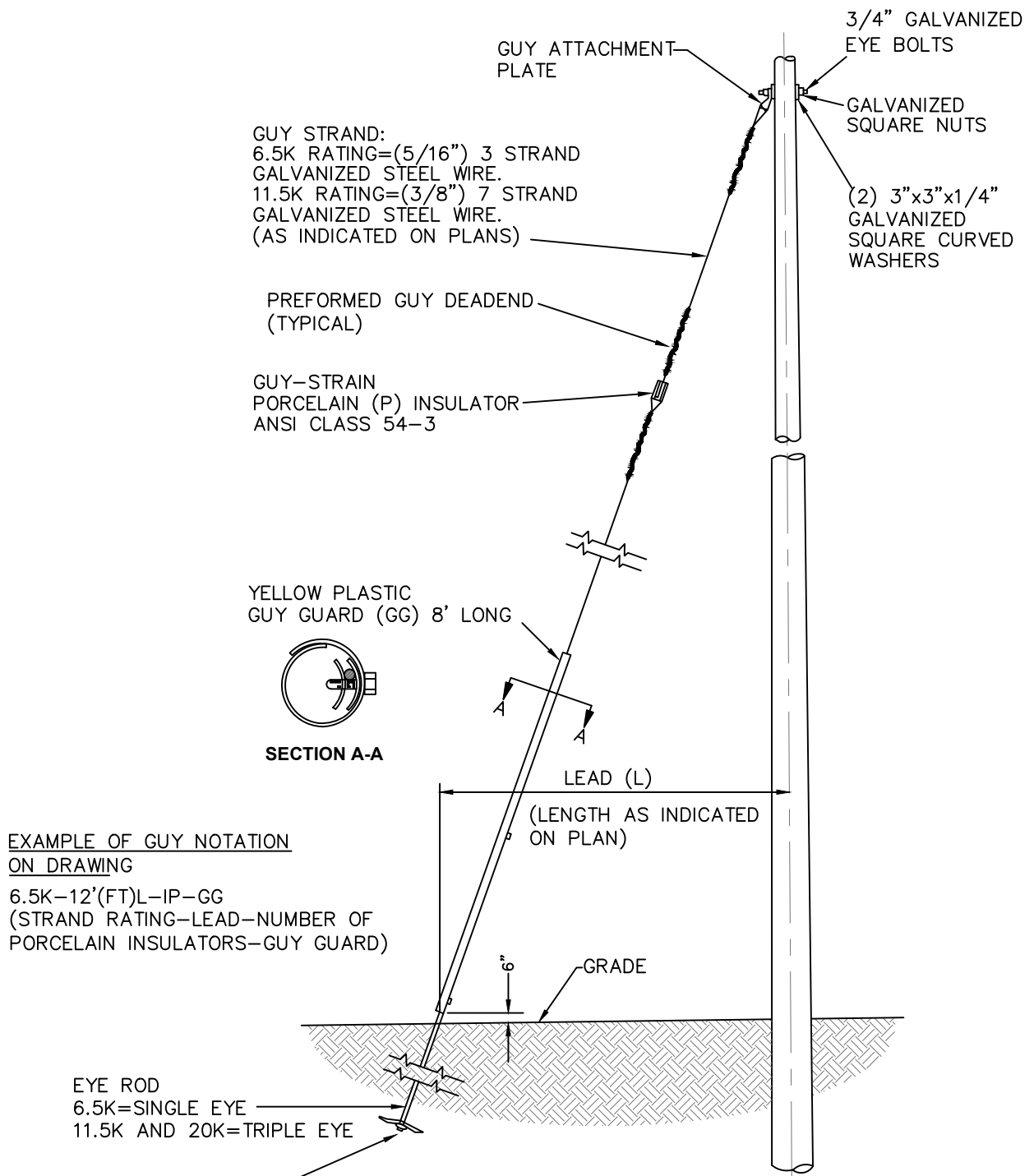
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E-245



EXAMPLE OF GUY NOTATION ON DRAWING

6.5K-12'(FT)L-IP-GG
(STRAND RATING-LEAD-NUMBER OF PORCELAIN INSULATORS-GUY GUARD)

EXPANDING ANCHOR

6.5K AND 11.5K - A.B. CHANCE #88135
OR CITY APPROVED EQUAL.
20K - A.B. CHANCE #1283-1 OR CITY APPROVED EQUAL.

POWER SCREW ANCHOR

6.5K AND 11.5K - A.B. CHANCE
#C102-5004 OR CITY APPROVED EQUAL.
20K - A.B. CHANCE #C102-5006 OR CITY APPROVED EQUAL.

DOWN GUY

N.T.S.

APPROVED BY

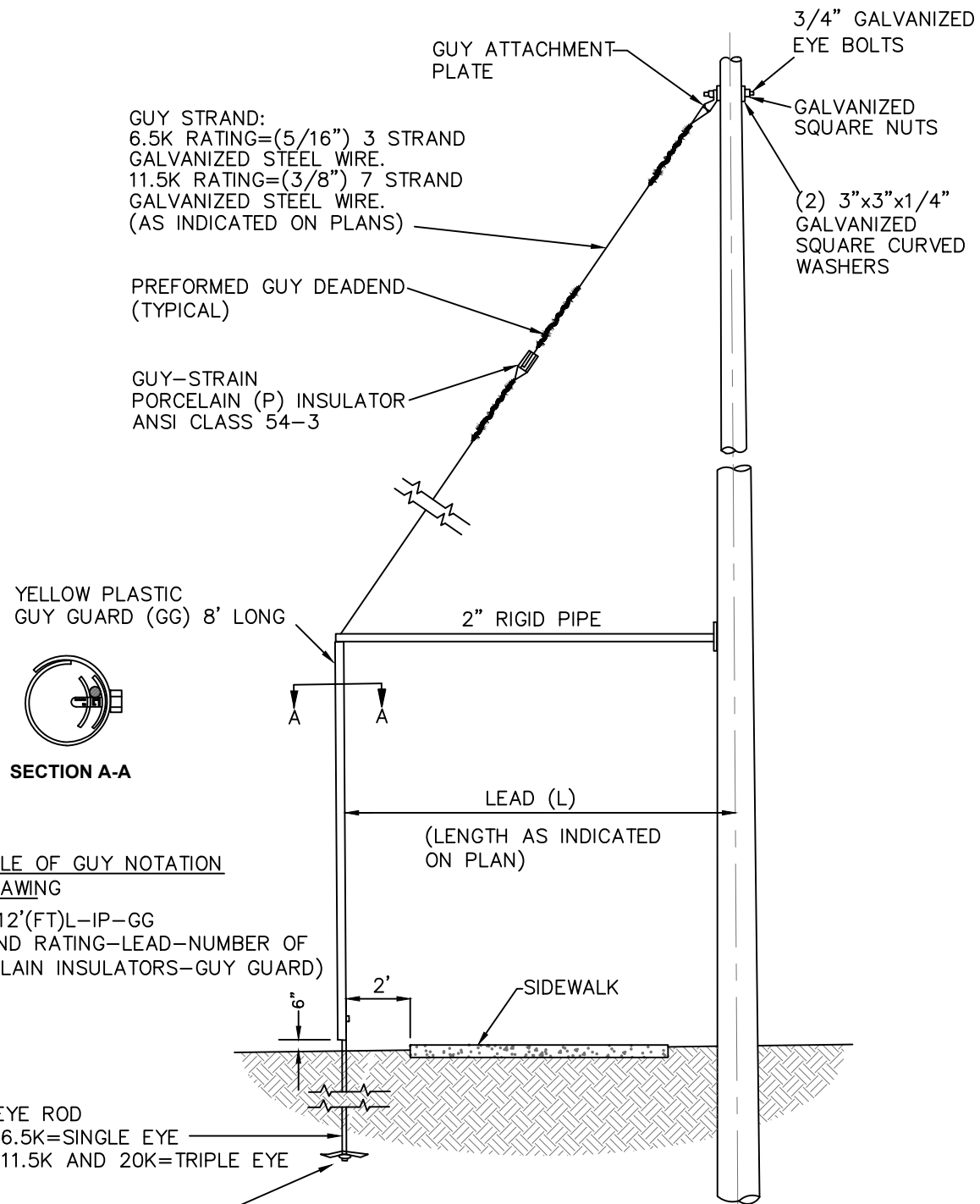
T. B. [Signature]
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E-250



EXAMPLE OF GUY NOTATION ON DRAWING

6.5K-12'(FT)L-IP-GG
(STRAND RATING-LEAD-NUMBER OF
PORCELAIN INSULATORS-GUY GUARD)

EYE ROD
6.5K=SINGLE EYE
11.5K AND 20K=TRIPLE EYE

EXPANDING ANCHOR

6.5K AND 11.5K - A.B. CHANCE #88135
OR CITY APPROVED EQUAL.
20K - A.B. CHANCE #1283-1 OR CITY APPROVED EQUAL.

POWER SCREW ANCHOR

6.5K AND 11.5K - A.B. CHANCE
#C102-5004 OR CITY APPROVED EQUAL.
20K - A.B. CHANCE #C102-5006 OR CITY
APPROVED EQUAL.

SIDEWALK DOWN GUY

N.T.S.

APPROVED BY

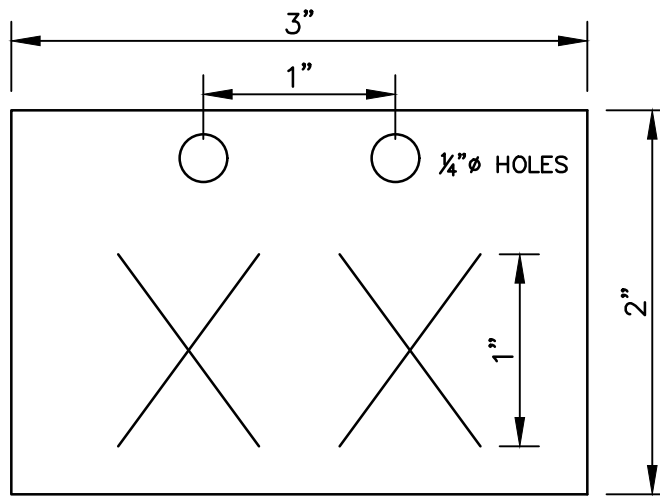
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E-255



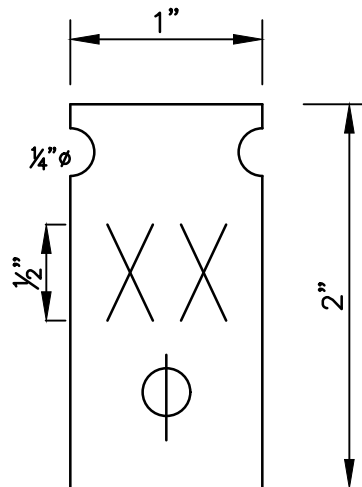
DUCT BUNDLE TAG

CIRCUIT NAME: XX

MR – MONROE
OT – OTTAWA
GO – GODFREY
PF – PLAINFIELD
FR – FULLER
RI – RICHMOND
BK – BELKNAP
SP – SPARE

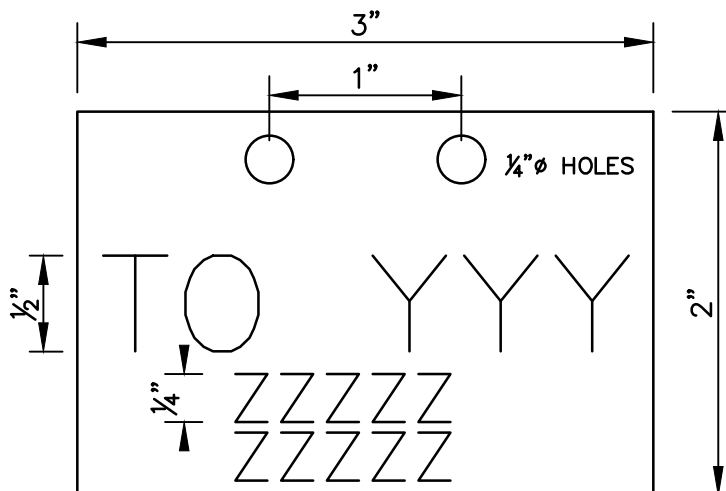
TAG COLOR
SURFACE/BASE

YELLOW/BLACK
GREEN/WHITE
RED/WHITE
ORANGE/BLACK
GRAY/BURGANDY
BLACK/WHITE
BLUE/WHITE
WHITE/BLACK



PHASE TAG

PHASE: ϕ
"X", "Y", OR "Z"



DESTINATION TAG

DESTINATION: YYY

VLT – VAULT
MH – MANHOLE
SUB – SUBSTATION
RIS – RISER
XFM – TRANSFORMER

LOCATION: ZZZZZ

INTERSECTION OR
ADDRESS OF OTHER
END OF PRIMARY CABLE

PRIMARY CABLE TAG

N.T.S

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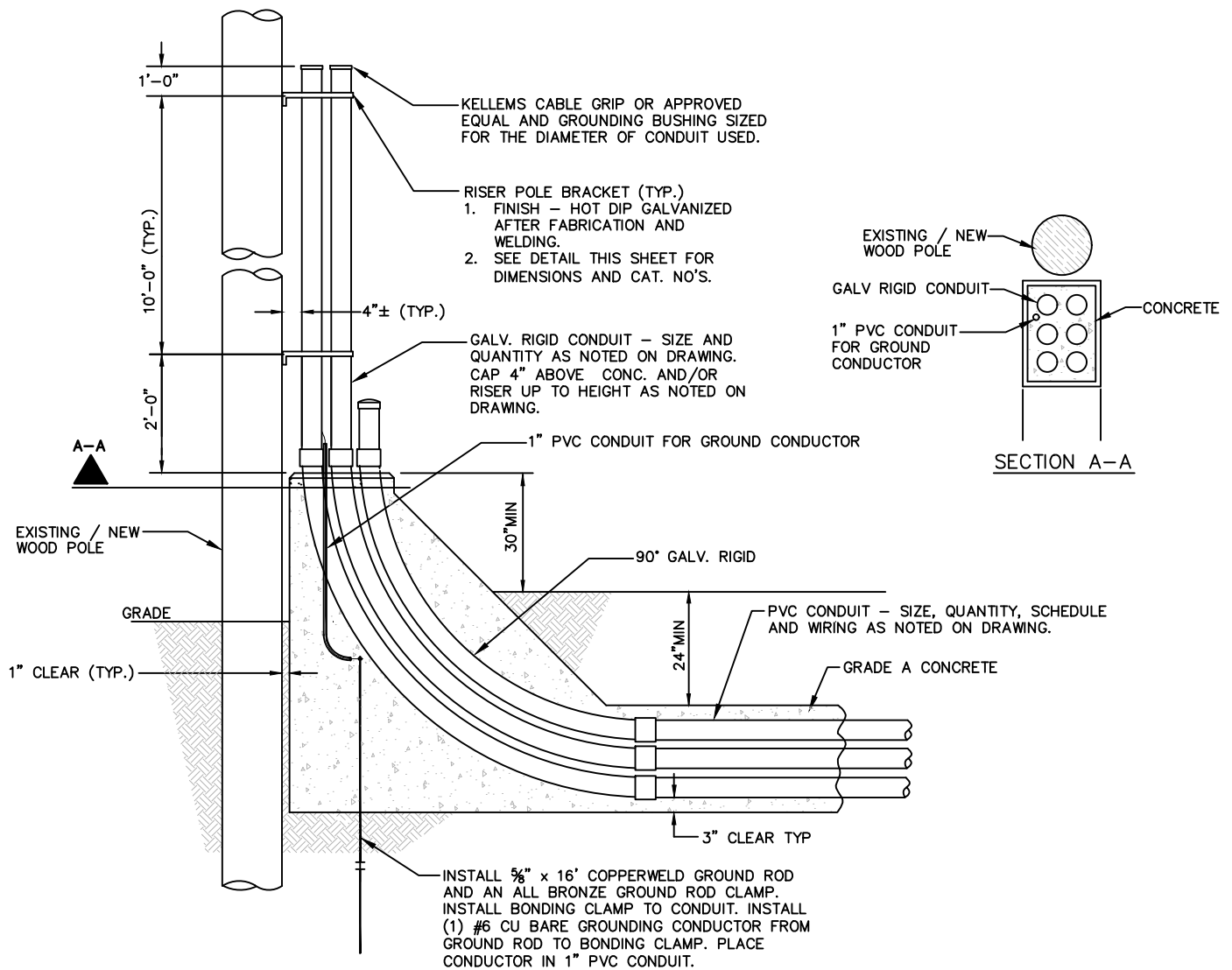
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E-330



PRIMARY RISER

N.T.S.

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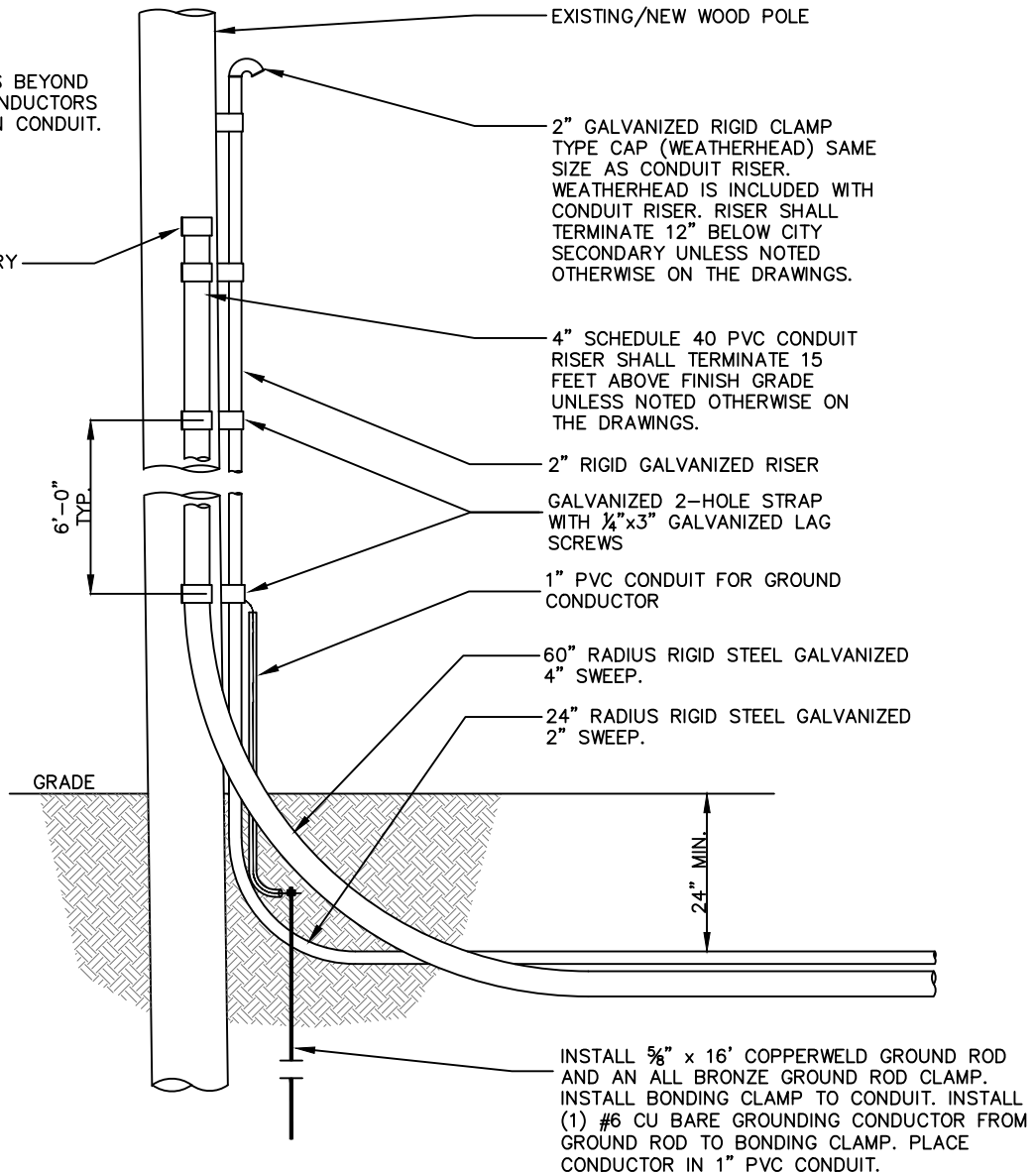
LAST REVISION DATE
2/17/2023

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E-360

NOTE - 2" RISER
PROVIDE 36" TAILS BEYOND
WEATHERHEAD, CONDUCTORS
TO BE SAME AS IN CONDUIT.

PLACE TEMPORARY
4" PVC CAP



(1)2" SECONDARY, AND (1)4" PRIMARY RISER

N.T.S.

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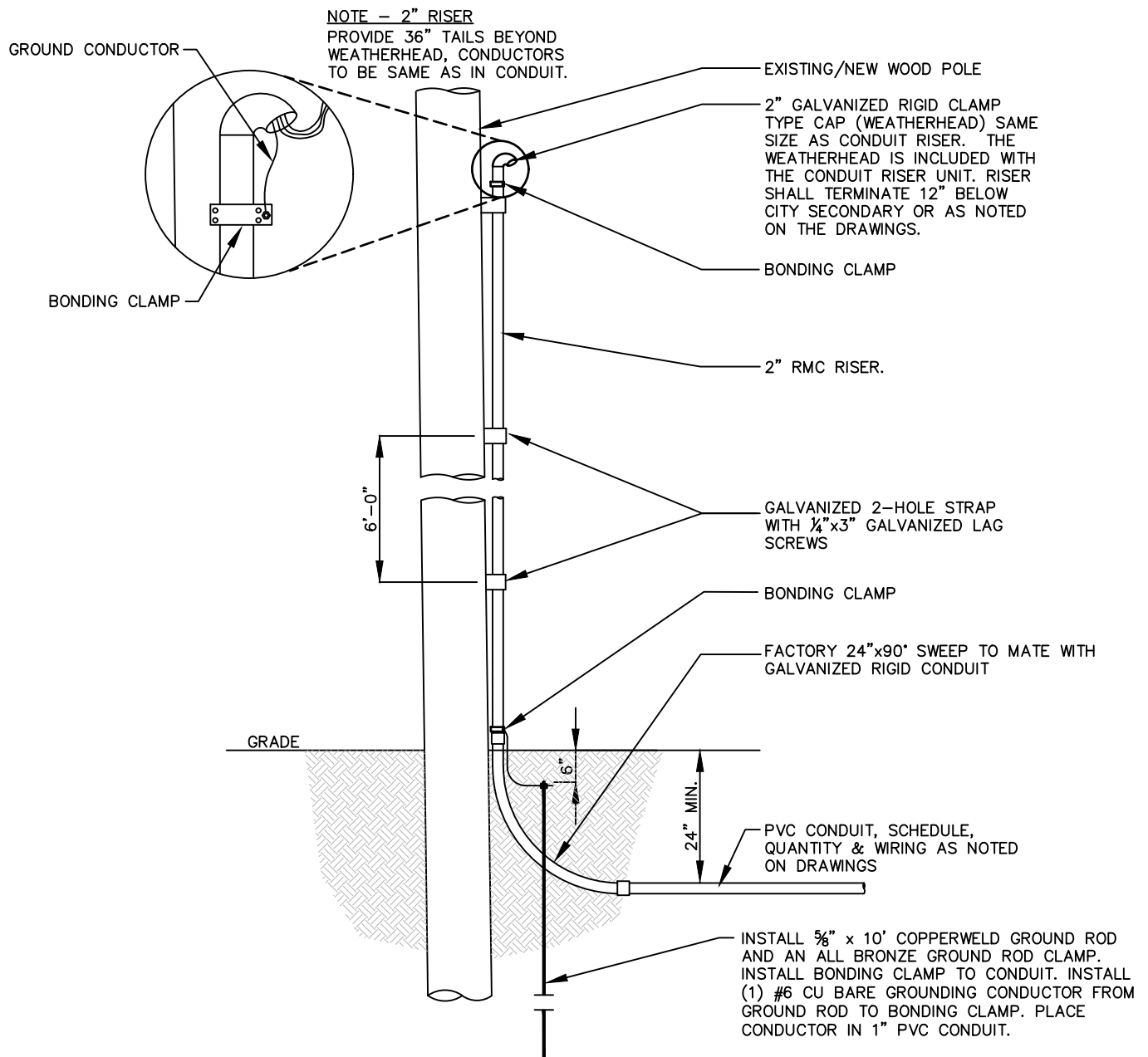
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(1)2" SECONDARY RISER

N.T.S.

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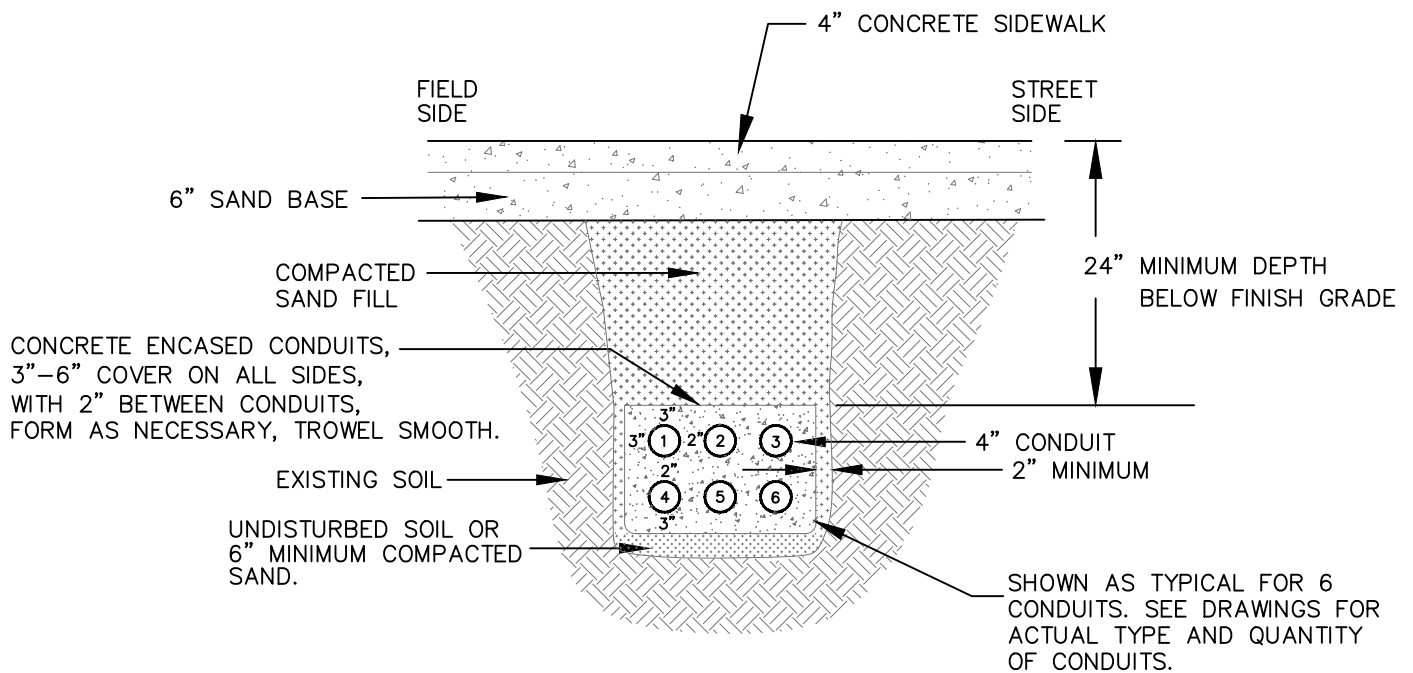
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NOTE: REFER TO E445 FOR INTERMEDIATE
CONCRETE POUR JOINT DETAILS

4" SCHEDULE 40 PVC CONCRETE ENCASED CONDUIT

(TYPICAL)

N.T.S.

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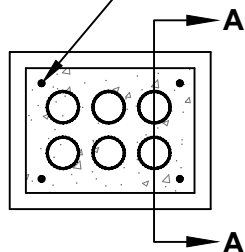
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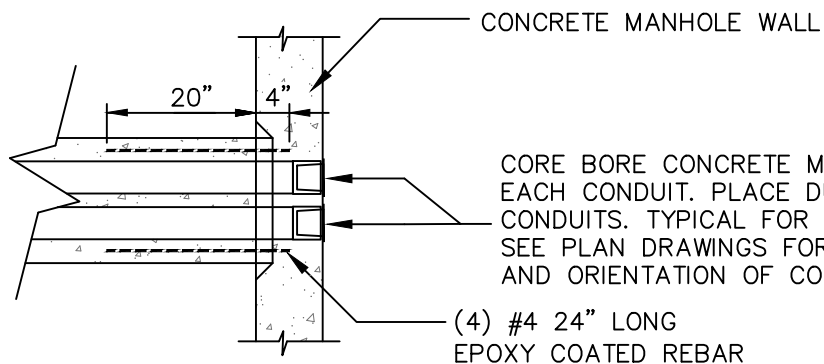
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E-400

(4) #4 24" LONG
EPOXY COATED REBAR



**DUCT WINDOW
END VIEW**



**DUCT WINDOW
SECTION A-A**

CORE BORE CONCRETE MANHOLE WALL FOR EACH CONDUIT. PLACE DUCT PLUGS IN UNUSED CONDUITS. TYPICAL FOR 6 CONDUITS SHOWN. SEE PLAN DRAWINGS FOR ACTUAL NUMBER, SIZE AND ORIENTATION OF CONDUITS.

(4) #4 24" LONG
EPOXY COATED REBAR

ENCASED CONDUIT TERMINATION AT A MANHOLE

N.T.S.

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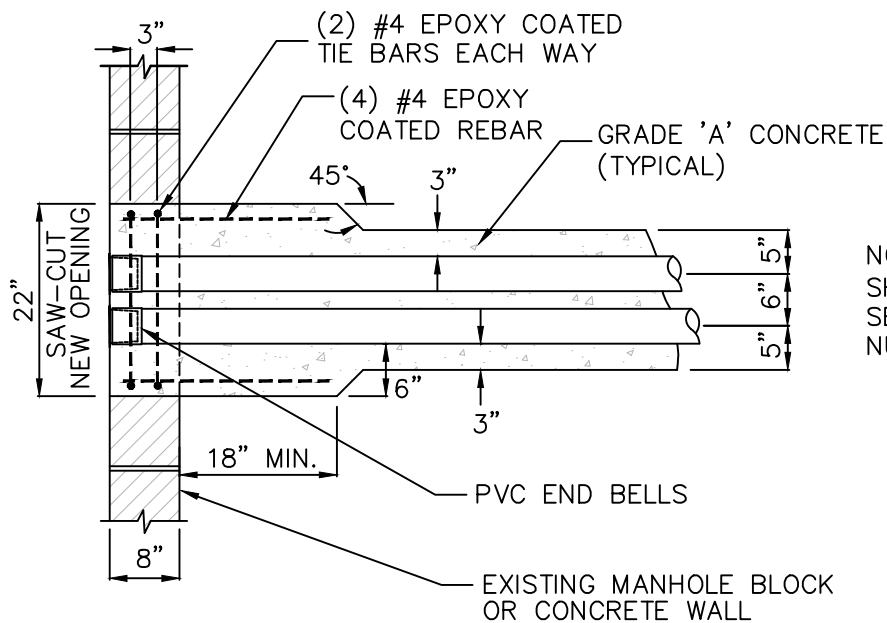
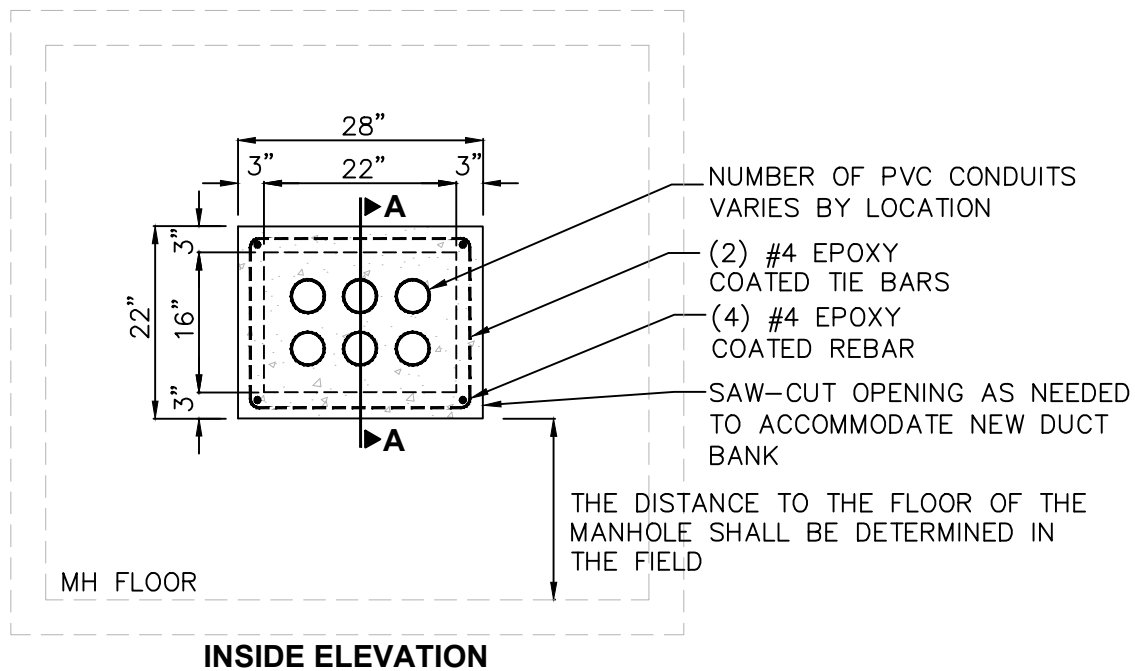
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E-435



NOTE:
SHOWN FOR 6(SIX) DUCTS.
SEE PLANS FOR ACTUAL
NUMBER OF DUCTS.

SECTION A-A

NEW DUCT WINDOW FOR EXISTING MANHOLES & VAULTS

N.T.S.

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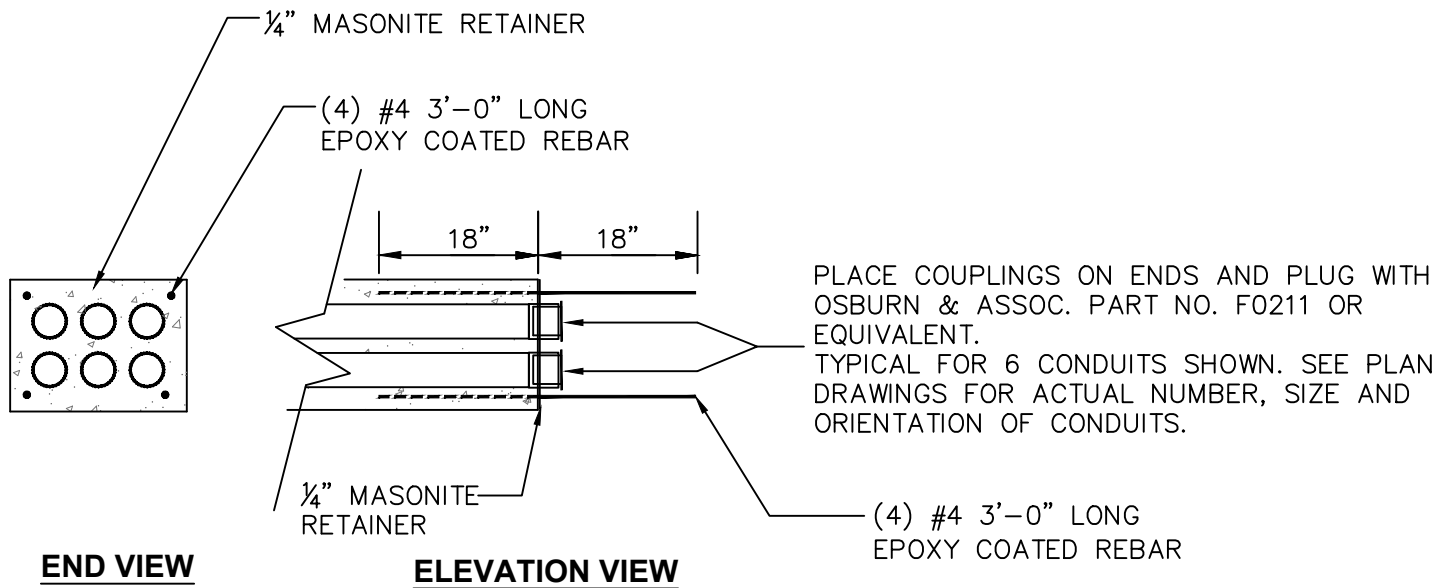
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TEMPORARY TERMINAL OF CONCRETE ENCASED CONDUIT

N.T.S.

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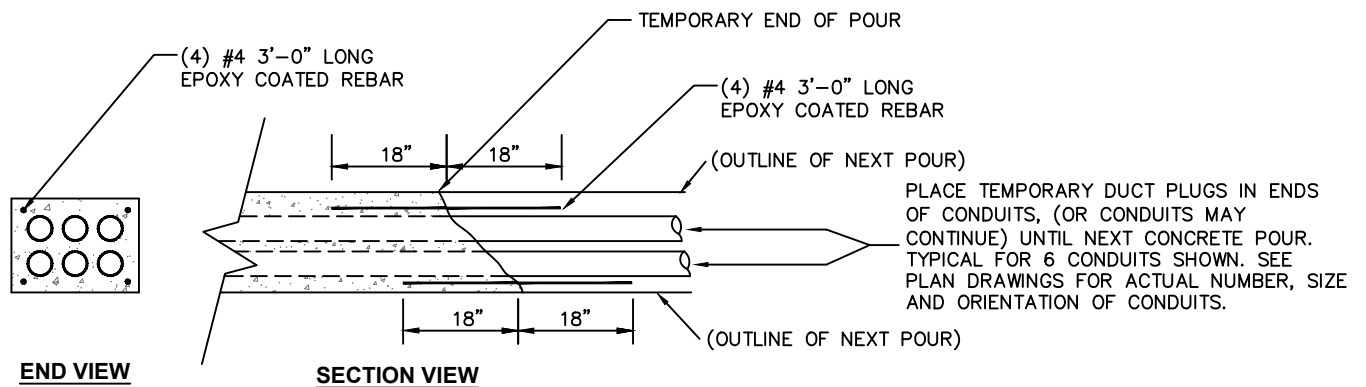
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**TEMPORARY END
OF CONCRETE POUR**
(NOT A PAY UNIT) N.T.S.

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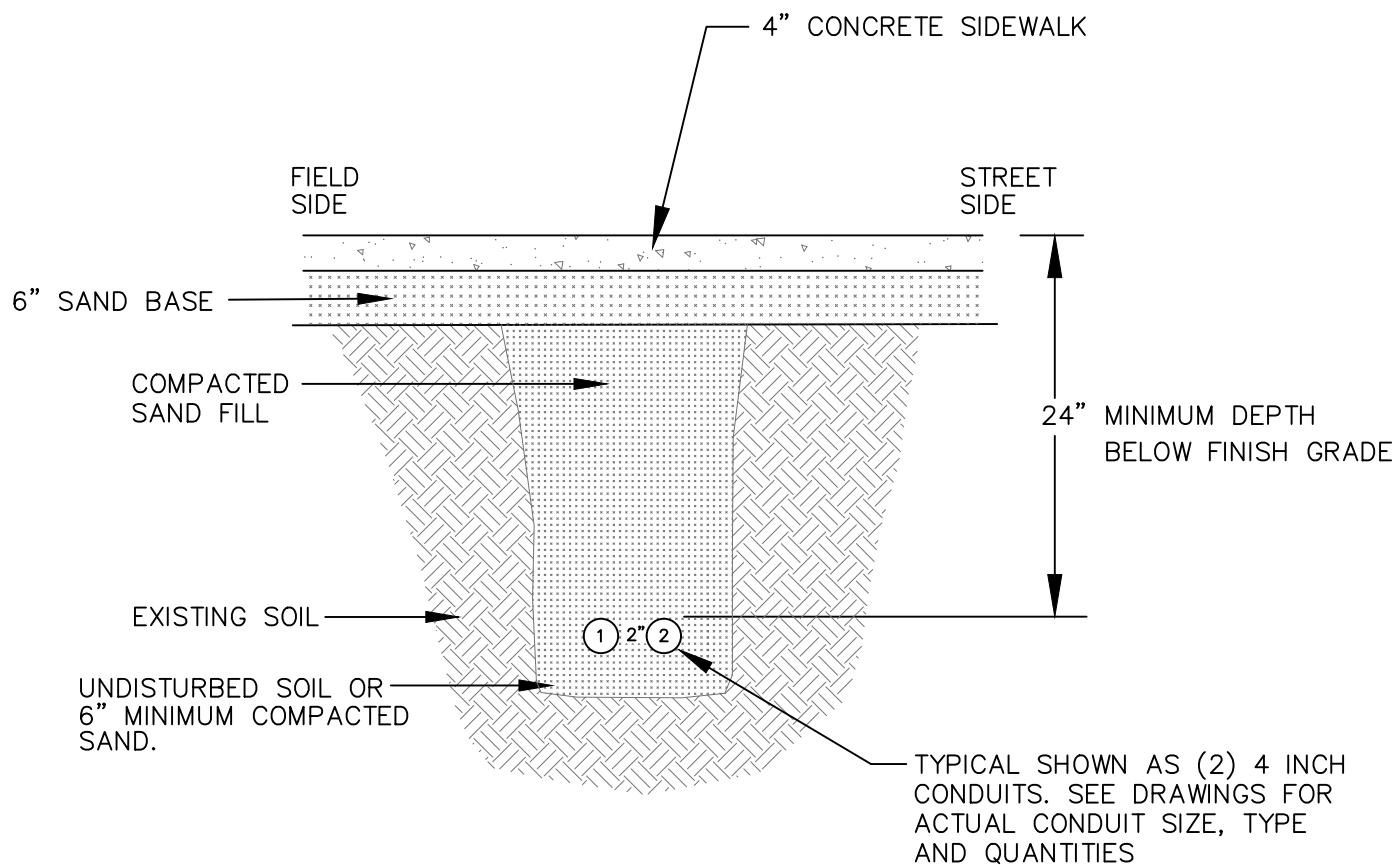
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4" SCHEDULE 40 PVC DIRECT BURIED CONDUITS

N.T.S.

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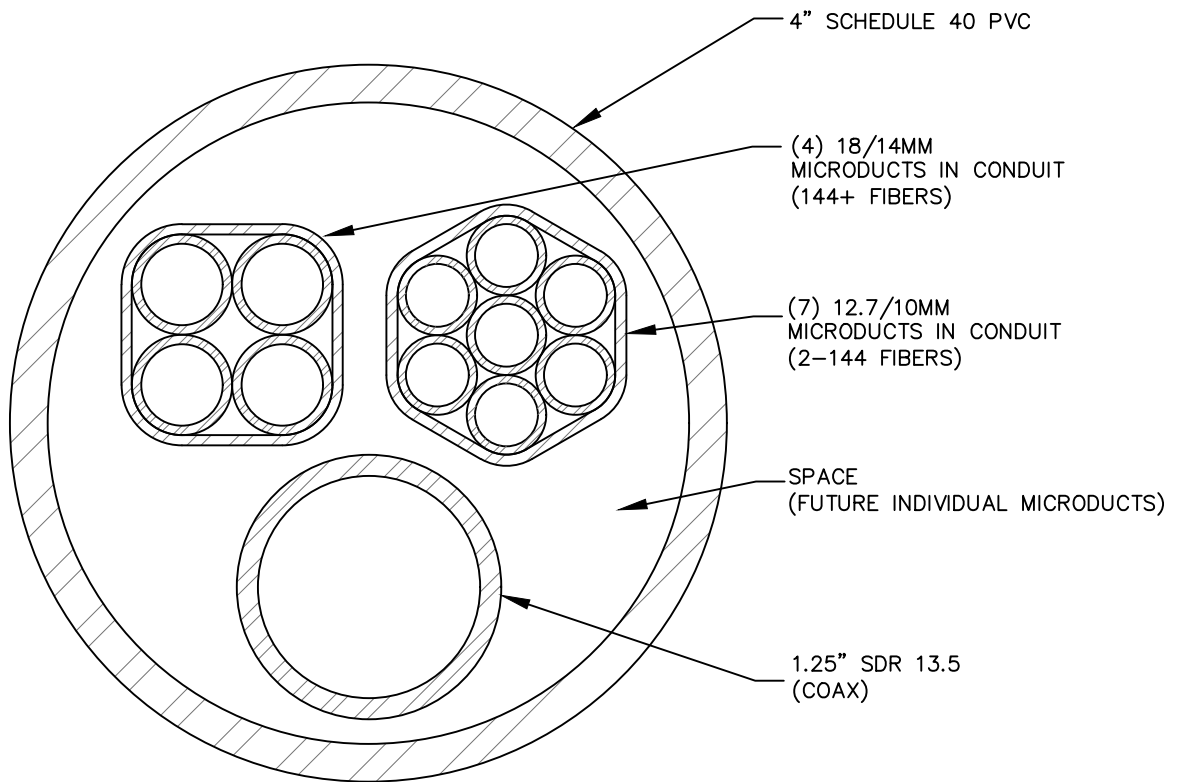
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E-460



**4" DUCT w/(1)1.25" AND (1)4 CELL
AND (1) 7 CELL MICRODUCT**

N.T.S.

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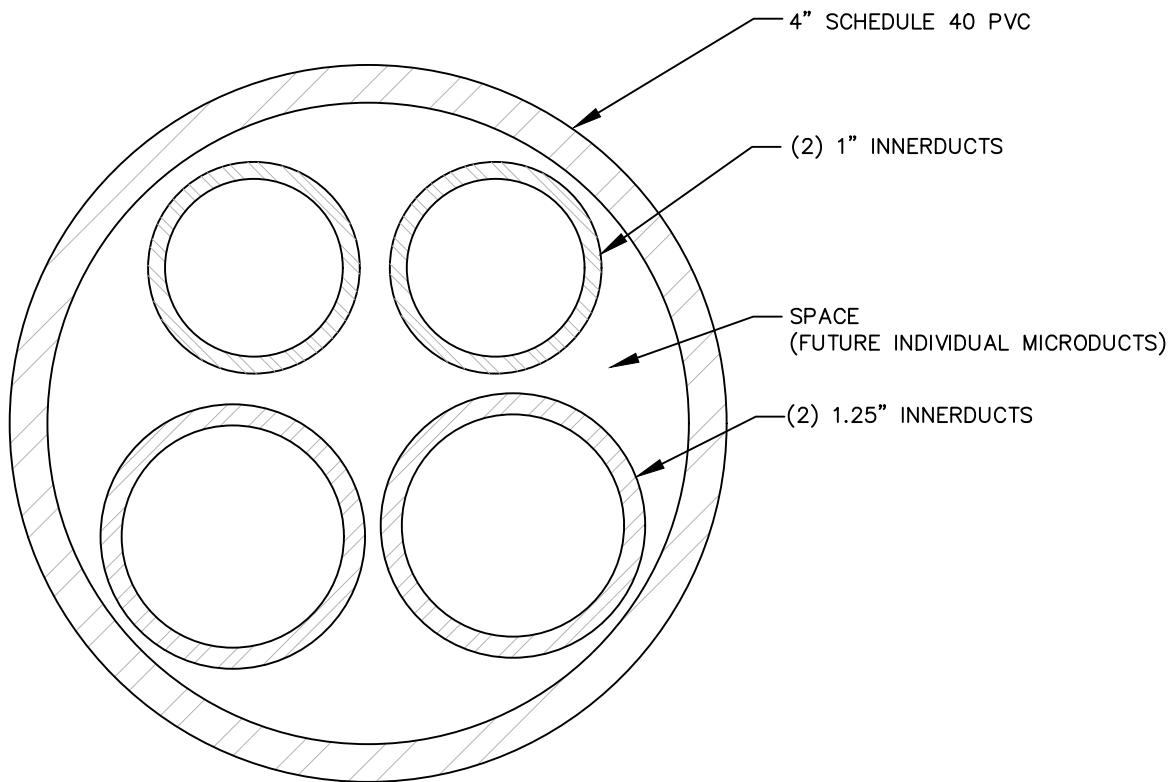
T. B. [Signature]
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4" DUCT w/(2)1.25" AND (2)1" INNERDUCTS

N.T.S.

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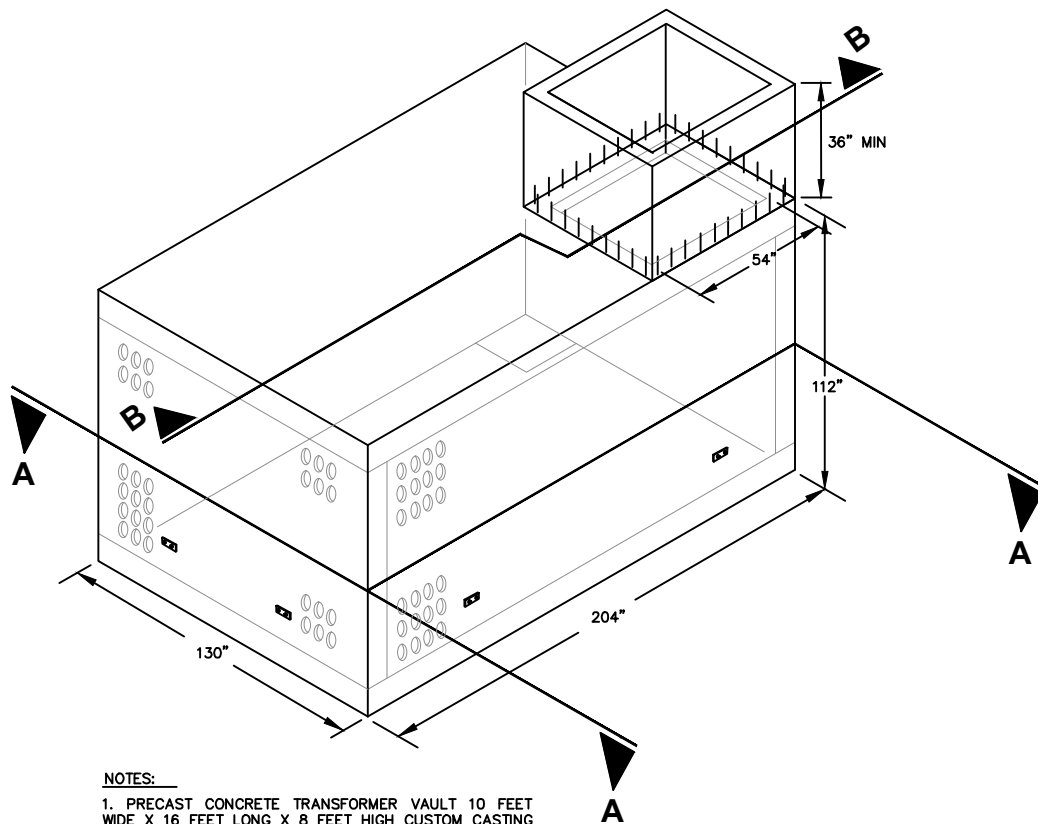
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E-486



NOTES:

1. PRECAST CONCRETE TRANSFORMER VAULT 10 FEET WIDE X 16 FEET LONG X 8 FEET HIGH CUSTOM CASTING TYPE "J" INCLUDING HARDWARE PACKAGE AS SPECIFIED.
2. ELECTRICAL TRANSFORMER VAULT SIDEWALK GRATING AS PER DETAILS E-500.3 & E-500.4.

ISOMETRIC VIEW

TRANSFORMER VAULT, SIX PANEL
N.T.S.

APPROVED BY

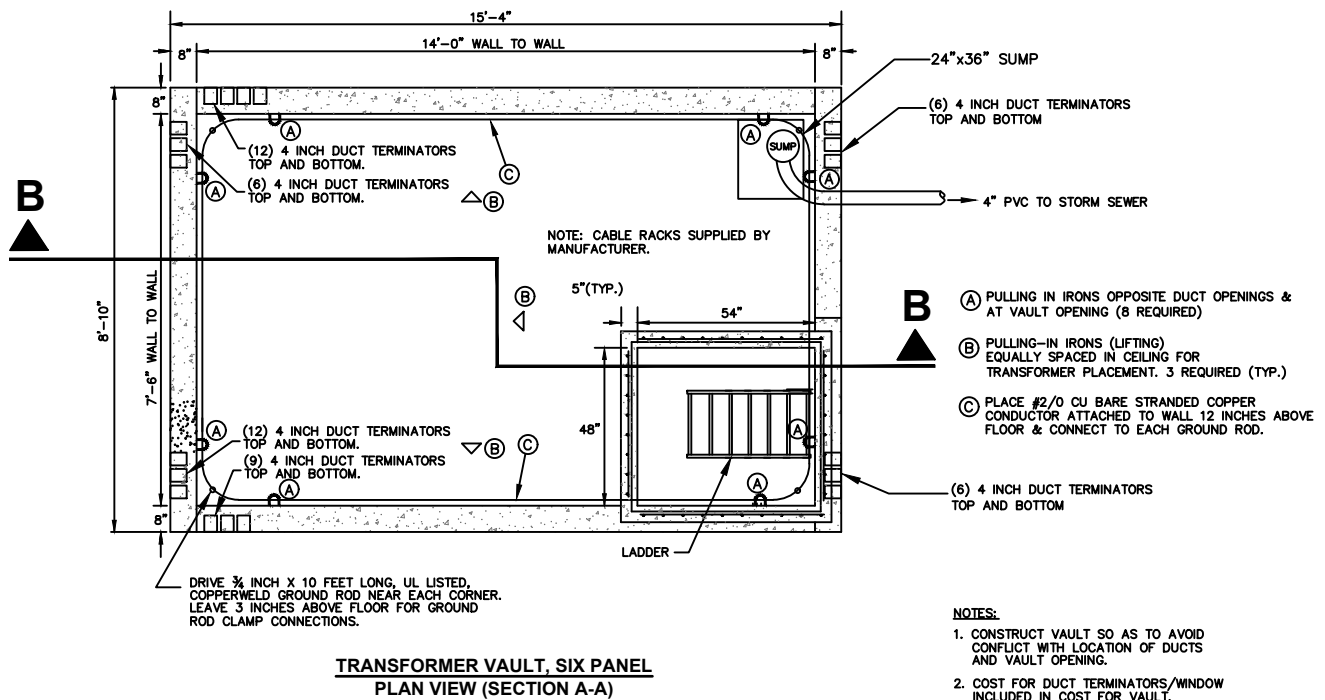
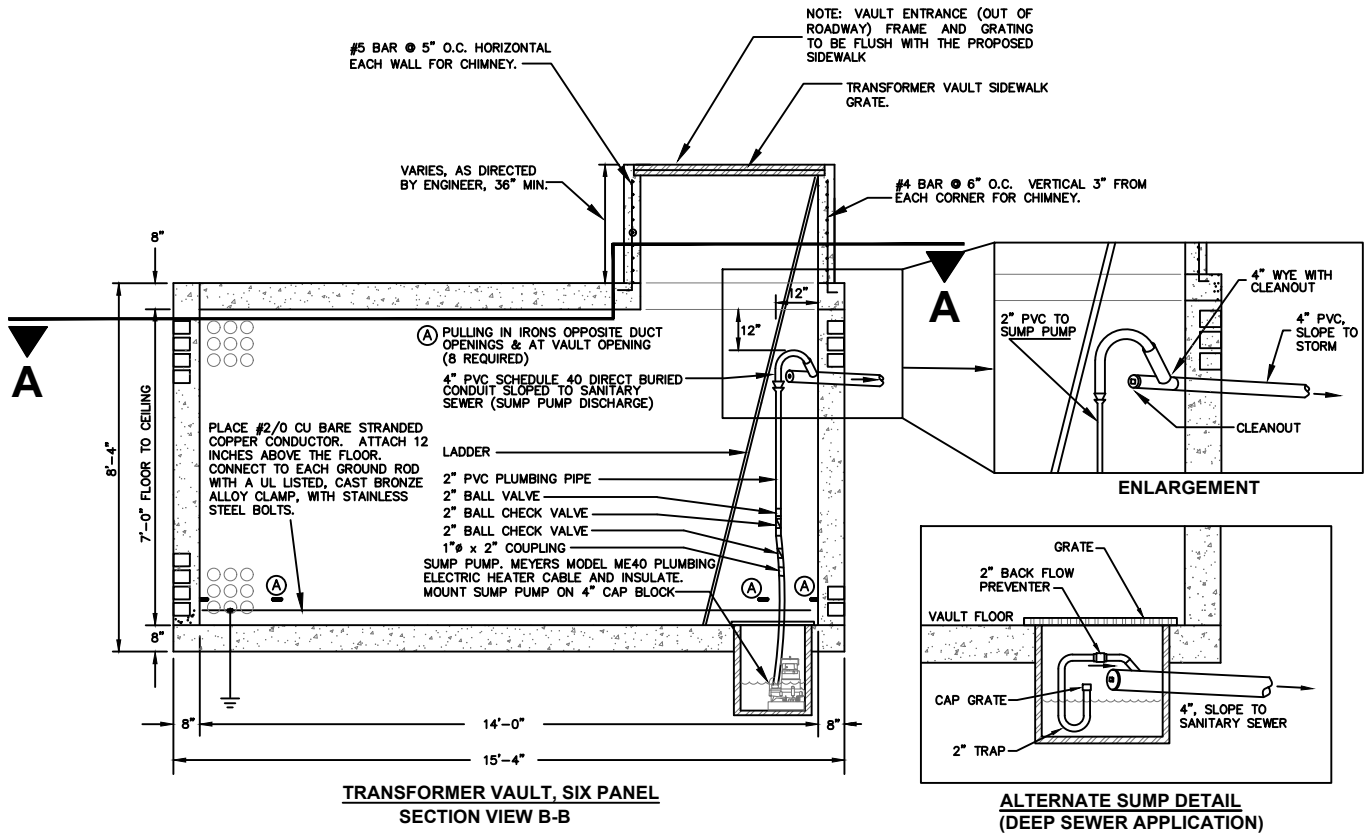
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E-500.1



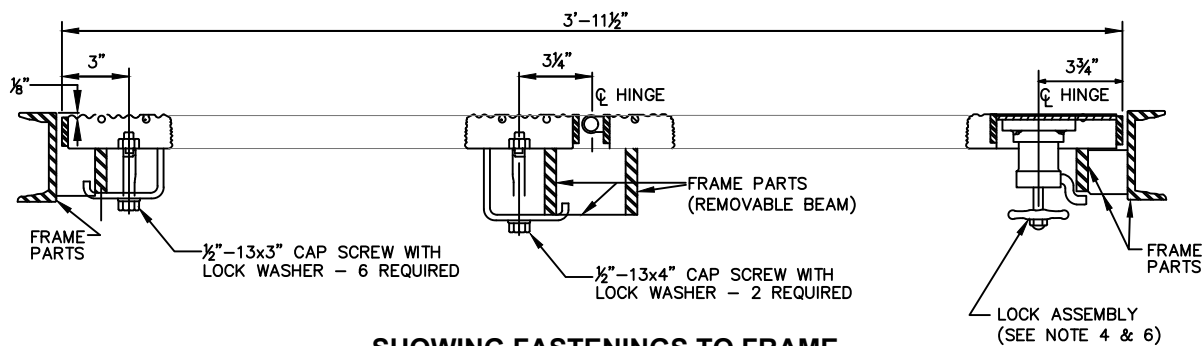
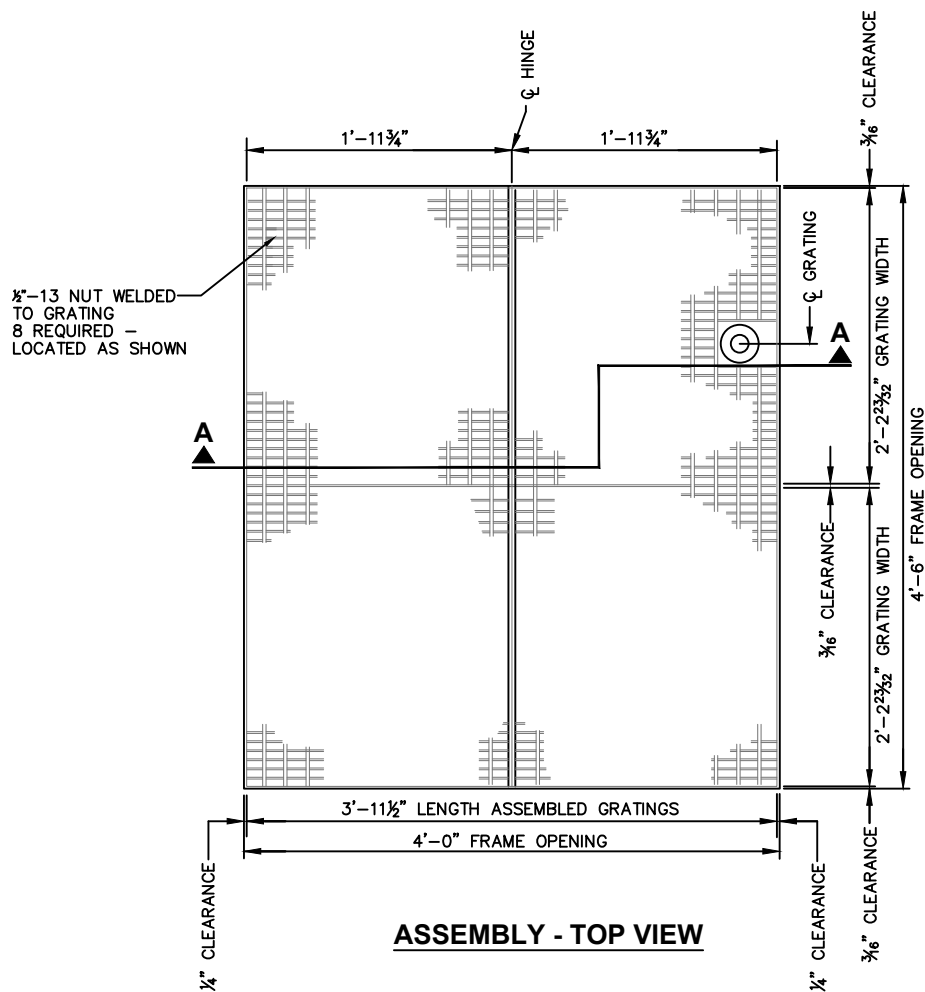
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ORIGINAL APPROVAL DATE
11/13/2020

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Public Services
Engineering Department

E-500.2



NOTES:

1. GRATING - WELDED STEEL, GARY TYPE SCW-ISO-2S, SERRATED, 1 1/2" x 3/16" MAIN BARS AT 0.915" CENTERS, 3/16" HEXAGON CROSS BARS AT 2" CENTERS.
2. EDGING - STEEL BARS, 1 1/4" x 1/4", WELDED TO GRATING.
3. FINISH - HOT DIP GALVANIZED AFTER FABRICATION AND WELDING.
4. LOCK MUST BE OPERABLE BY USE OF STANDARD CITY STREET LIGHTING VAULT KEY. (SEE NOTE 6)
5. AVAILABLE FROM LEITELT IRON WORKS, GRAND RAPIDS, MICHIGAN.
6. LOCK & KEY MANUFACTURER:

LEV-L-LOK SALES
LOVETT & RADCLIFFE
937 E. 26TH ST.
PATERSON, NEW JERSEY 07513

TYPE B COMBINATION R
CAT. #MS-F3219

TRANSFORMER VAULT SIDEWALK GRATING

N.T.S.

APPROVED BY

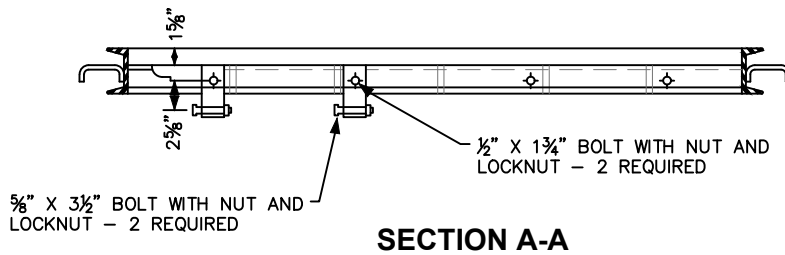
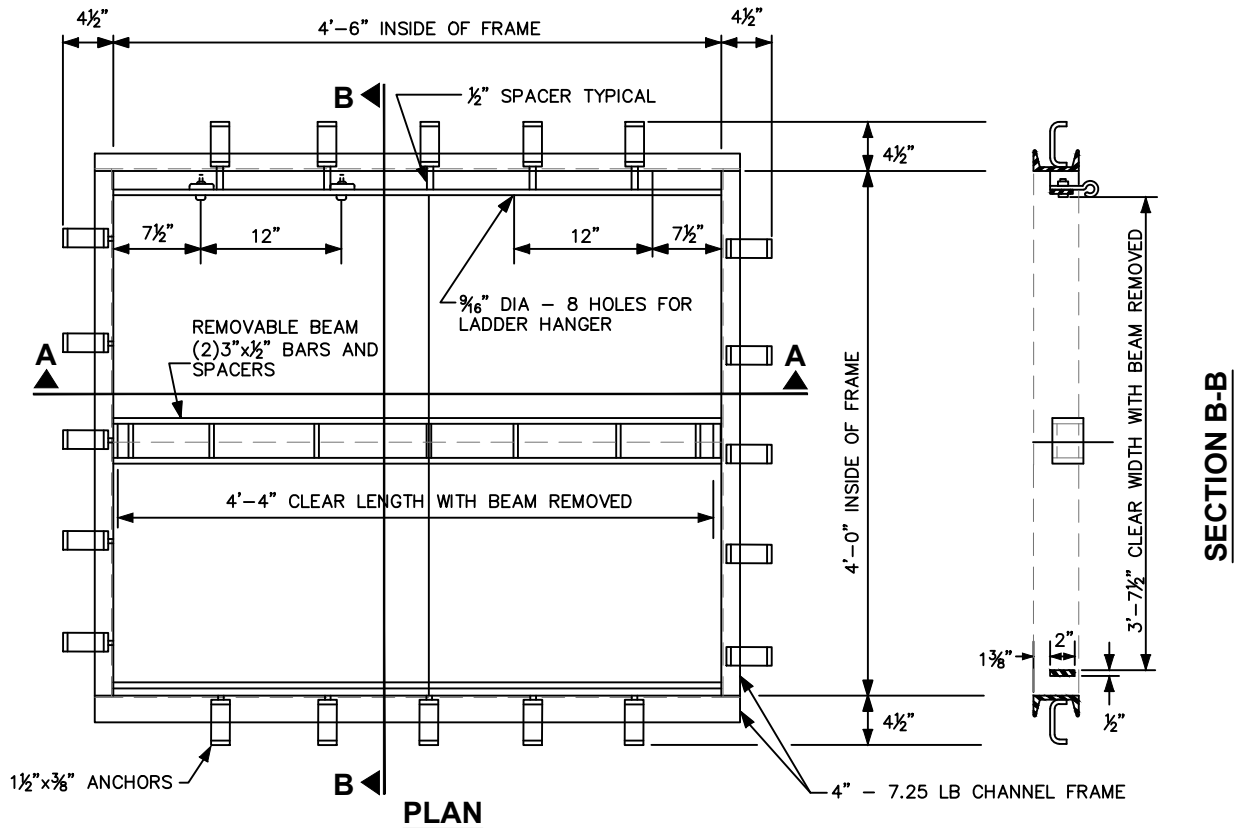
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E-500.3



NOTES:

1. MATERIAL - STRUCTURAL STEEL PER ASTM A7-58T.
2. ASSEMBLY - WELDED, EXCEPT AS INDICATED TO BE BOLTED OR REMOVABLE.
3. FINISH - HOT DIP GALVANIZED AFTER FABRICATION AND WELDING PER ASTM A123-53.
4. AVAILABLE FROM LEITELT IRON WORKS, GRAND RAPIDS, MICHIGAN.

TRANSFORMER VAULT HATCH FRAME

N.T.S.

APPROVED BY

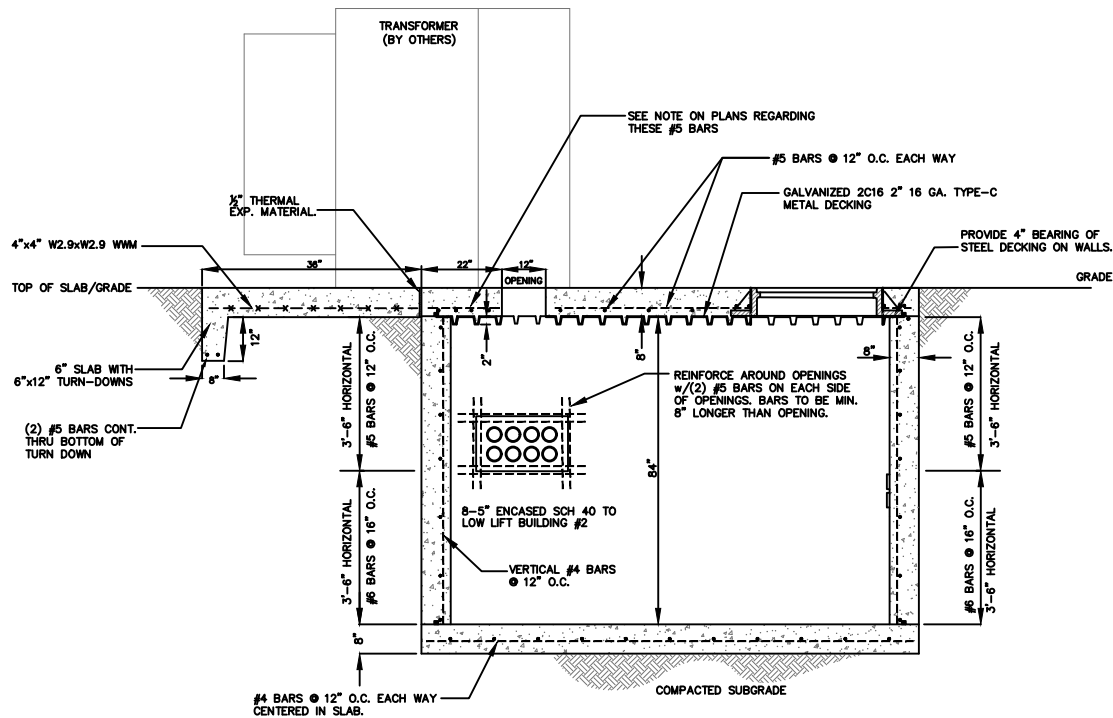
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11/13/2020

LAST REVISION DATE

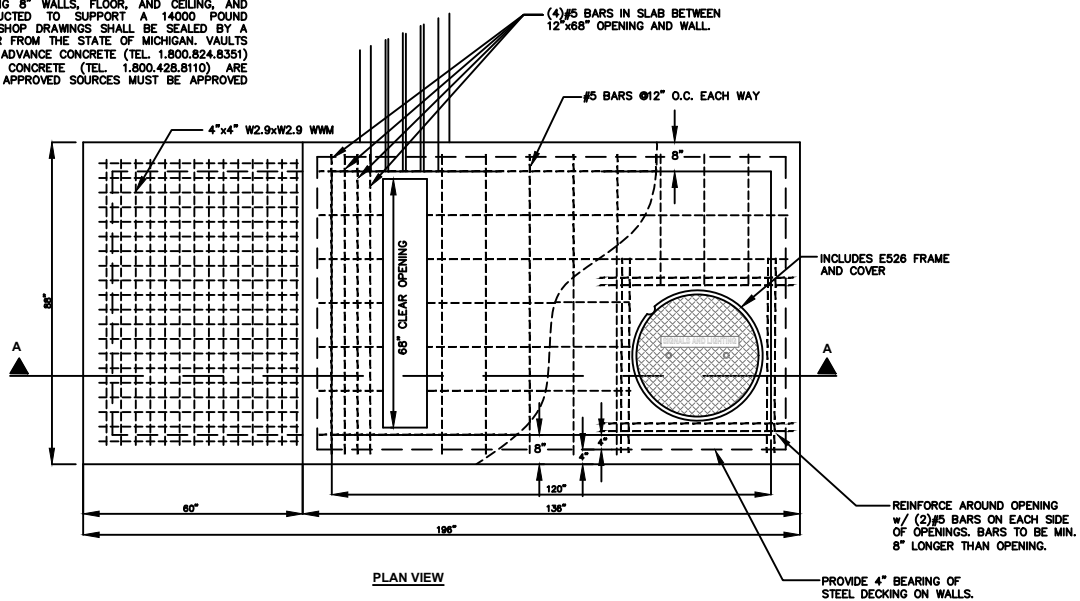
City of Grand Rapids
Public Services
Engineering Department

E-500.4



NOTE:
 VAULT NOTE: THIS DRAWING REPRESENTS A POURED-IN-PLACE VAULT. IN ORDER TO PERFECT A FASTER INSTALLATION AND CUTOVER, THIS CONTRACTOR MAY ELECT TO PURCHASE AND INSTALL A PRECAST VAULT. IF THIS OPTION IS EXERCISED, THE PRECAST VAULT SHALL BE BUILT WITH THE SAME DIMENSIONS AS SHOWN, INCLUDING 8" WALLS, FLOOR, AND CEILING, AND SHALL BE CONSTRUCTED TO SUPPORT A 14000 POUND TRANSFORMER. THE SHOP DRAWINGS SHALL BE SEALED BY A REGISTERED ENGINEER FROM THE STATE OF MICHIGAN. VAULTS MANUFACTURED BY ADVANCE CONCRETE (TEL. 1.800.824.8351) OR BY HARTFORD CONCRETE (TEL. 1.800.428.6110) ARE ACCEPTABLE. OTHER APPROVED SOURCES MUST BE APPROVED BY THE CITY.

SECTION A-A (LOOKING NORTH)



ACCESSIBLE 10 FOOT TRANSFORMER VAULT
 N.T.S.

APPROVED BY

T. B. B.
 CITY ENGINEER

ORIGINAL APPROVAL DATE
 11/13/2020

REVISED DATE

City of Grand Rapids
 Public Services
 Engineering Department

E-501

CONCRETE

1. ALL CONCRETE WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE" (ACI 318-02) AND WITH THE "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" (ACI 301-99).
2. CONCRETE MIX SHALL ADHERE TO ASTM C 94 WITH TESTING DONE BY AN INDEPENDENT TESTING AGENCY TO PERFORM MATERIAL EVALUATION TESTS. PROVIDE 7 AND 28 DAY CYLINDER TESTS. COMPLY WITH ASTM C143, C173, C31, AND C39.
3. REINFORCING BARS SHALL BE DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO ASTM A615, GRADE 60. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
4. ALL CONCRETE SLABS SHALL BE REINFORCED WITH WELDED WIRE FABRIC AS FOLLOWS UNLESS NOTED OTHERWISE:

a. 4 inch concrete slab	6"x6" W1.4xW1.4	(alternate: 20 lb/cubic yard xorex)
b. 6 inch concrete slab	6"x6" W2.1xW2.1	(alternate: 25 lb/cubic yard xorex)
c. 8 inch concrete slab	4"x4" W2.9xW2.9	(alternate: 35 lb/cubic yard xorex)
5. PROVIDE DIAGONAL REINFORCEMENT ACROSS ALL CORNERS OF OPENINGS IN CONCRETE WALLS AND SLABS AS FOLLOWS UNLESS NOTED OTHERWISE:

a. 6 inch concrete thickness	(1) #4 x 44" long
b. 8 inch concrete thickness	(1) #5 x 48" long
c. 10 inch concrete thickness	(2) #4 x 44" long
d. 12 inch concrete thickness	(2) #5 x 48" long

 - e. The following minimum cover shall be provided for the reinforcement of all cast in place concrete work:

f. Concrete cast against & permanently exposed to earth	3 inches
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 - g. Formed surfaces permanently exposed to earth or weather

i. Bars #5 and smaller	1 1/2 inches
ii. Bars #6 and larger	2 inches
 - h. Formed surfaces not exposed to earth or weather

i. Slabs, walls, joists	3/4 inches
ii. Beams, columns	1 1/2 inches
6. ALL EXPOSED EDGES OF CONCRETE PIERS, BEAMS, AND WALLS SHALL BE CHAMFERED 3/4" X 45 DEGREES.
7. PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCEMENT AT POSITIONS SHOWN ON THE PLANS.
8. REINFORCEMENT SHALL BE CONTINUOUS ACROSS JOINTS AND AROUND CORNERS, OR SPLICE BARS SHALL BE PROVIDED IN ACCORDANCE WITH ACI 315-99. BARS SHALL BE PROVIDED AT ALL WALL CORNERS OF SIZE AND SPACING EQUAL TO THE HORIZONTAL WALL REINFORCEMENT.
9. ALL CONCRETE SHALL BE THOROUGHLY CONSOLIDATED BY SUITABLE MEANS DURING PLACEMENT. IF VIBRATORS ARE USED, DO NOT OVER-VIBRATE OR TRANSPORT CONCRETE ALONG FORMS BY VIBRATING.
10. CONTROL JOINTS FOR SLABS ON GRADE SHALL MAINTAIN AN ASPECT RATIO LESS THAN 1.5, AND BE SPACED NOT MORE THAN 15 FEET ON CENTER EACH WAY.
11. GENERAL CONTRACTOR SHALL COORDINATE WITH ALL TRADES REGARDING OPENINGS, SLEEVES, ANCHORS, HANGERS, INSERTS, SLAB DEPRESSIONS AND OTHER ITEMS RELATED TO THE CONCRETE WORK PRIOR TO CONCRETE PLACEMENT. PATCH CONCRETE SLABS AS REQUIRED TO ALL FLOOR DRAINS.
12. ALL FILL MATERIAL SHALL BE THOROUGHLY COMPACTED PRIOR TO PLACEMENT OF CONCRETE. THERE SHALL BE A MINIMUM OF 6 INCHES OF CLEAN SAND UNDER ALL SLABS ON GRADE.
13. FOUNDATION ELEMENTS THAT RETAIN EARTH ON BOTH SIDES SHALL BE BACKFILLED ON BOTH SIDES SIMULTANEOUSLY.
14. FOUNDATION ELEMENTS THAT RETAIN EARTH ON ONE SIDE SHALL NOT BE BACKFILLED UNTIL CONCRETE HAS REACHED ITS 28 DAY STRENGTH, AND ALL NECESSARY TEMPORARY BRACING ELEMENTS ARE IN PLACE.

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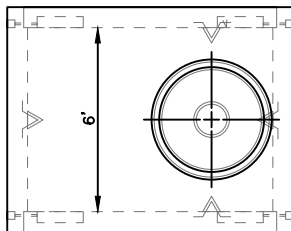

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ORIGINAL APPROVAL DATE
11/13/2020

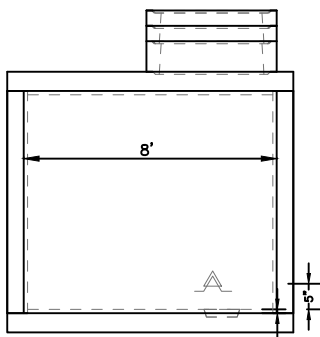
LAST REVISION DATE

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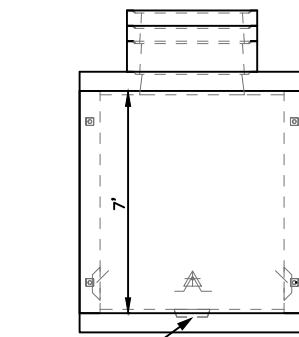
E-501.1



PLAN VIEW



FRONT VIEW



END VIEW

6'x8'x7' ELECTRICAL PANEL MANHOLE

N.T.S.

NOTES:

1. PRECAST, PANELIZED CONCRETE ELECTRICAL MANHOLE, TYPE 'J' - MINIMUM INSIDE DIMENSIONS - 6' WIDE x 8' LONG x 7' HIGH.
2. PRECAST CONCRETE ADJUSTING RINGS WITH GALVANIZED STEP. STEP TO BE ORIENTED PARALLEL WITH, AND ADJACENT TO, THE NEAR WALL OF THE MANHOLE. A MINIMUM OF (1) 12 INCH AND (2) 6 INCH GRADE RING SHALL BE INCLUDED WITH EACH MANHOLE.
3. ELECTRICAL MANHOLE FRAME AND COVER AS PER DETAIL E526.
4. MINIMUM EARTH COVER IS 26" BELOW ROADWAY, 32" BELOW SIDEWALKS
5. ADJUSTMENTS TO GRADE GREATER THAN 6" SHALL BE MADE USING A GRADE RING WITH STEP.
6. MANHOLE SHALL HAVE SIX PULL-IN IRONS WITH BACKING PLATES.
7. HOOK LADDER OF SUITABLE LENGTH WHEN POSITIONED AT CORRECT CLIMBING ANGLE SHALL BE INCLUDED WITH EACH MANHOLE.
8. EACH MANHOLE SHALL INCLUDE: (1) 5/8 INCH x 10 FOOT - UL LISTED, COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND ROD CLAMP WITH STAINLESS STEEL BOLTS. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR, ATTACHED TO THE WALL (MINIMUM OF 2 ATTACHMENT POINTS PER WALL), AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.

A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH MANHOLE. MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:

(100) 1/2" HEX BOLTS WITH WASHERS.

(20) 36 INCH CABLE RACK STANCHIONS - *UNDERGROUND DEVICES #CR36.

(50) CABLE RACK SADDLES - *UNDERGROUND DEVICES #3HDS.

*FIBERGLASS HARDWARE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR APPROVED EQUAL.

CONDUIT TERMINATIONS AND WINDOWS FOR EXISTING CONDUIT TO BE DETERMINED (FIELD VERIFIED) AFTER EXISTING MANHOLE IS EXPOSED AND PRIOR TO PLACING PANEL MANHOLE ORDER.

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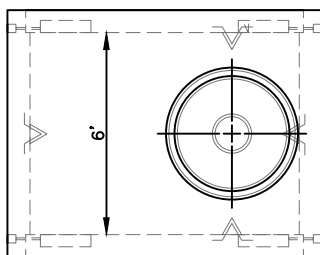
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

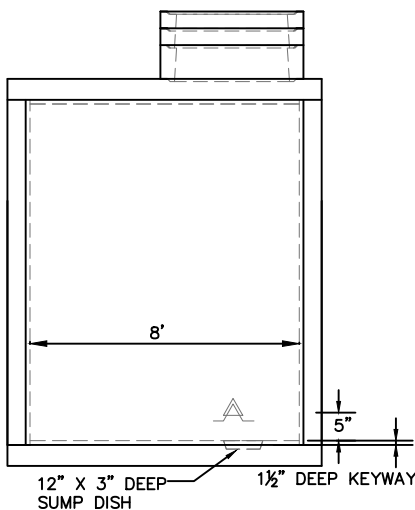
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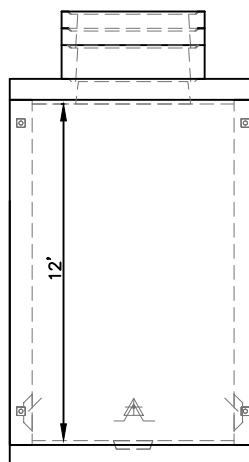
E-503



PLAN VIEW



FRONT VIEW



END VIEW

6'x8'x12' ELECTRICAL PANEL MANHOLE

N.T.S.

NOTES:

1. PRECAST, PANELIZED CONCRETE ELECTRICAL MANHOLE, TYPE 'J' – MINIMUM INSIDE DIMENSIONS – 6' WIDE x 8' LONG x 12' HIGH.
2. PRECAST CONCRETE ADJUSTING RINGS WITH GALVANIZED STEP. STEP TO BE ORIENTED PARALLEL WITH, AND ADJACENT TO, THE NEAR WALL OF THE MANHOLE. A MINIMUM OF (1) 12 INCH AND (2) 6 INCH GRADE RING SHALL BE INCLUDED WITH EACH MANHOLE.
3. ELECTRICAL MANHOLE FRAME AND COVER AS PER DETAIL E526.
4. MINIMUM EARTH COVER IS 26" BELOW ROADWAY, 32" BELOW SIDEWALKS
5. ADJUSTMENTS TO GRADE GREATER THAN 6" SHALL BE MADE USING A GRADE RING WITH STEP.
6. MANHOLE SHALL HAVE SIX PULL-IN IRONS WITH BACKING PLATES.
7. HOOK LADDER OF SUITABLE LENGTH WHEN POSITIONED AT CORRECT CLIMBING ANGLE SHALL BE INCLUDED WITH EACH MANHOLE.
8. EACH MANHOLE SHALL INCLUDE: (1) 5/8 INCH x 10 FOOT – UL LISTED, COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND ROD CLAMP WITH STAINLESS STEEL BOLTS. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR, ATTACHED TO THE WALL (MINIMUM OF 2 ATTACHMENT POINTS PER WALL), AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.

A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH MANHOLE. MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:

(100) 1/2" HEX BOLTS WITH WASHERS.

(20) 36 INCH CABLE RACK STANCHIONS – *UNDERGROUND DEVICES #CR36.

(50) CABLE RACK SADDLES – *UNDERGROUND DEVICES #3HDS.

*FIBERGLASS HARDWARE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR APPROVED EQUAL.

CONDUIT TERMINATIONS AND WINDOWS FOR EXISTING CONDUIT TO BE DETERMINED (FIELD VERIFIED) AFTER EXISTING MANHOLE IS EXPOSED AND PRIOR TO PLACING PANEL MANHOLE ORDER.

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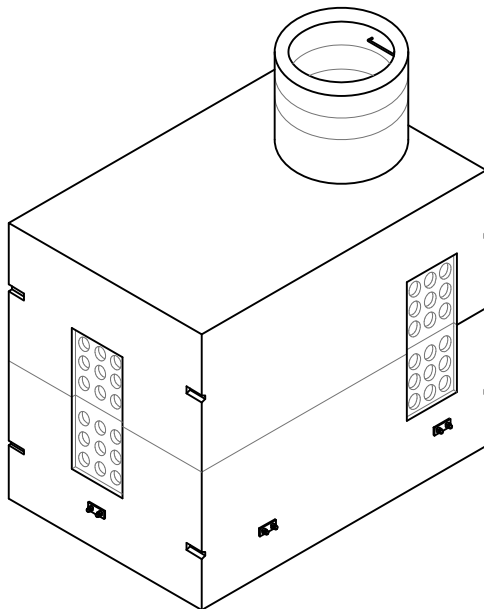
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE

City of Grand Rapids
Public Services
Engineering Department

E-504



NOTES:

1. PRECAST CONCRETE ELECTRICAL MANHOLE, TYPE 'J' - MINIMUM INSIDE DIMENSIONS: 72" WIDE x 96" LONG x 84" HIGH.
2. PRECAST CONCRETE ADJUSTING RINGS. A MINIMUM OF (1) 12 INCH AND (2) 6 INCH GRADE RINGS SHALL BE INCLUDED WITH EACH MANHOLE. THE 12 INCH GRADE RING SHALL HAVE A GALVANIZED STEP AND ONE 6 INCH GRADE RING SHALL HAVE A GALVANIZED STEP. STEP(S) SHALL BE ORIENTED PARALLEL WITH, AND ADJACENT TO, THE NEAR WALL OF THE MANHOLE.
3. ELECTRICAL MANHOLE FRAME AND COVER AS PER DETAIL E526.
4. MINIMUM EARTH COVER IS 26" BELOW THE ROADWAY, AND 32" BELOW SIDEWALKS.
5. ADJUSTMENTS TO GRADE GREATER THAN 6" SHALL BE MADE USING A GRADE RING WITH A STEP.
6. THE MANHOLE SHALL HAVE SIX PULL-IN IRONS WITH BACKING PLATES.
7. A HOOK LADDER OF SUITABLE LENGTH, WHEN POSITIONED AT THE CORRECT CLIMBING ANGLE, SHALL BE INCLUDED WITH EACH MANHOLE.
8. REFER TO DETAIL E435 FOR THE CONDUIT TERMINATION DETAIL.
9. EACH MANHOLE SHALL INCLUDE: (1) 5/8" x 10 FOOT - UL LISTED COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND ROD CLAMP WITH STAINLESS STEEL BOLTS. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR, ATTACHED TO THE WALL (MINIMUM OF 2 ATTACHMENT POINTS PER WALL), AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.

A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH MANHOLE. MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:

- (100) 1/2" HEX BOLTS WITH WASHERS.
- (20) 36 INCH CABLE RACK STANCHIONS - *UNDERGROUND DEVICES #CR36.
- (50) CABLE RACK SADDLES - *UNDERGROUND DEVICES #3HDS.

*FIBERGLASS HARDWARE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR CITY APPROVED EQUAL.

6'x8'x7' PRECAST CONCRETE MANHOLE

N.T.S.

APPROVED BY

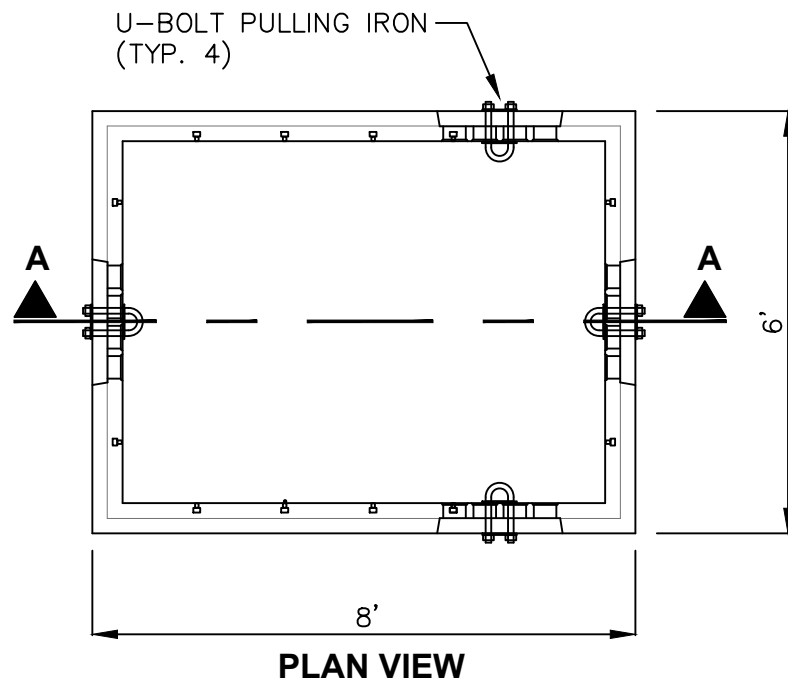
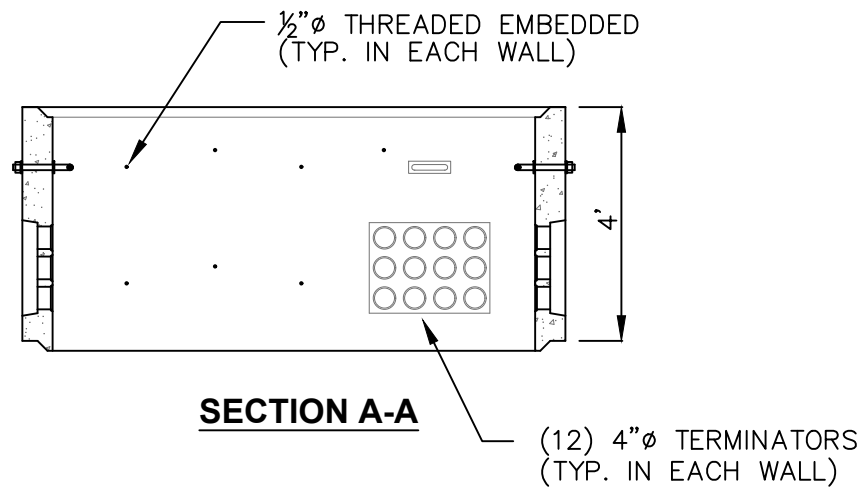
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E-505



ELECTRICAL MANHOLE MIDSECTION

N.T.S.

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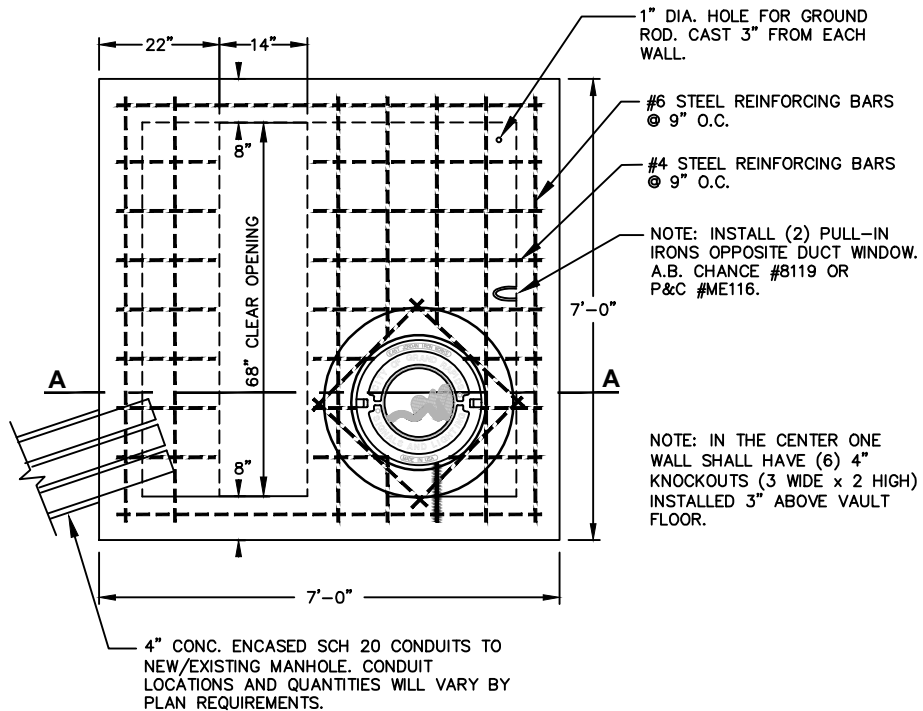
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11/13/2020

LAST REVISION DATE

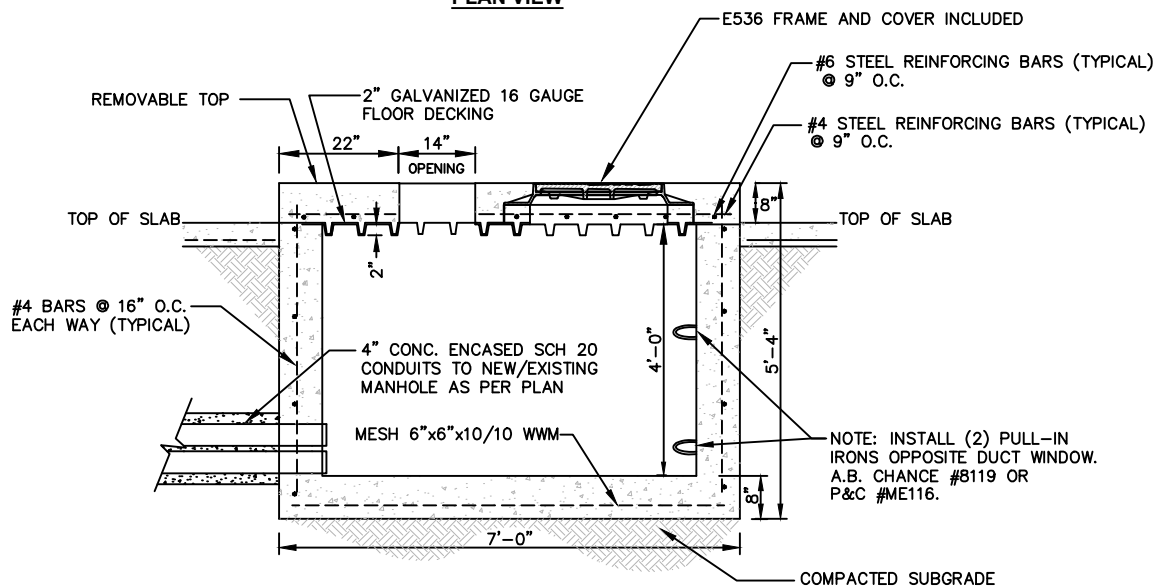
City of Grand Rapids
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Engineering Department

E-507

VAULT NOTE:
THIS DRAWING REPRESENTS A POURED-IN-PLACE VAULT. IN ORDER TO PERFECT A FASTER INSTALLATION AND CUTOVER, THIS CONTRACTOR MAY ELECT TO PURCHASE AND INSTALL A PRECAST VAULT. IF THIS OPTION IS EXERCISED, THE PRECAST VAULT SHALL BE BUILT WITH THE SAME DIMENSIONS AS SHOWN, INCLUDING 8" WALLS, FLOOR, AND CEILING, AND SHALL BE CONSTRUCTED TO SUPPORT A 7200 POUND TRANSFORMER. THE SHOP DRAWINGS SHALL BE SEALED BY A REGISTERED ENGINEER FROM THE STATE OF MICHIGAN. VAULTS MANUFACTURED BY ADVANCE CONCRETE (TEL. 1.800.824.8351) OR BY HARTFORD CONCRETE (TEL. 1.800.428.8110) ARE ACCEPTABLE. OTHER SOURCES MUST BE APPROVED BY THE CITY.



PLAN VIEW



SECTION A-A

TRANSFORMER CABLE VAULT

N.T.S.

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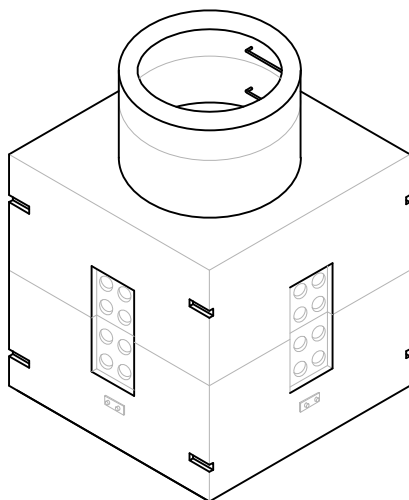
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE
3/6/2023

City of Grand Rapids
Public Services
Engineering Department

E-508



NOTES:

1. PRECAST CONCRETE CABLE HANDHOLE, TYPE 'S' – INSIDE DIMENSIONS: 48" WIDE x 48" LONG x 48" HIGH.
 2. PRECAST CONCRETE ADJUSTING RINGS WITH GALVANIZED STEP. A MINIMUM OF (1) 12 INCH AND (1) 6 INCH GRADE RING SHALL BE INCLUDED WITH EACH CABLE HANDHOLE.
 3. INCLUDES CAST IRON FRAME AND COVER PER DETAIL E526.
 4. MINIMUM EARTH COVER IS 26".
 5. ADJUSTMENTS TO GRADE GREATER THAN 6" SHALL BE MADE USING A GRADE RING WITH STEP.
 6. CABLE HANDHOLE SHALL HAVE FOUR PULL-IN IRONS WITH BACKING PLATES.
 7. HOOK LADDER OF SUITABLE LENGTH WHEN POSITIONED AT CORRECT CLIMBING ANGLE SHALL BE INCLUDED WITH EACH CABLE HANDHOLE
 8. TERMINATE CONCRETE ENCASED CONDUITS AS PER DETAIL E435.
 9. EACH CABLE HANDHOLE SHALL INCLUDE: (1) 5/8 INCH x 10 FOOT – UL LISTED, COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND RODCLAMP WITH STAINLESS STEEL BOLTS. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR, ATTACHED TO THE WALL (MINIMUM OF 2 ATTACHMENT POINTS PER WALL), AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.
- A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH CABLE HANDHOLE. MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:
- (40) 1/2" HEX BOLTS WITH WASHERS.
 - (8) 36 INCH CABLE RACK STANCHIONS – *UNDERGROUND DEVICES #CR36
 - (16) CABLE RACK SADDLES – *UNDERGROUND DEVICES #3HDS

*FIBERGLASS HARDWARE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR CITY APPROVED EQUAL.

4'x4'x4' PRECAST CONCRETE HANDHOLE

N.T.S.

APPROVED BY

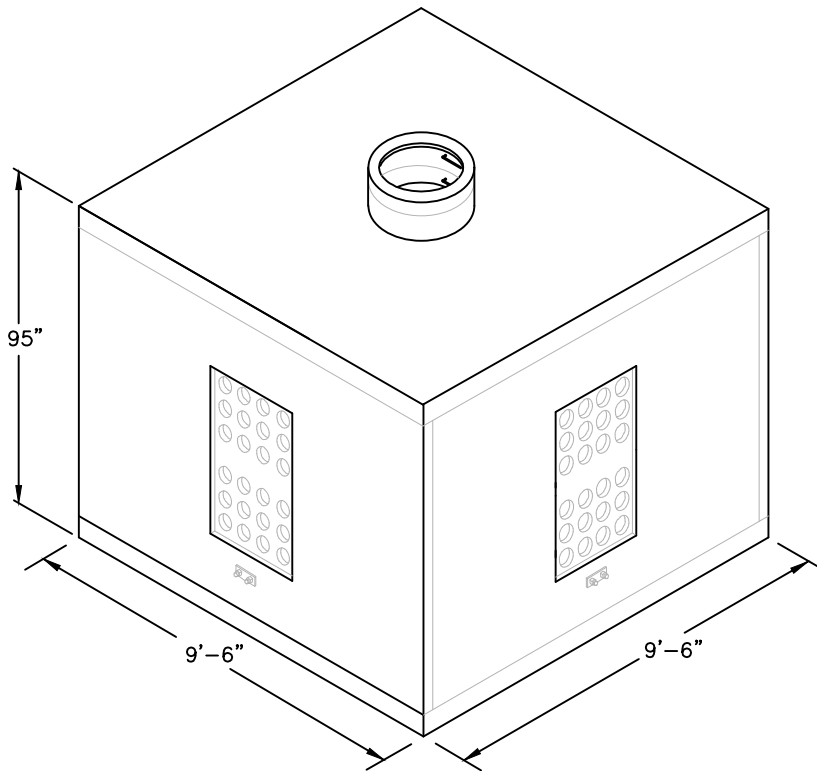
T. B. H.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE
2/17/2023

City of Grand Rapids
Public Services
Engineering Department

E-515



NOTES:

1. SIX PANEL CONCRETE ELECTRICAL MANHOLE 8' WIDE x 8' LONG x 7'-0" HIGH (INSIDE DIMENSIONS). TYPE "A" BY ADVANCE CONCRETE PRODUCTS, OR APPROVED EQUAL.
2. PRECAST CONCRETE ADJUSTING RINGS WITH STEP. STEP TO BE ORIENTED PARALLEL AND ADJACENT TO NEAR WALL OF MANHOLE.
3. ELECTRICAL MANHOLE CASTING AS PER DETAIL E526.
4. MINIMUM EARTH COVER IS 26" BELOW ROADWAY, 32" BELOW SIDEWALKS.
5. ALL ADJUSTMENTS TO GRADE OVER 6" TO BE MADE WITH GRADE RING WITH STEP—MINIMUM OF (1) 12" AND (1) 6" REQUIRED PER MANHOLE.
6. LEVEL AND COMPACTED SOIL BELOW MANHOLE.

A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH HANDHOLE. ALL MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:

- (1) HOOK LADDER OF SUITABLE LENGTH TO BE HOOKED ON THE STEP OF THE BOTTOM GRADE RING WHEN POSITIONED AT THE PROPER CLIMBING ANGLE.
- (1) $\frac{5}{8}$ " DIA x 10'-0" LONG COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND ROD CLAMP. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR ATTACHED TO THE WALL (MINIMUM 2 ATTACHMENT'S EACH WALL) AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.
- (2) 12" GRADE RINGS WITH INTEGRAL STEP (HARTFORD #12-001)
- (4) PULL-IN IRONS WITH BACKING PLATES (HARTFORD #23-001)
- (160) HEX BOLTS WITH WASHERS (HARTFORD #1015)
- (32) 36 INCH CABLE RACK STANCHION *UNDERGROUND DEVICES #CR36
- (80) CABLE RACK SADDLE *UNDERGROUND DEVICES #3HDS

* THE FIBERGLASS HARDWARE PACKAGE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR EQUIVALENT DETERMINED BY THE CITY.

8'x8'x7' ELECTRICAL SIX PANEL MANHOLE

N.T.S.

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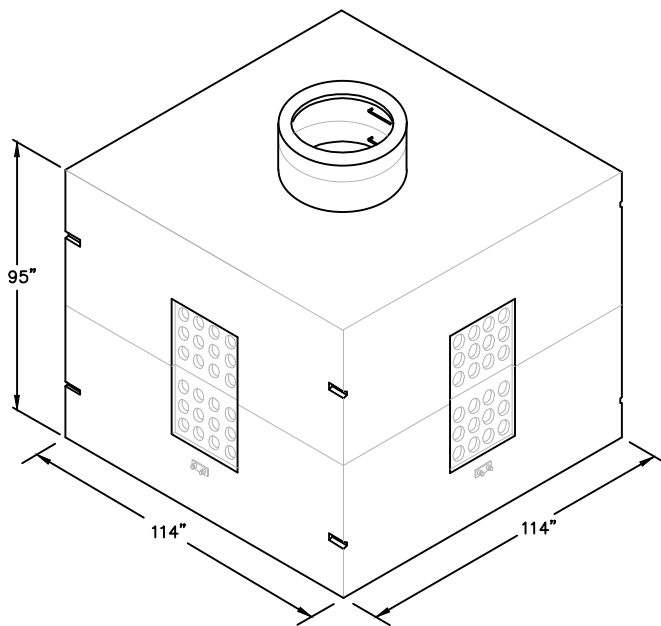
T. B. H.
CITY ENGINEER

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11/13/2020

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3/6/2023

City of Grand Rapids
Public Services
Engineering Department

E-520



NOTES:

1. PRECAST CONCRETE ELECTRICAL MANHOLE 8'-8" WIDE x 8'-8" LONG x 7'-0" HIGH CASTING NO. 10-112T TYPE "A" BY ADVANCE CONCRETE PRODUCTS, OR APPROVED EQUAL.
2. PRECAST CONCRETE ADJUSTING RINGS WITH STEP. STEP TO BE ORIENTED PARALLEL AND ADJACENT TO NEAR WALL OF MANHOLE.
3. ELECTRICAL MANHOLE CASTING AND COVER AS PER DETAIL E526.
4. MINIMUM EARTH COVER IS 26" BELOW ROADWAY, 32" BELOW SIDEWALKS.
5. ALL ADJUSTMENTS TO GRADE OVER 6" TO BE MADE WITH GRADE RING WITH STEP-MINIMUM OF (1) 12" AND (1) 6" REQUIRED PER MANHOLE.

A COMPLETE HARDWARE PACKAGE SHALL BE INCLUDED WITH EACH MANHOLE. ALL MOUNTING HARDWARE SHALL BE HOT-DIPPED GALVANIZED OR STAINLESS STEEL. THE MINIMUM ACCEPTABLE HARDWARE PACKAGE SHALL INCLUDE:

- (1) HOOK LADDER OF SUITABLE LENGTH TO BE HOOKED ON THE STEP OF THE BOTTOM GRADE RING WHEN POSITIONED AT THE PROPER CLIMBING ANGLE.
- (1) 5/8" DIA x 10'-0" LONG COPPERWELD GROUND ROD WITH AN ALL BRONZE GROUND ROD CLAMP. #2CU U.S.E. XLP GREEN GROUNDING CONDUCTOR ATTACHED TO THE WALL (MINIMUM 2 ATTACHMENT'S EACH WALL) AND BONDED TO THE GROUND STRAP(S) WITH #6CU U.S.E. XLP GREEN GROUNDING CONDUCTOR.
- (2) 12" GRADE RINGS WITH INTEGRAL STEP (HARTFORD #12-001)
- (4) PULL-IN IRONS WITH BACKING PLATES (HARTFORD #23-001)
- (160) HEX BOLTS WITH WASHERS (HARTFORD #1015)
- (32) 36 INCH CABLE RACK STANCHION
*UNDERGROUND DEVICES #CR36
- (80) CABLE RACK SADDLE
*UNDERGROUND DEVICES #3HDS

* THE FIBERGLASS HARDWARE PACKAGE SHALL BE MANUFACTURED BY UNDERGROUND DEVICES, INC. OR EQUIVALENT DETERMINED BY THE CITY.

8'x8'x7' ELECTRICAL PRECAST CONCRETE MANHOLE

N.T.S.

APPROVED BY

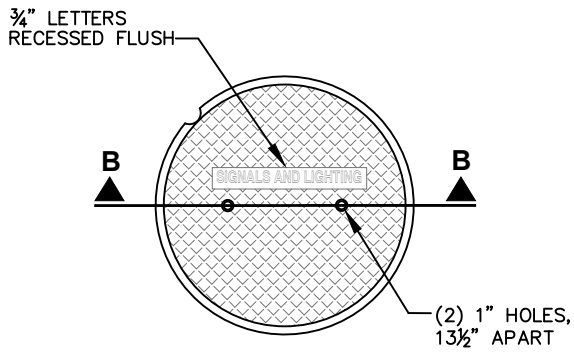
Tim B. [Signature]
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

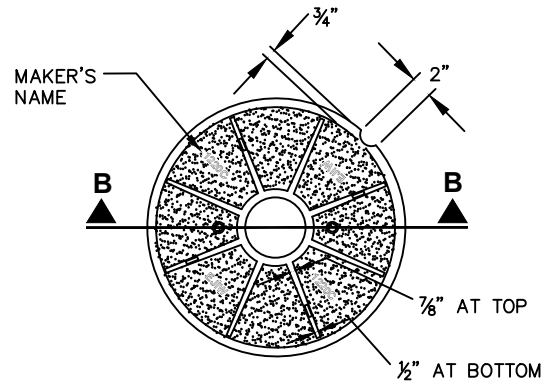
LAST REVISION DATE
3/6/2023

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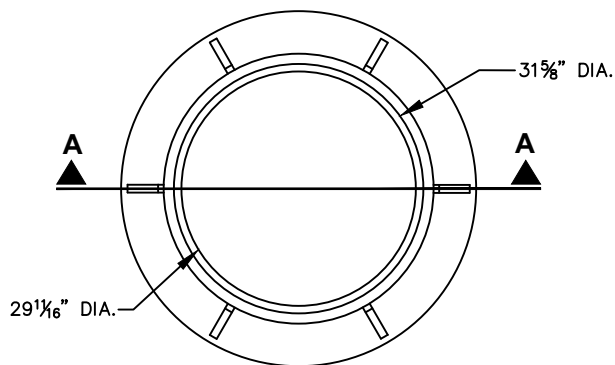
E-525



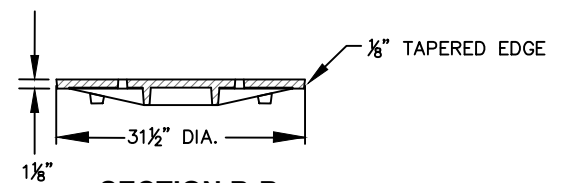
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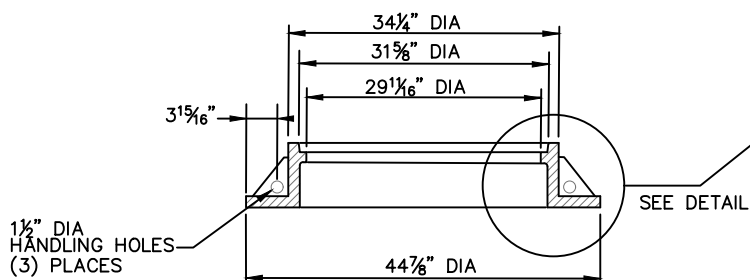
BOTTOM OF COVER



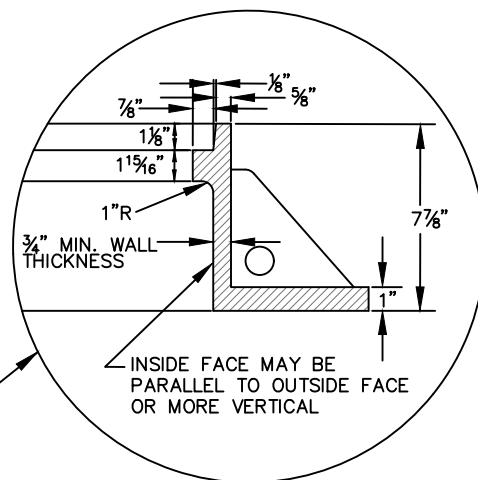
FRAME PLAN VIEW



SECTION B-B



FRAME SECTION A-A



EJIW #1220 TYPE C - NO EXCEPTIONS

29" MANHOLE FRAME AND COVER

N.T.S.

APPROVED BY

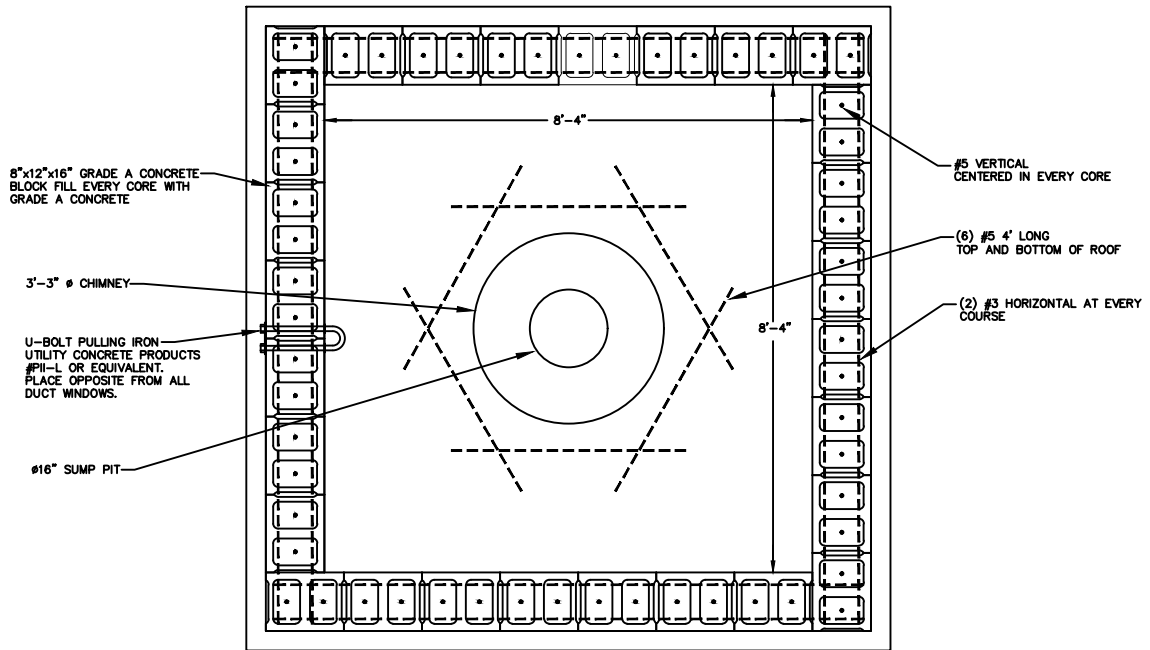
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

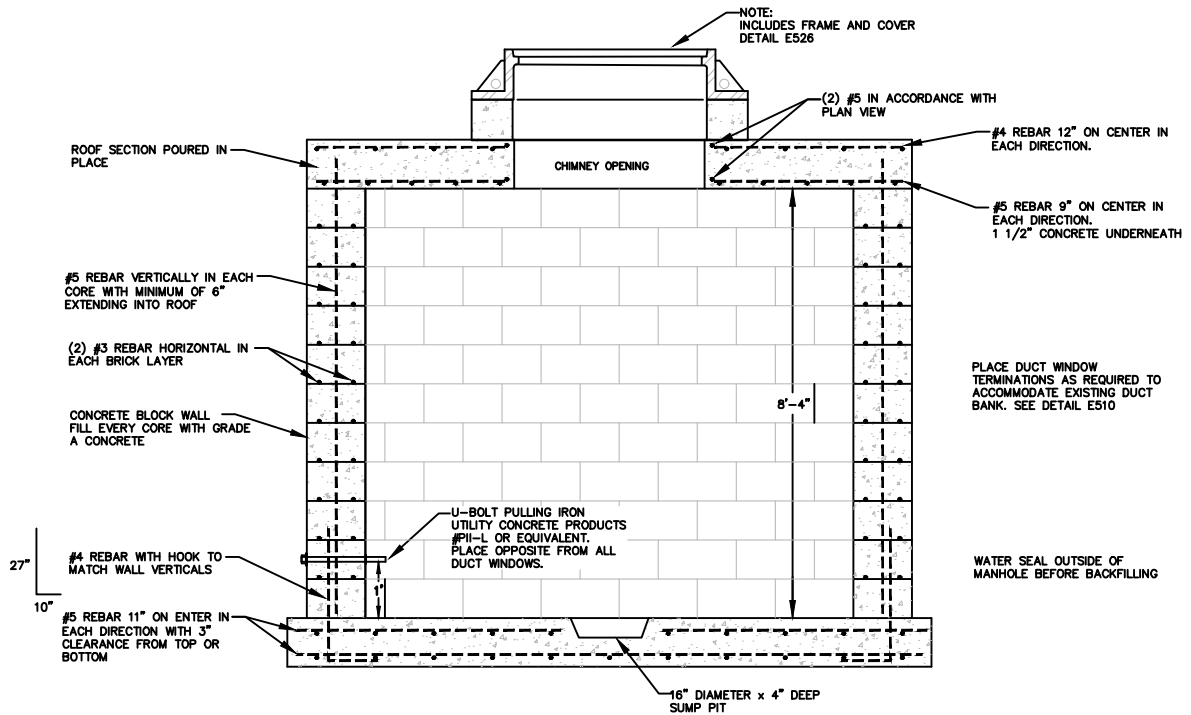
LAST REVISION DATE

City of Grand Rapids
Public Services
Engineering Department

E-526



PLAN VIEW



ELEVATION

8'x8'x8' ELECTRICAL CONCRETE BLOCK MANHOLE

N.T.S.

APPROVED BY

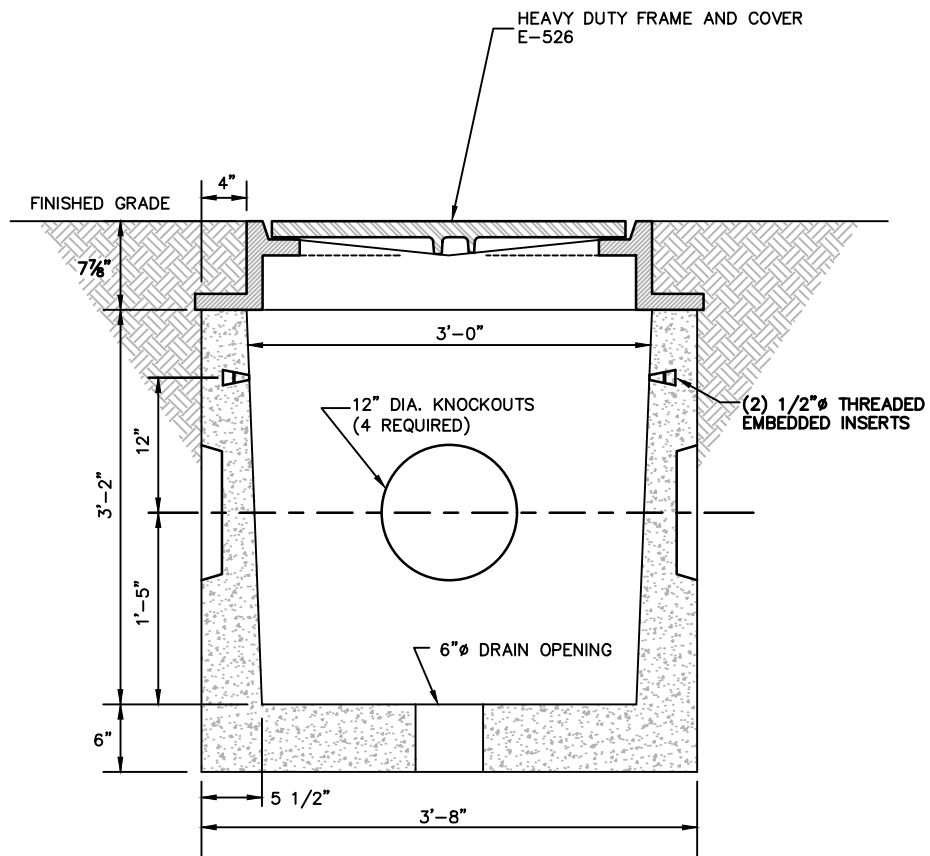
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE
2/17/2023

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Public Services
Engineering Department

E-528



36" CABLE HANDHOLE AND COVER

N.T.S.

APPROVED BY

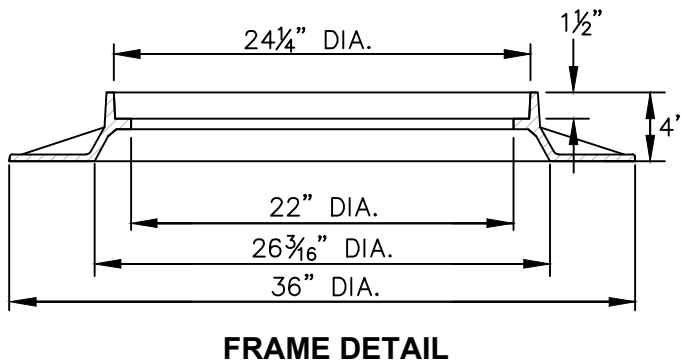
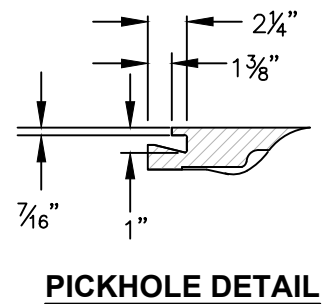
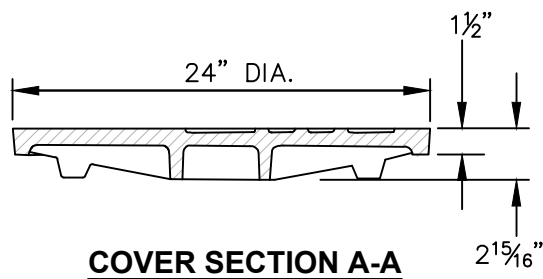
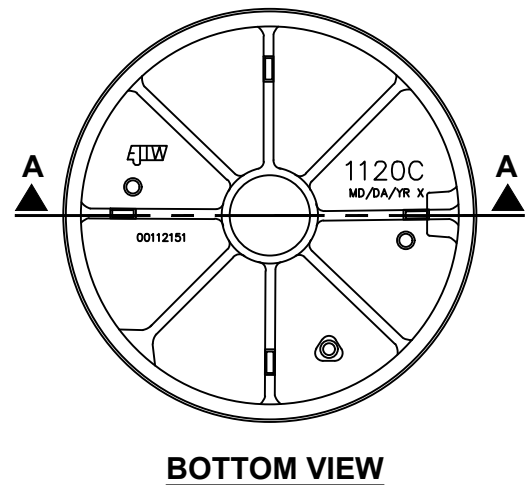
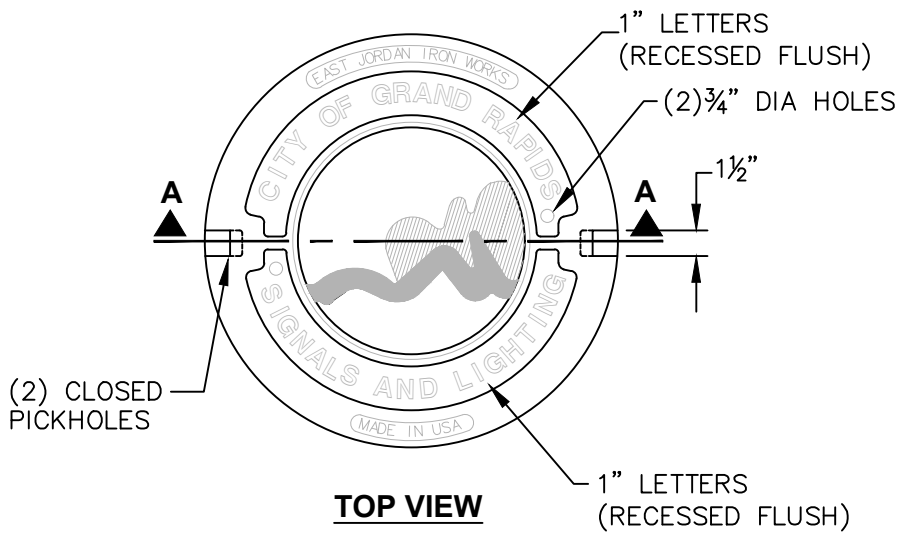
Tim B. H.
CITY ENGINEER

ORIGINAL APPROVAL DATE
3/6/2023

LAST REVISION DATE

City of Grand Rapids
Public Services
Engineering Department

E-530



22" HANDHOLE FRAME AND COVER

N.T.S.

APPROVED BY

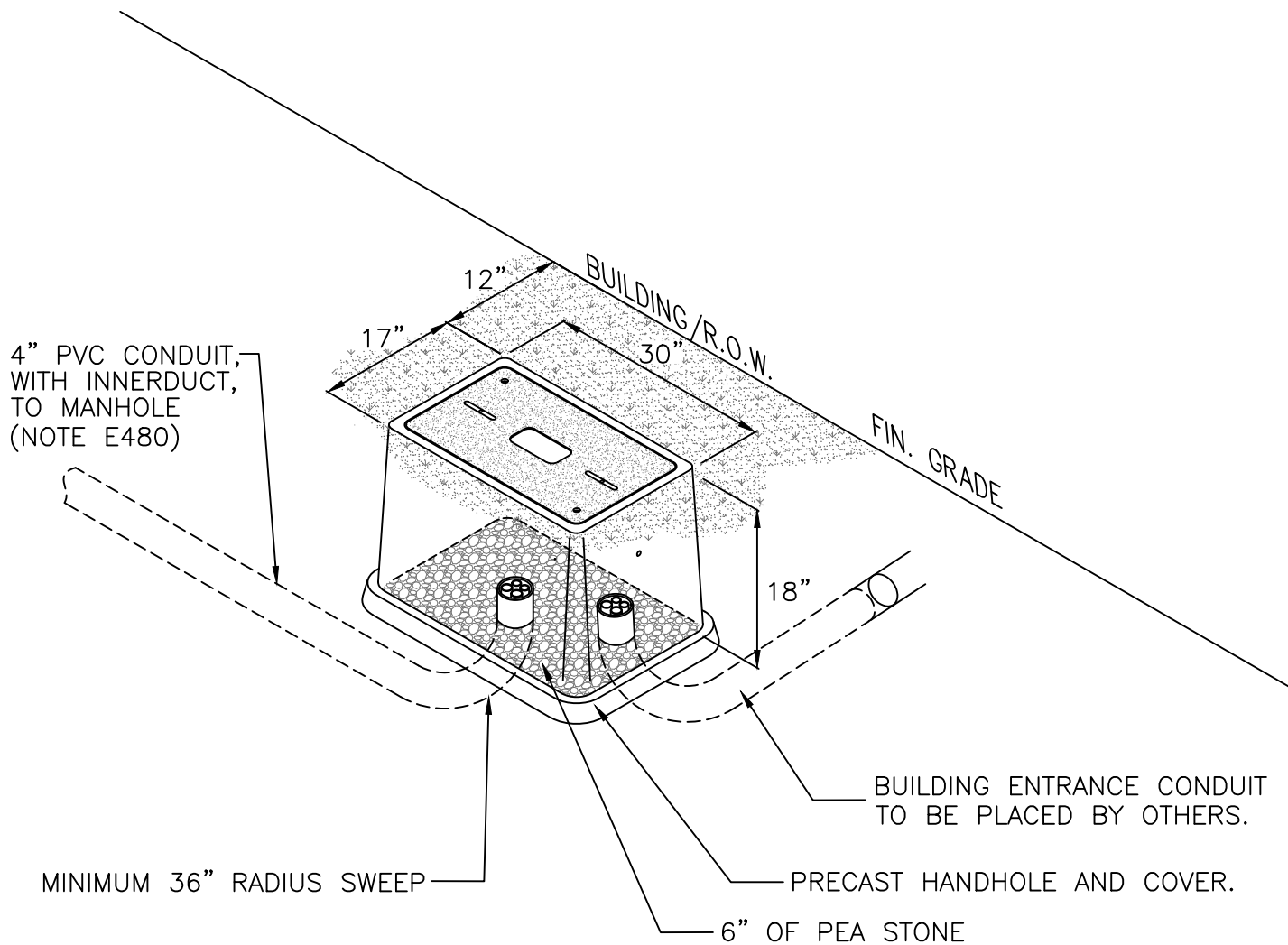
T. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE
2/17/2023

City of Grand Rapids
Public Services
Engineering Department

E-536



17"x30" POLYMER CONCRETE HANDHOLE w/COVER

N.T.S.

APPROVED BY


 CITY ENGINEER

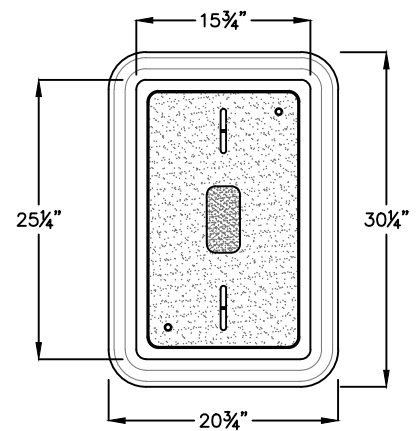
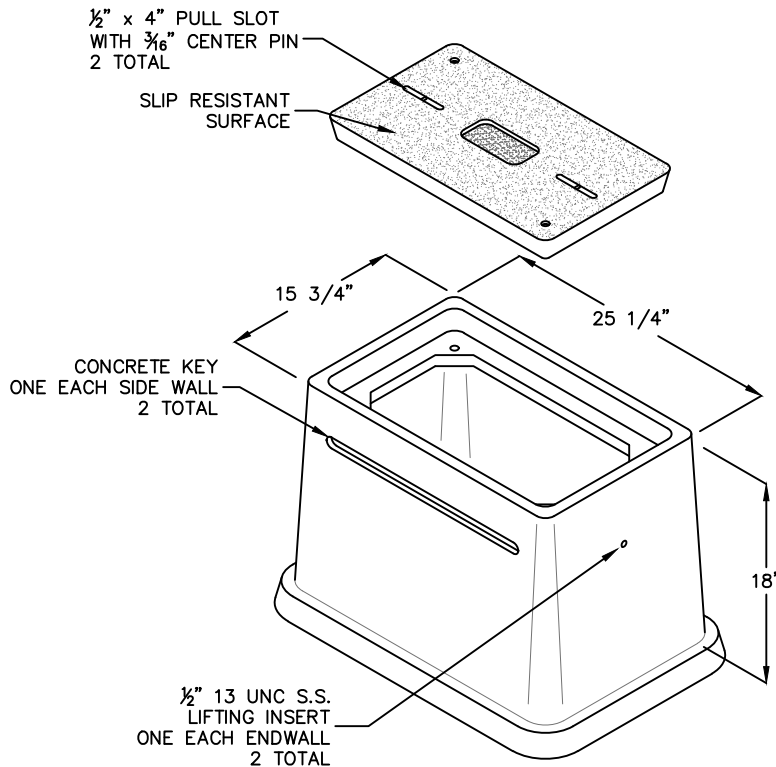
ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE

City of Grand Rapids
 Public Services
 Engineering Department

E-540

PG&E APPROVED. POLYMER CONCRETE FRAME
AND NON-SKID COVER FOR STRENGTH. "FRP"
FIBERGLASS REINFORCED BODY FOR LIGHT WEIGHT.
FLARED AT BASE TO PROVIDE ADDITIONAL WORK
SPACE. MEETS ALL REQUIREMENTS OF W.U.C..



TOP VIEW

NOMINAL DIMENSIONS	PG&E CODE NO.	DESCRIPTION	APPROX. WT. LBS.
13"x24"x18"	04-0933	BOX AND COVER ASSEMBLY	170
13"x24"x18"	04-0931	BOX ONLY	136
13"x24"x3"	04-0241	3" EXTENSIONS	39
	04-3716	LID ONLY	34

DESIGN LOAD: STATIC DESIGN LOAD OF 8000 LBS. OVER
A 10" X 10" AREA.

FOR COMPLETE DESIGN AND PRODUCT INFORMATION
CONTACT JENSEN PRECAST.

13"x24" FLARED-WALL POLYMER CONCRETE HANDHOLE w/COVER

N.T.S.

APPROVED BY

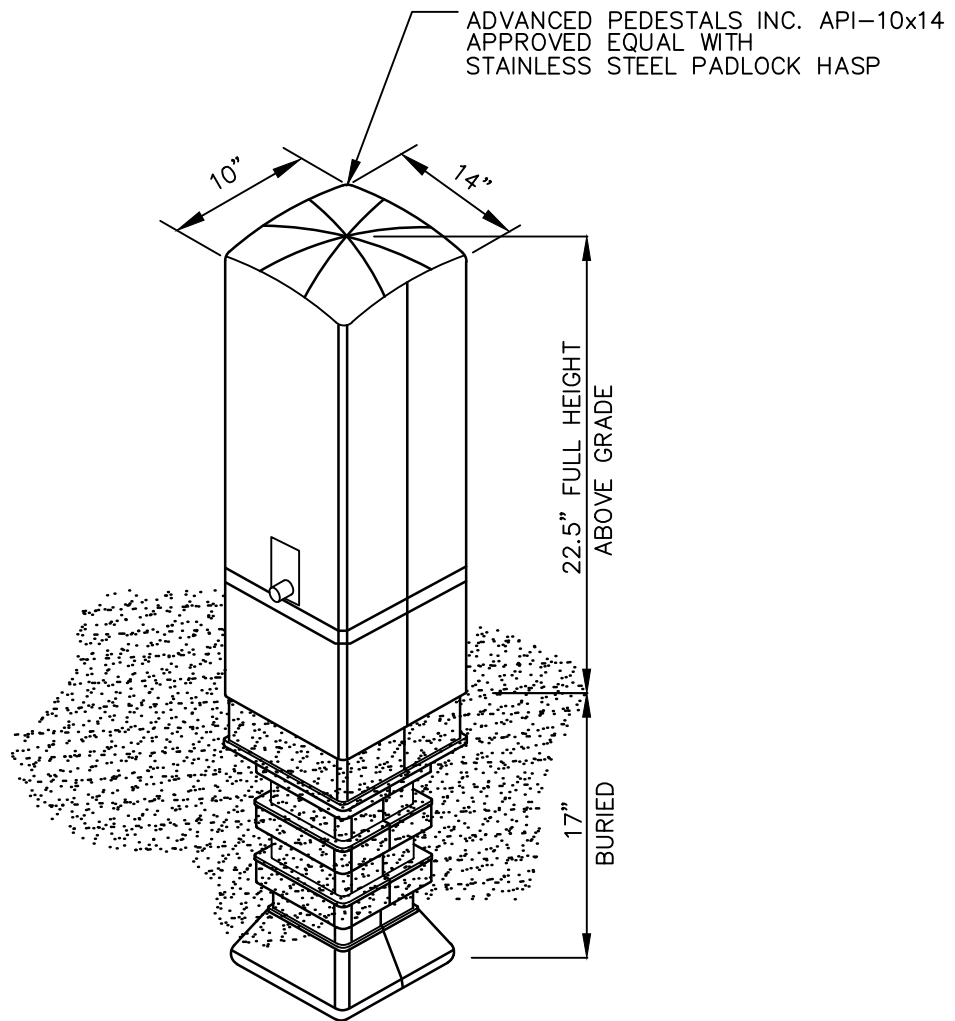
T. B. Jensen
CITY ENGINEER

ORIGINAL APPROVAL DATE
11/13/2020

LAST REVISION DATE

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Public Services
Engineering Department

E-550



CABLE WIRING PEDESTAL

N.T.S.

APPROVED BY

Tim B.
CITY ENGINEER

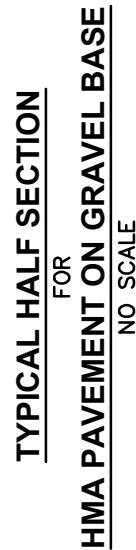
ORIGINAL APPROVAL DATE
2/21/2023

LAST REVISION DATE

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Public Services
Engineering Department

E-560

1. ALL STREET, PARKWAY AND SIDEWALK WIDTHS SHALL BE IN ACCORDANCE WITH THE VITAL STREET GUIDELINES.
2. WHERE THERE IS EXISTING PAVEMENT, NEW PAVEMENT THICKNESS SHALL MATCH EXISTING IF GREATER THAN SHOWN IN THE CITY ENGINEER'S APPROVED DESIGN, OR A THICKNESS AS DIRECTED BY THE ENGINEER.

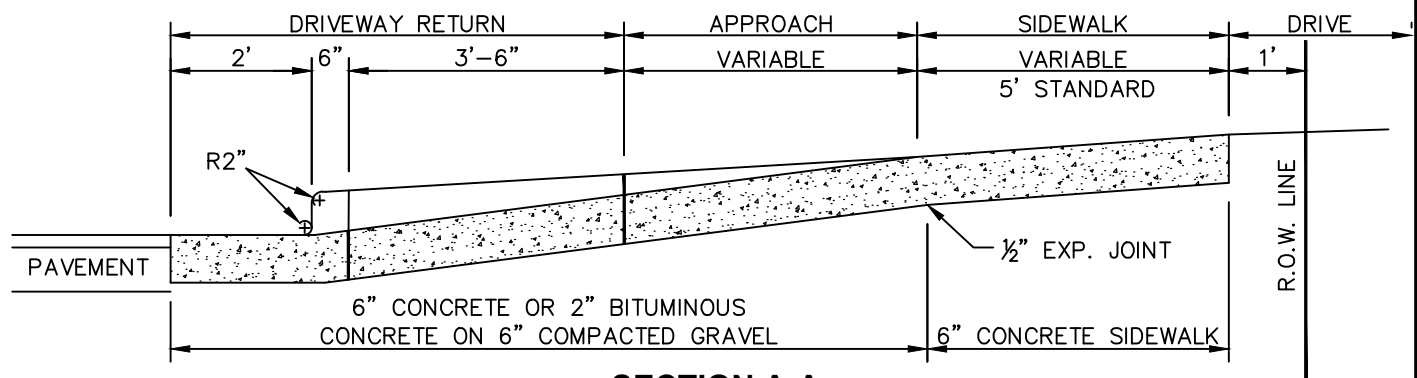
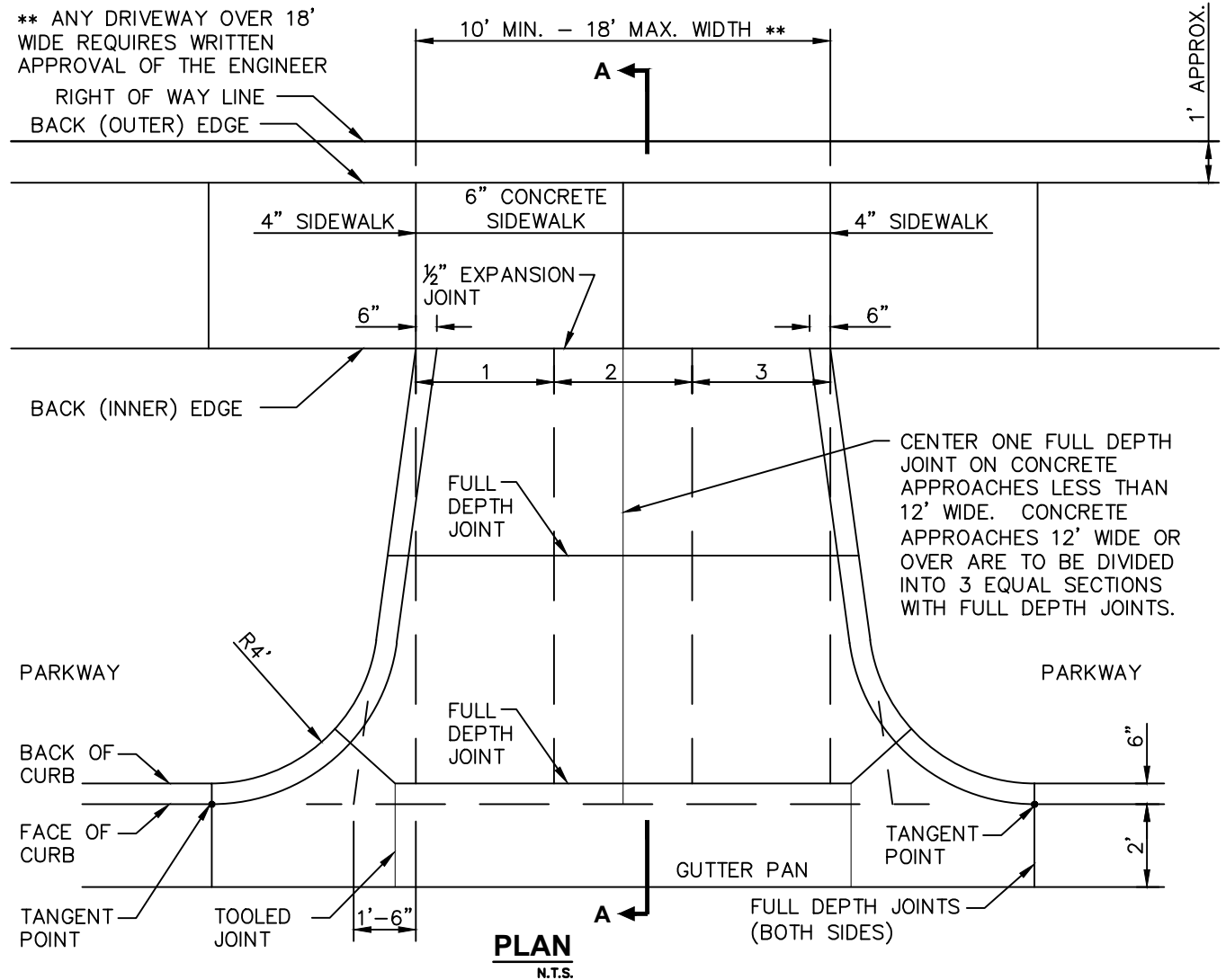


N.T.S.

P-1

** ANY DRIVEWAY OVER 18'
WIDE REQUIRES WRITTEN
APPROVAL OF THE ENGINEER

RIGHT OF WAY LINE
BACK (OUTER) EDGE



NOTE:

THIS DETAIL SHOWS THE HISTORIC STANDARD FOR DRIVEWAYS AND IS NOT TO BE USED FOR CONSTRUCTION UNLESS SPECIALLY CALLED FOR ON THE DRAWING, IN THE ITEMS OR AS DIRECTED BY THE ENGINEER.

**RADIUS DRIVEWAY RETURN
APPROACH AND SIDEWALK**

N.T.S.

APPROVED BY

T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

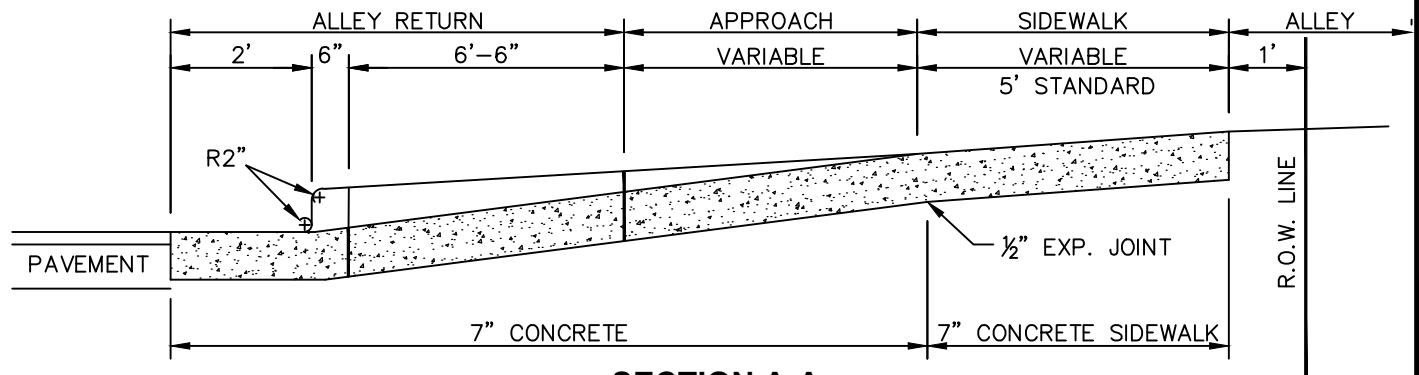
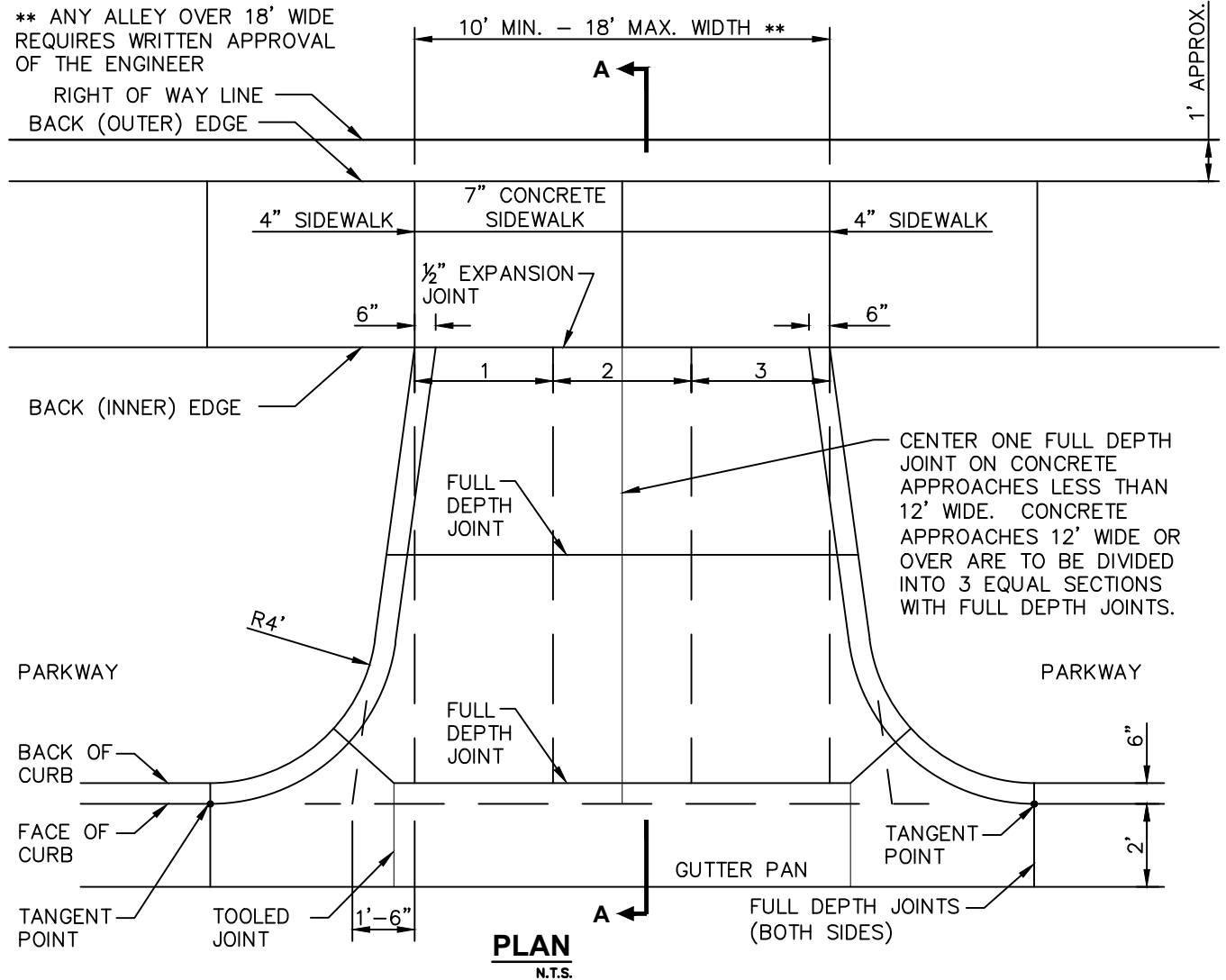
LAST REVISION DATE
1/23/2023

City of Grand Rapids
Public Services
Engineering Department

P-2

** ANY ALLEY OVER 18' WIDE
REQUIRES WRITTEN APPROVAL
OF THE ENGINEER

RIGHT OF WAY LINE
BACK (OUTER) EDGE



NOTE:

THIS DETAIL SHOWS THE HISTORIC STANDARD FOR ALLEYS AND IS NOT
TO BE USED FOR CONSTRUCTION UNLESS SPECIALLY CALLED FOR ON
THE DRAWING, IN THE ITEMS OR AS DIRECTED BY THE ENGINEER.

**RADIUS ALLEY RETURN
APPROACH AND SIDEWALK**

N.T.S.

APPROVED BY

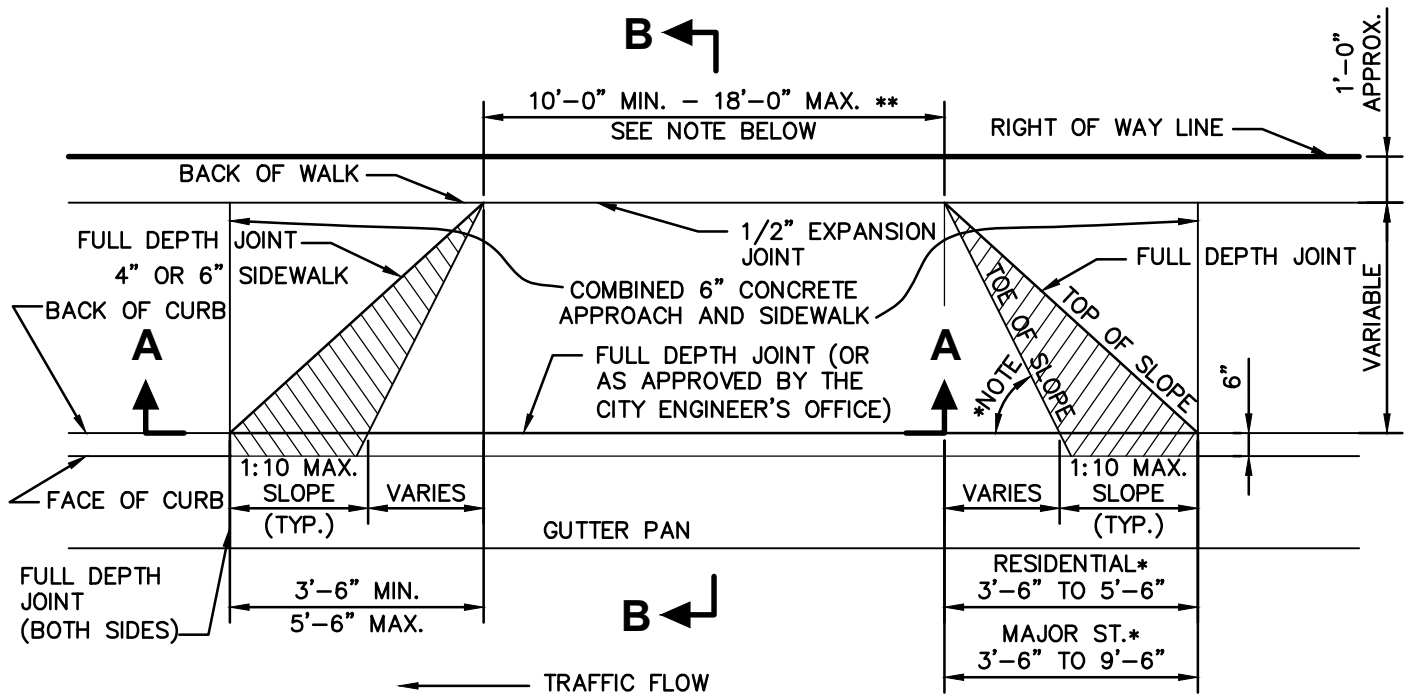
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

LAST REVISION DATE
1/23/2023

City of Grand Rapids
Public Services
Engineering Department

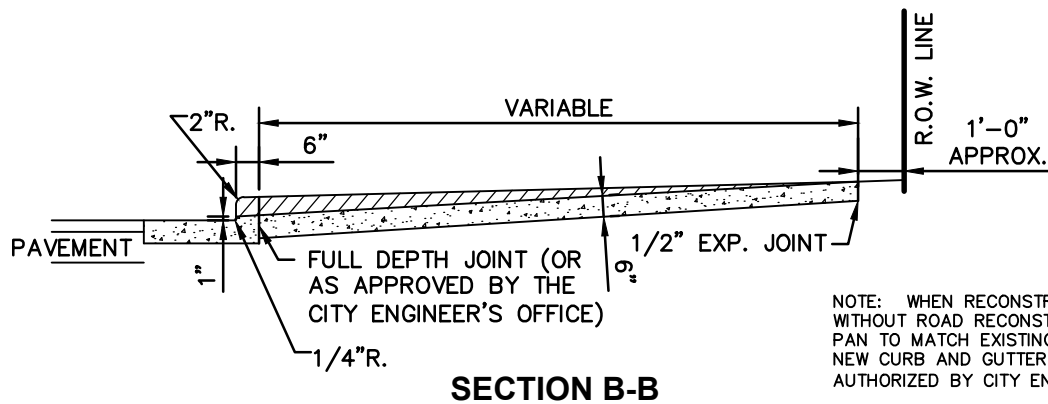
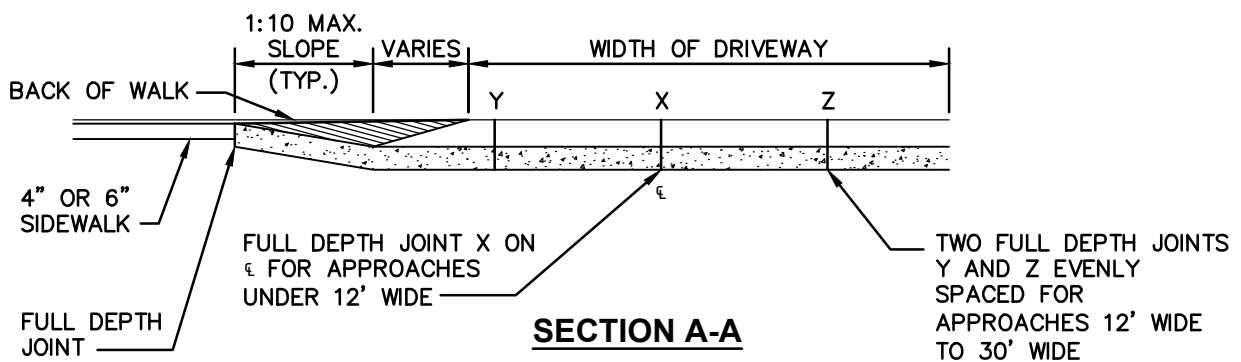
P-2A



***NOTE:**
ANGLE IS SUBJECT TO
THE MIN. AND MAX.
RESTRICTIONS

PLAN

****NOTE:**
ANY DRIVEWAY OVER 18' WIDE
REQUIRES WRITTEN APPROVAL
OF THE ENGINEER



NOTE: WHEN RECONSTRUCTING DRIVEWAY
WITHOUT ROAD RECONSTRUCTION, NEW CURB
PAN TO MATCH EXISTING ROAD SURFACE.
NEW CURB AND GUTTER REQUIRED UNLESS
AUTHORIZED BY CITY ENGINEER'S OFFICE.

COMBINED DRIVEWAY APPROACH AND SIDEWALK

N.T.S.

APPROVED BY

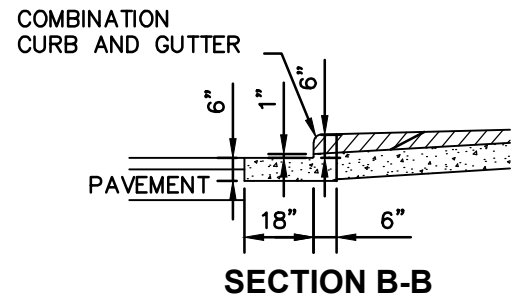
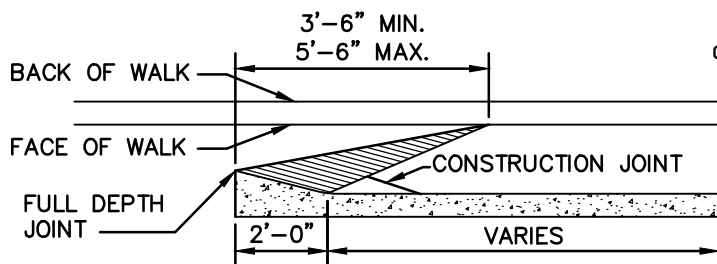
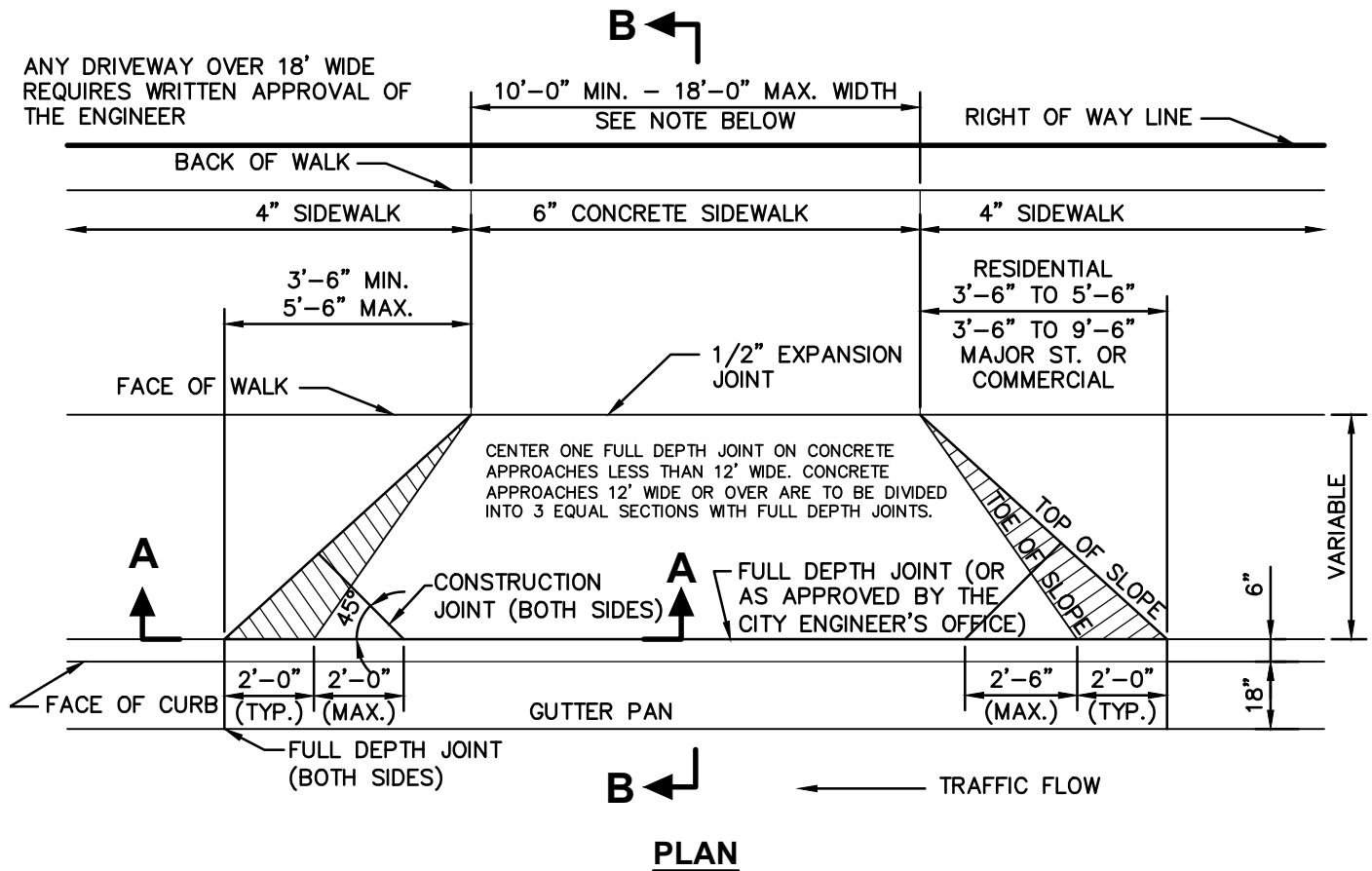
[Signature]
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

LAST REVISION DATE
1/23/2023

City of Grand Rapids
Public Services
Engineering Department

P-3



NOTE: WHEN RECONSTRUCTING DRIVEWAY WITHOUT
CONCURRENT ROAD RECONSTRUCTION, NEW CURB PAN TO
MATCH EXISTING ROAD SURFACE. NEW CURB AND GUTTER
REQUIRED UNLESS AUTHORIZED BY CITY ENGINEER'S OFFICE.

DUB-DOWN DRIVEWAY APPROACH

N.T.S.

APPROVED BY

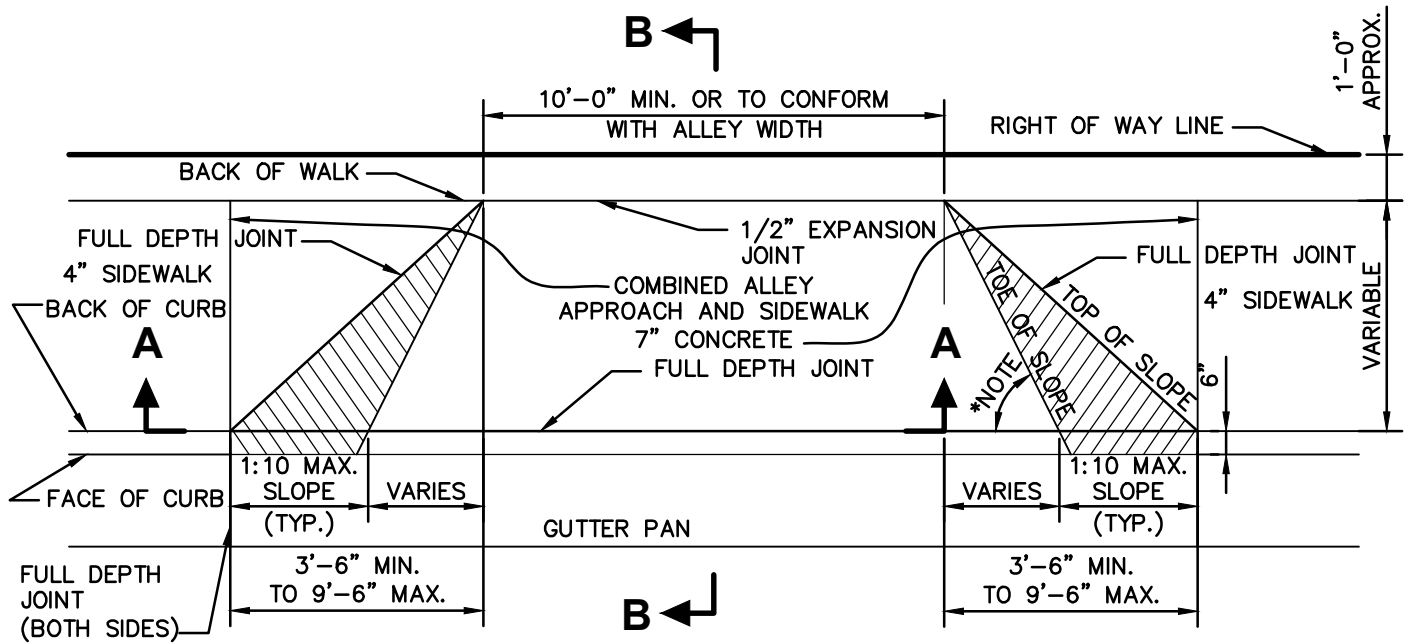
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CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

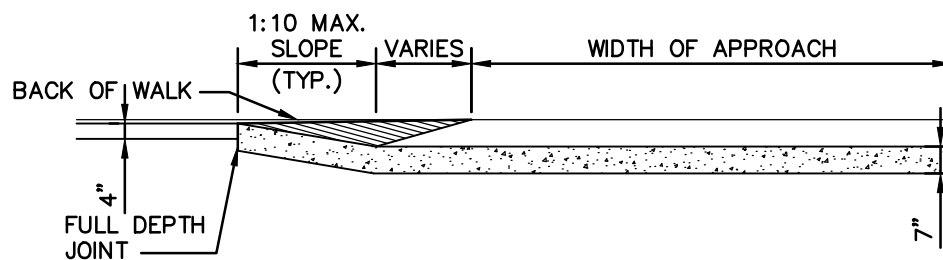
LAST REVISION DATE
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Public Services
Engineering Department

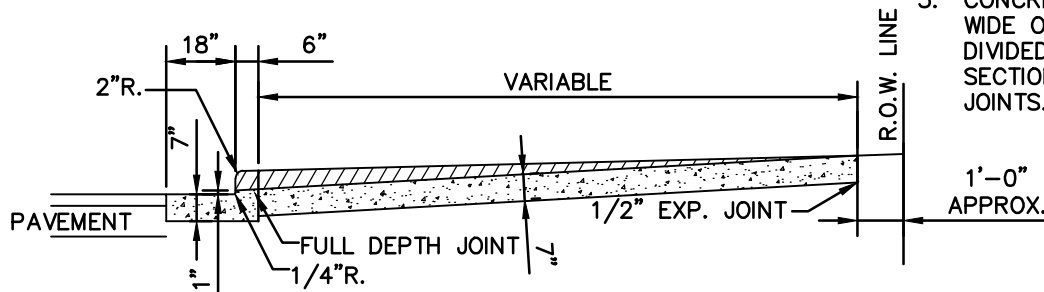
P-3A



***NOTE:**
ANGLE IS SUBJECT TO
THE MIN. AND MAX.
RESTRICTIONS



SECTION A-A



SECTION B-B

GENERAL NOTES:

1. CONCRETE PER SECTION 6.1 TO BE USED.
2. CENTER ONE FULL DEPTH JOINT ON CONCRETE APPROACHES LESS THAN 12' WIDE.
3. CONCRETE APPROACHES 12' WIDE OR OVER ARE TO BE DIVIDED INTO 3 EQUAL SECTIONS WITH FULL DEPTH JOINTS.

**COMBINED DUB-DOWN ALLEY
APPROACH AND SIDEWALK**

N.T.S.

APPROVED BY

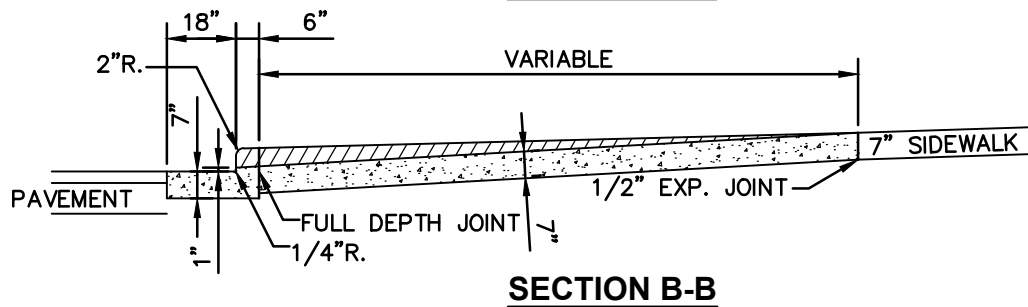
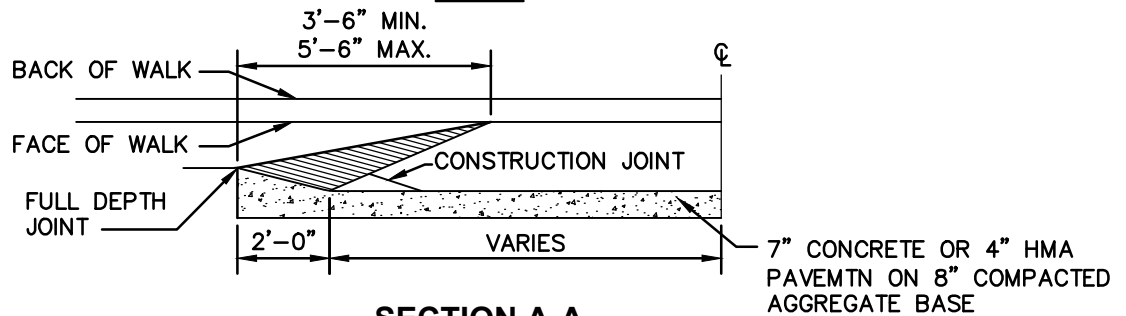
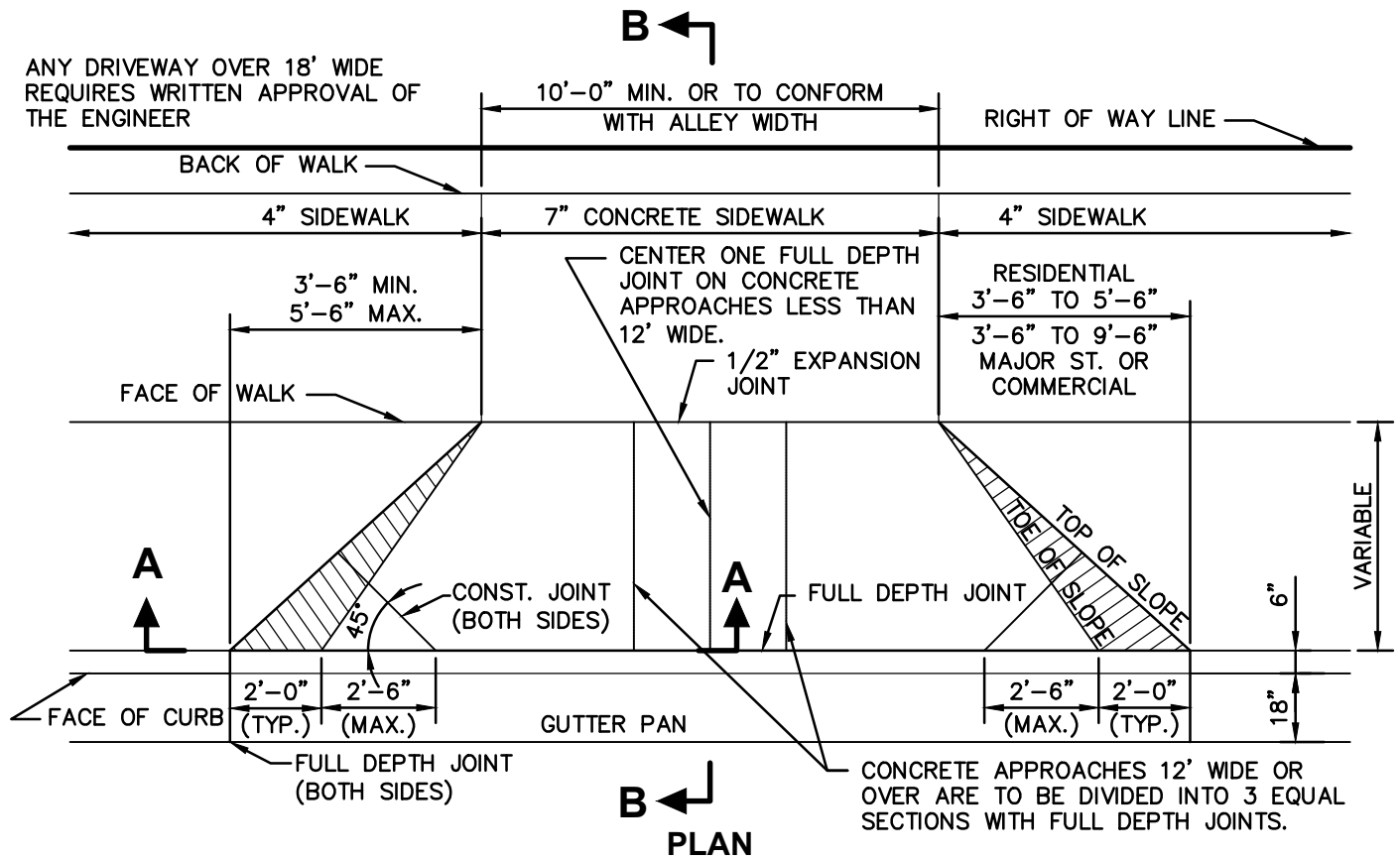
[Signature]
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Public Services
Engineering Department

P-4



STANDARD DUB-DOWN ALLEY APPROACH

N.T.S.

APPROVED BY

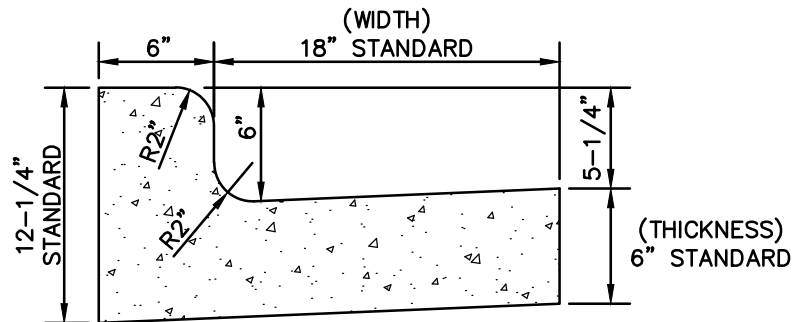
T. B. B.
CITY ENGINEER

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1/4/2021

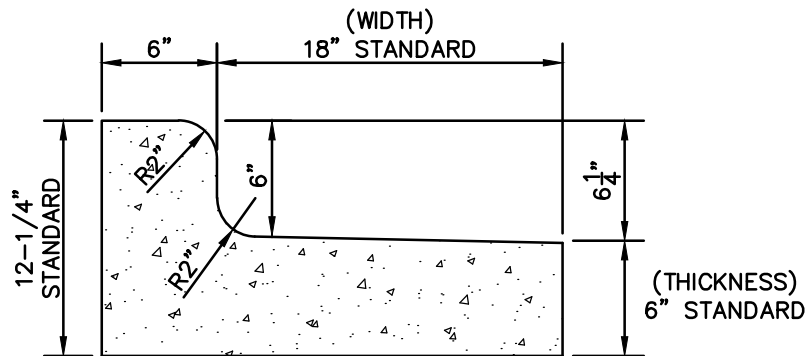
LAST REVISION DATE

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Public Services
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P-4A



CURB AND GUTTER
(WIDTH) x (THICKNESS) INCH PAN
(STANDARD)



CURB AND GUTTER
(WIDTH) x (THICKNESS) INCH PAN
(INVERTED)

STANDARD CURB AND GUTTER

N.T.S.

APPROVED BY

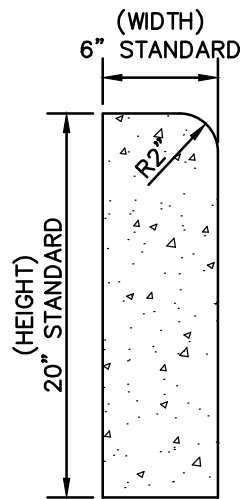
[Signature]
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LAST REVISION DATE
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 Public Services
 Engineering Department

P-5



CURB
(WIDTH) x (HEIGHT) INCH

STRAIGHT CURB
 N.T.S.

APPROVED BY

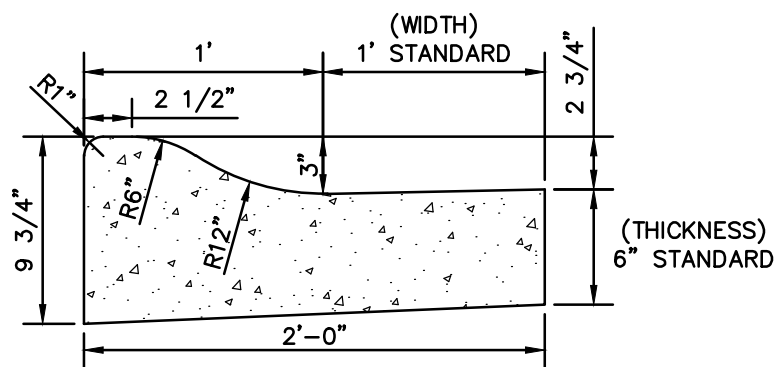
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 Public Services
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P-5A



ROLL CURB AND GUTTER
(WIDTH) x (THICKNESS) INCH PAN

ROLL CURB AND GUTTER

N.T.S.

APPROVED BY

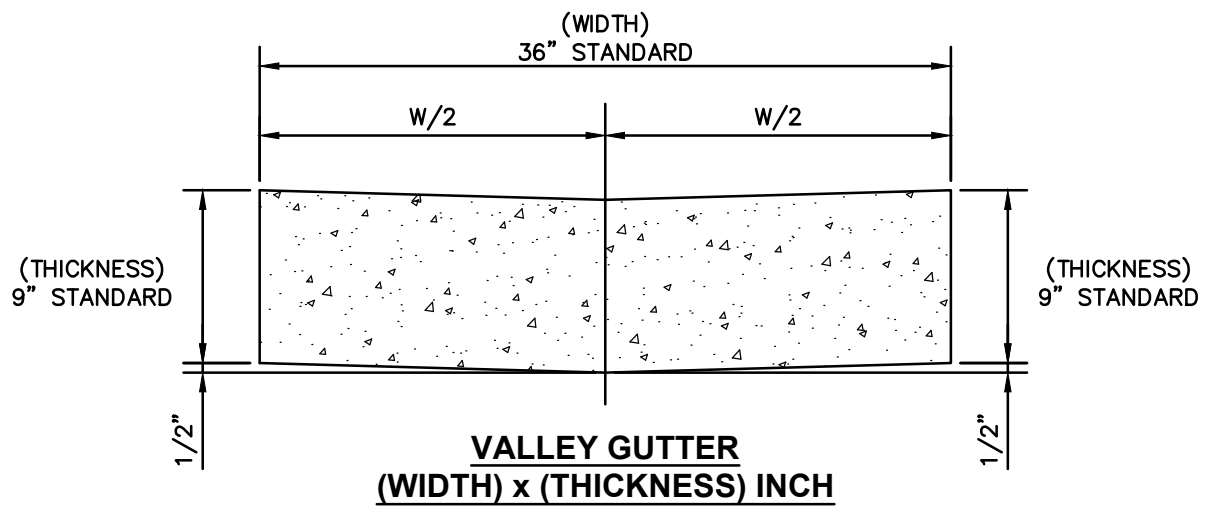
T. B. B.
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P-5B



VALLEY GUTTER
N.T.S.

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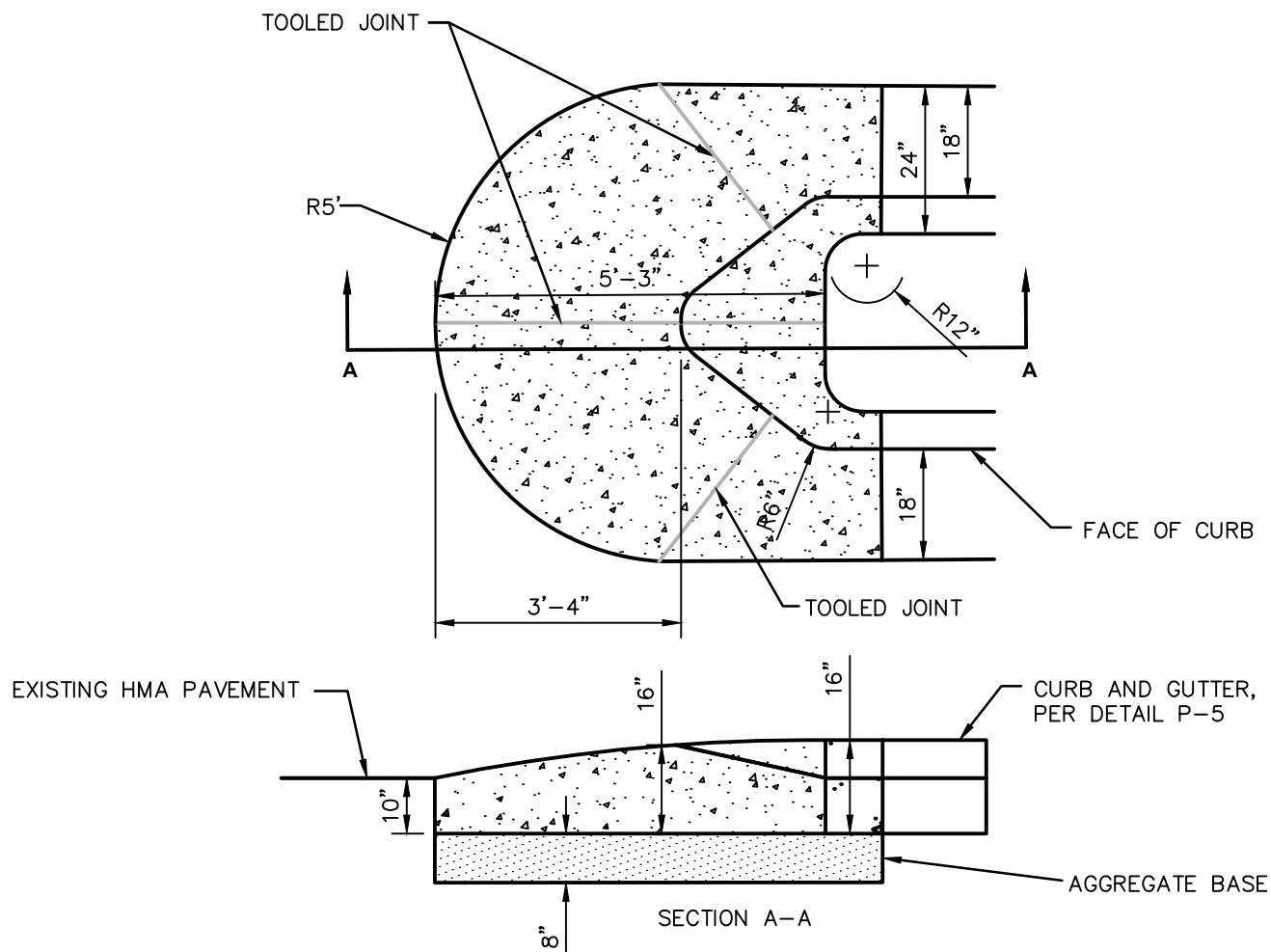
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ORIGINAL APPROVAL DATE
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Public Services
Engineering Department

P-5C



MEDIAN AND ISLAND END TREATMENT

N.T.S.

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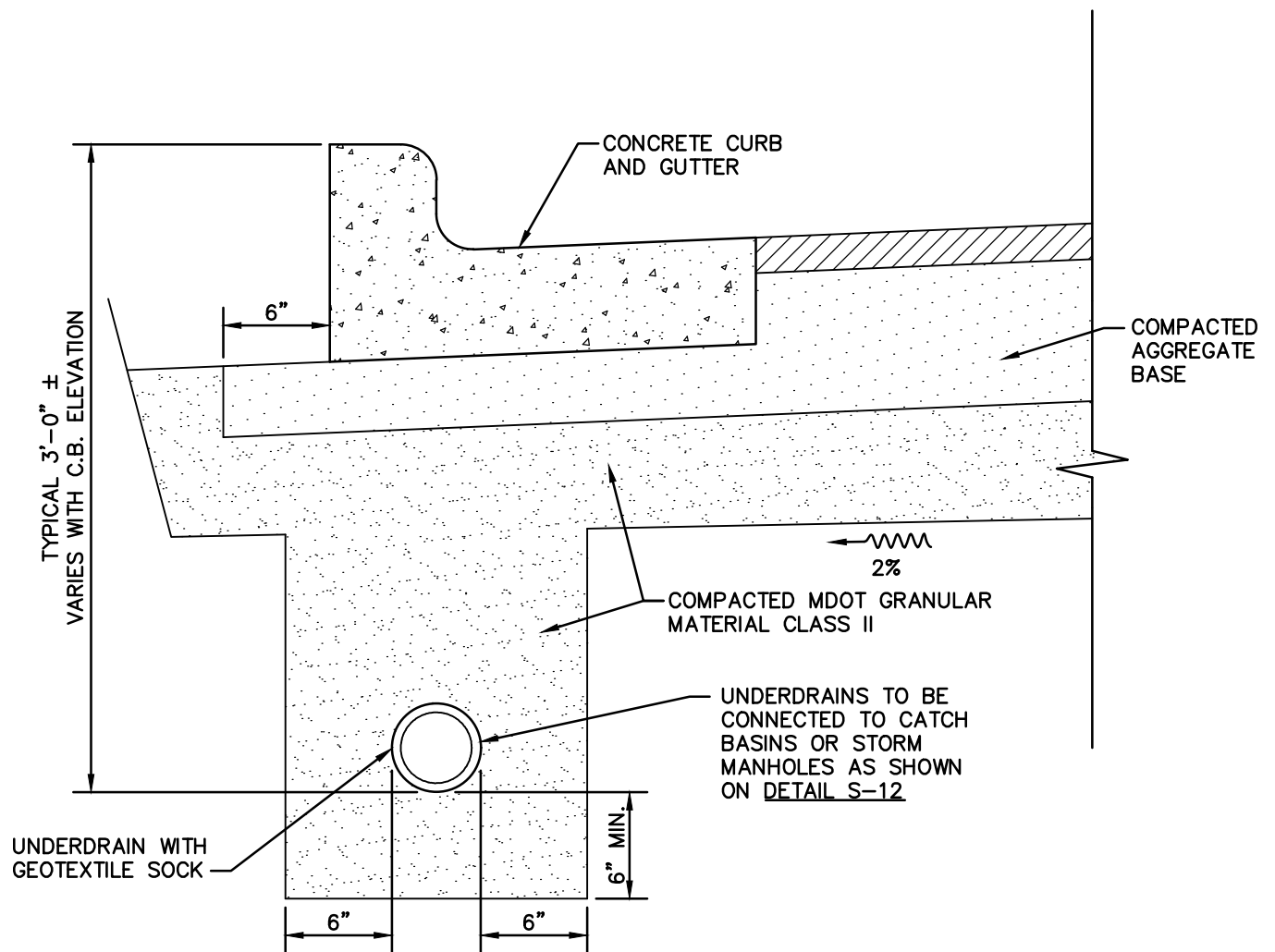
Tim B. [Signature]
CITY ENGINEER

ORIGINAL APPROVAL DATE
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Public Services
Engineering Department

P-5D



SUBBASE UNDERDRAIN

N.T.S.

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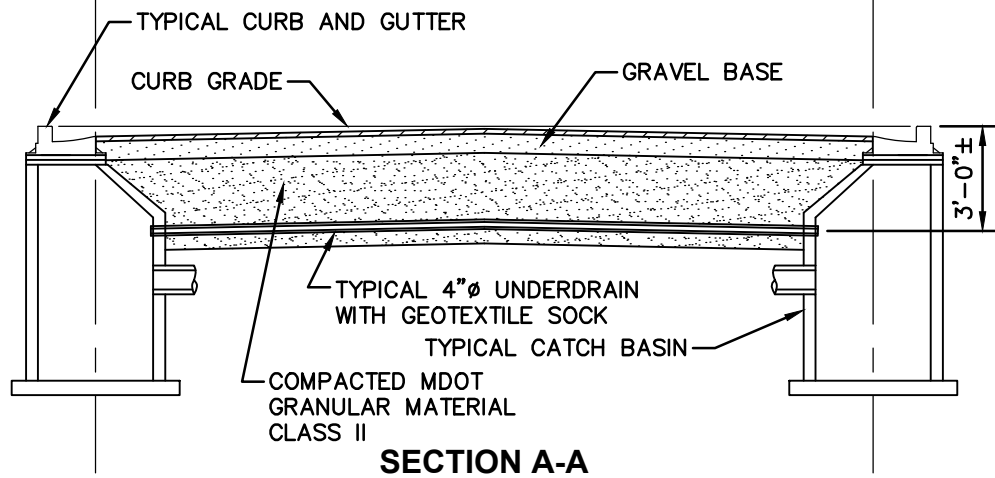
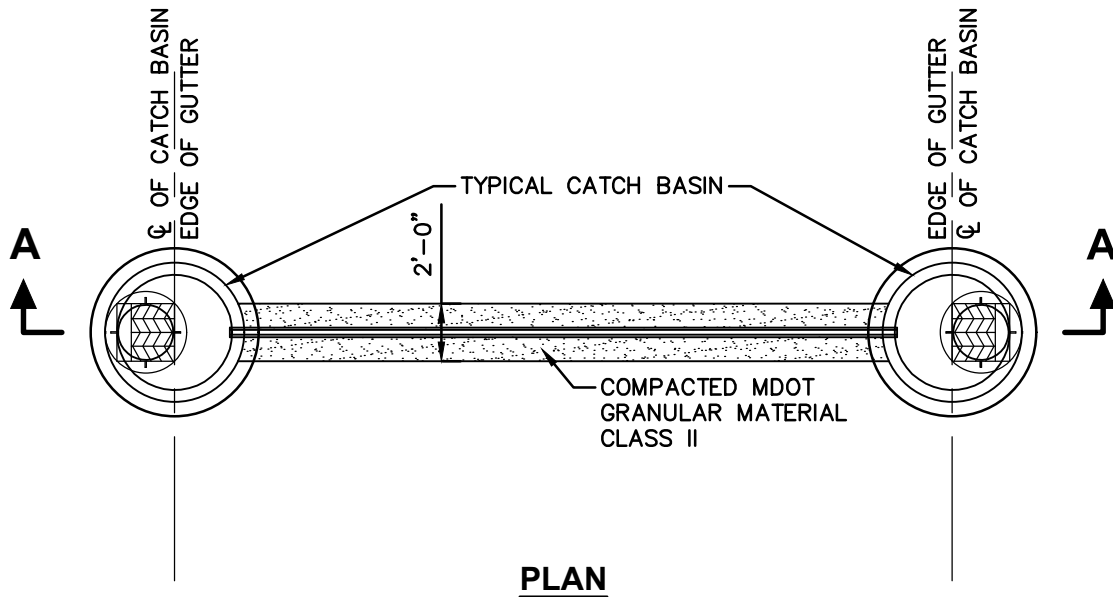
T. B. B.
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Engineering Department

P-6



NOTES:

1. THIS SPECIAL UNDERDRAIN IS DESIGNED FOR USE IN CLAY SOIL AT LOW POINT IN GRADE LINE OF STREET.
2. UNTIL THE BASE COURSE HAS BEEN PLACED THE CONTRACTOR SHALL MAINTAIN THE SPECIAL UNDERDRAIN BY KEEPING THE SURFACE REASONABLY FREE OF CLAY AND SILT.
3. UNDERDRAINS TO BE CONNECTED TO CATCH BASINS OR STORM MANHOLES AS SHOWN ON DETAIL S-12

SPECIAL UNDERDRAIN

N.T.S.

APPROVED BY

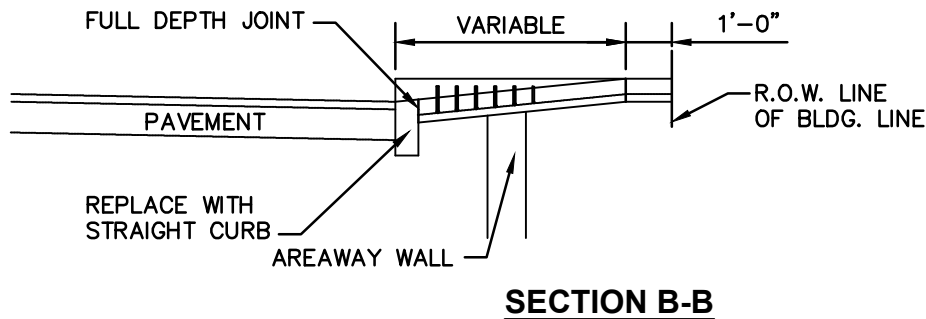
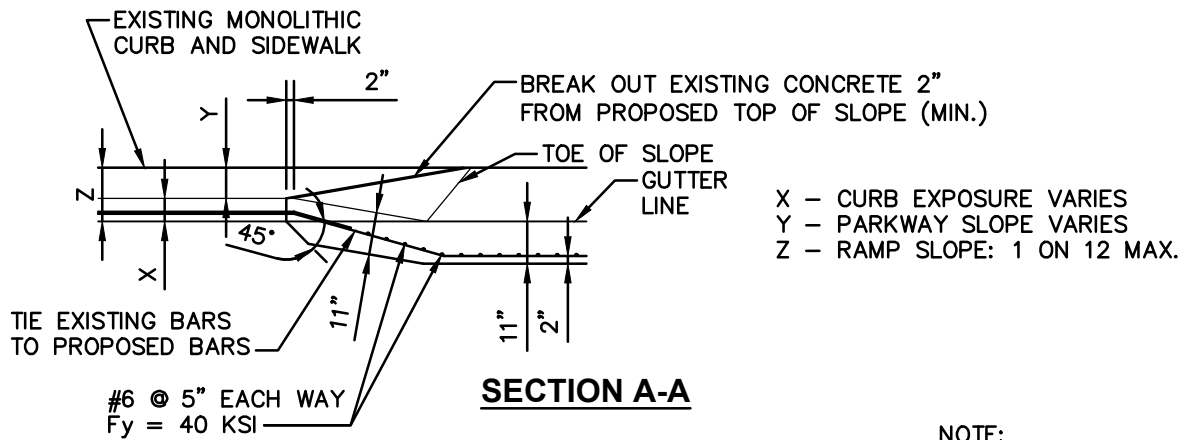
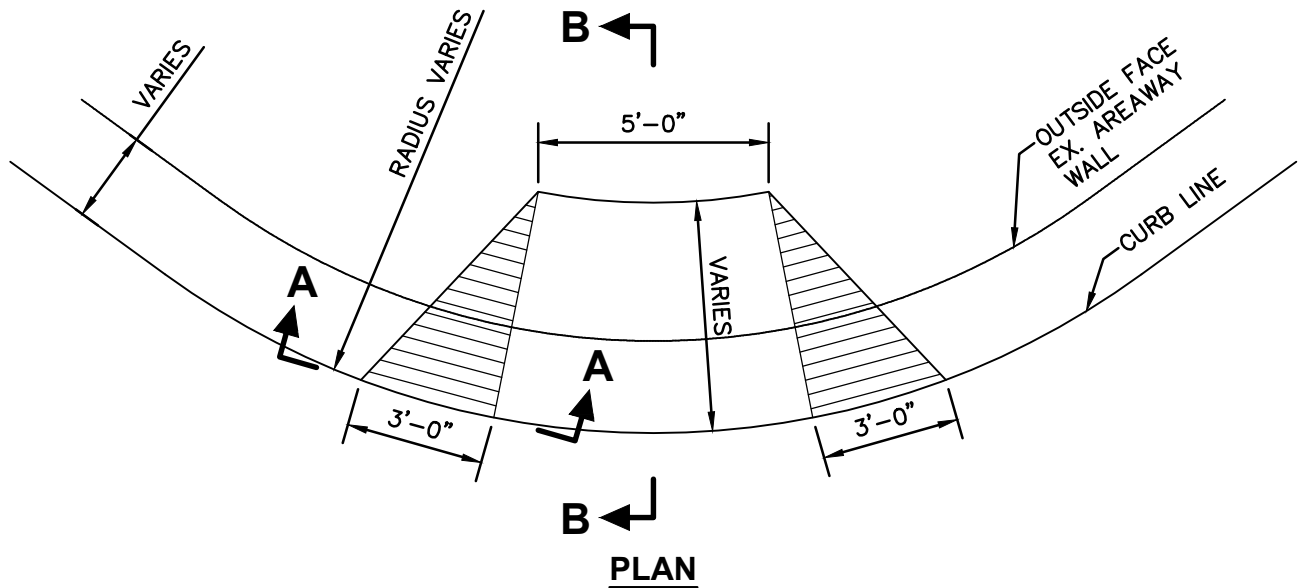
[Signature]
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Public Services
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P-7



SIDEWALK RAMP IN REINFORCED CONCRETE OVER AREAWAYS

N.T.S.

APPROVED BY

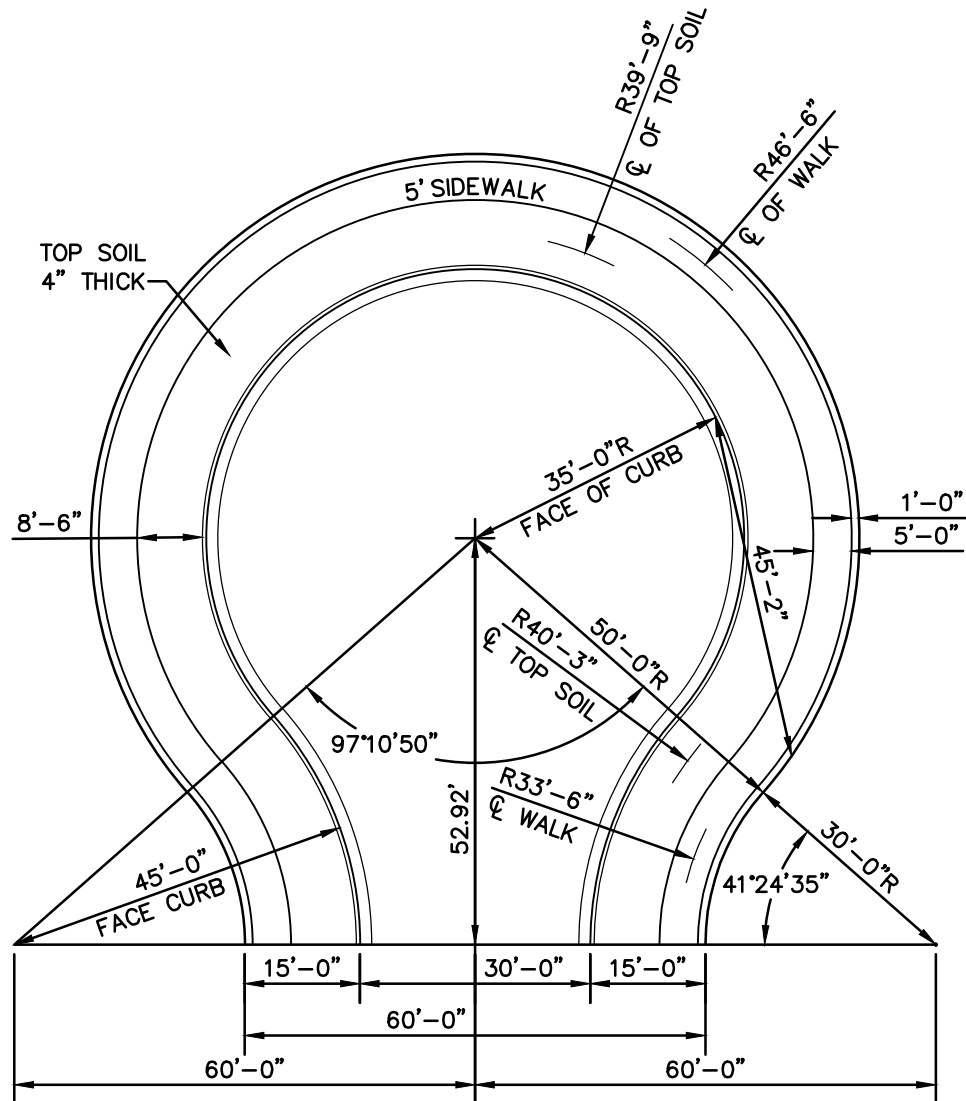
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CITY ENGINEER

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P-9



ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

237.8 LFT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS

474.1 SQ. YDS. PAVEMENT

154.4 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE

33.4 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CUL-DE-SAC FOR
60' R.O.W. - 30' & 50' RADII

N.T.S.

APPROVED BY

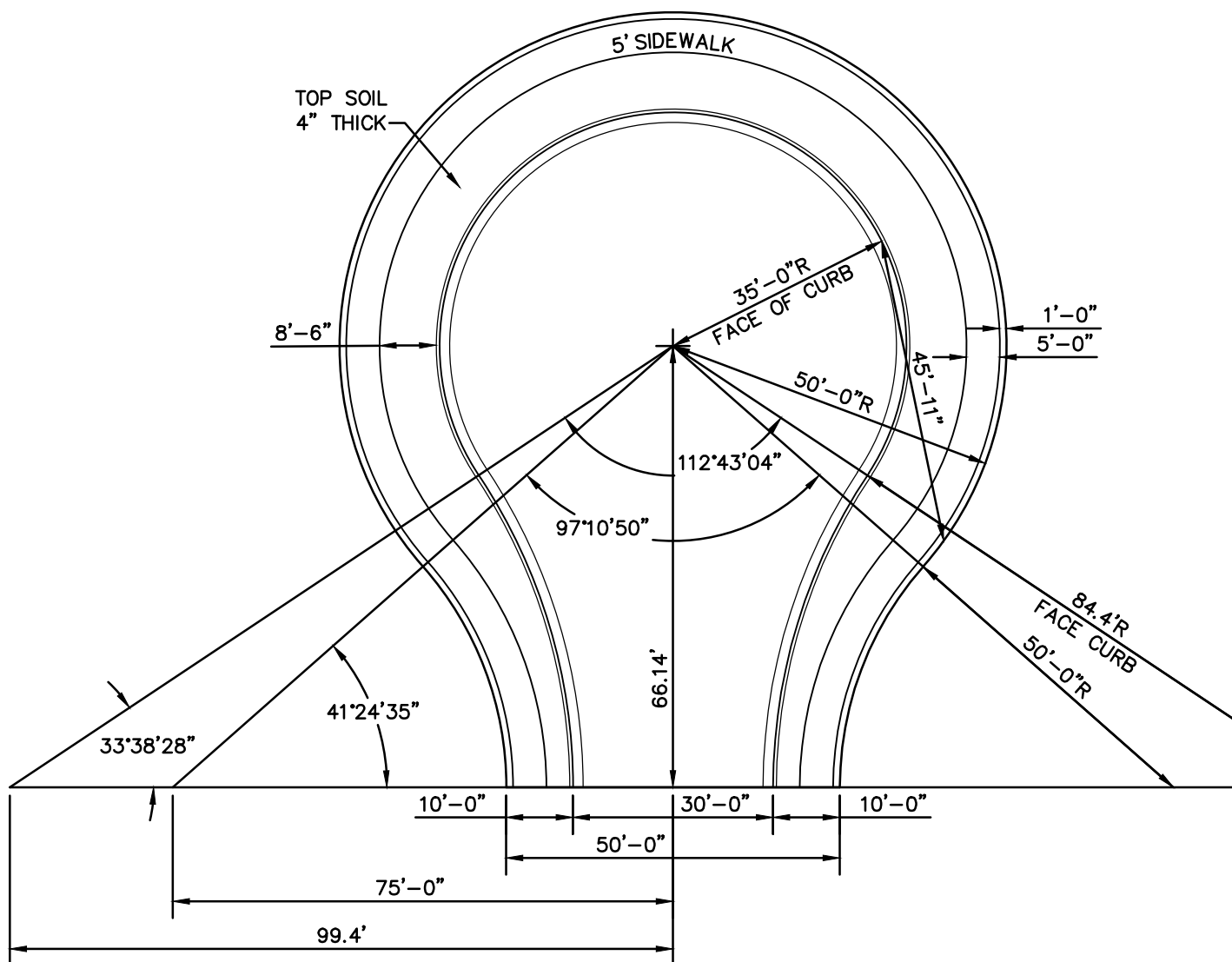
T. B. B.
CITY ENGINEER

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1/4/2021

LAST REVISION DATE
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Public Services
Engineering Department

P-10



ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

250.2 LFT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS

504.6 SQ. YDS. PAVEMENT

161.4 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE

33.1 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CUL-DE-SAC FOR
50' R.O.W. - 50' & 50' RADII

N.T.S.

APPROVED BY

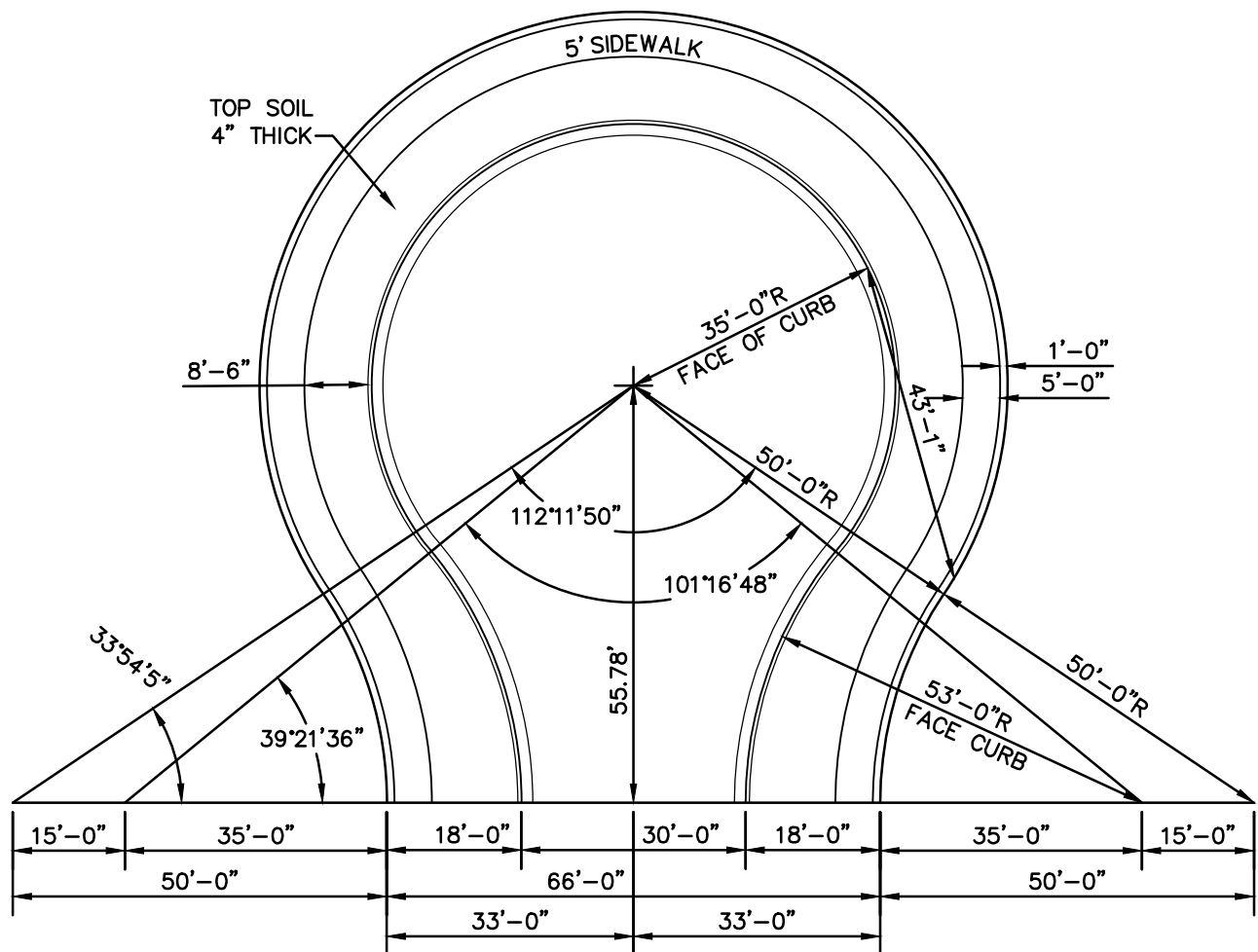
T. B. B.
CITY ENGINEER

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1/4/2021

LAST REVISION DATE
1/18/2022

City of Grand Rapids
Public Services
Engineering Department

P-12



ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN
DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE
WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

230.7 LFT. COMBINED CURB AND GUTTER INCLUDING
DRIVEWAY RETURNS

463.5 SQ. YDS. PAVEMENT

146.8 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5'
WIDE

33.7 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR
SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CUL-DE-SAC FOR
66' R.O.W. - 50' & 50' RADII

N.T.S.

APPROVED BY

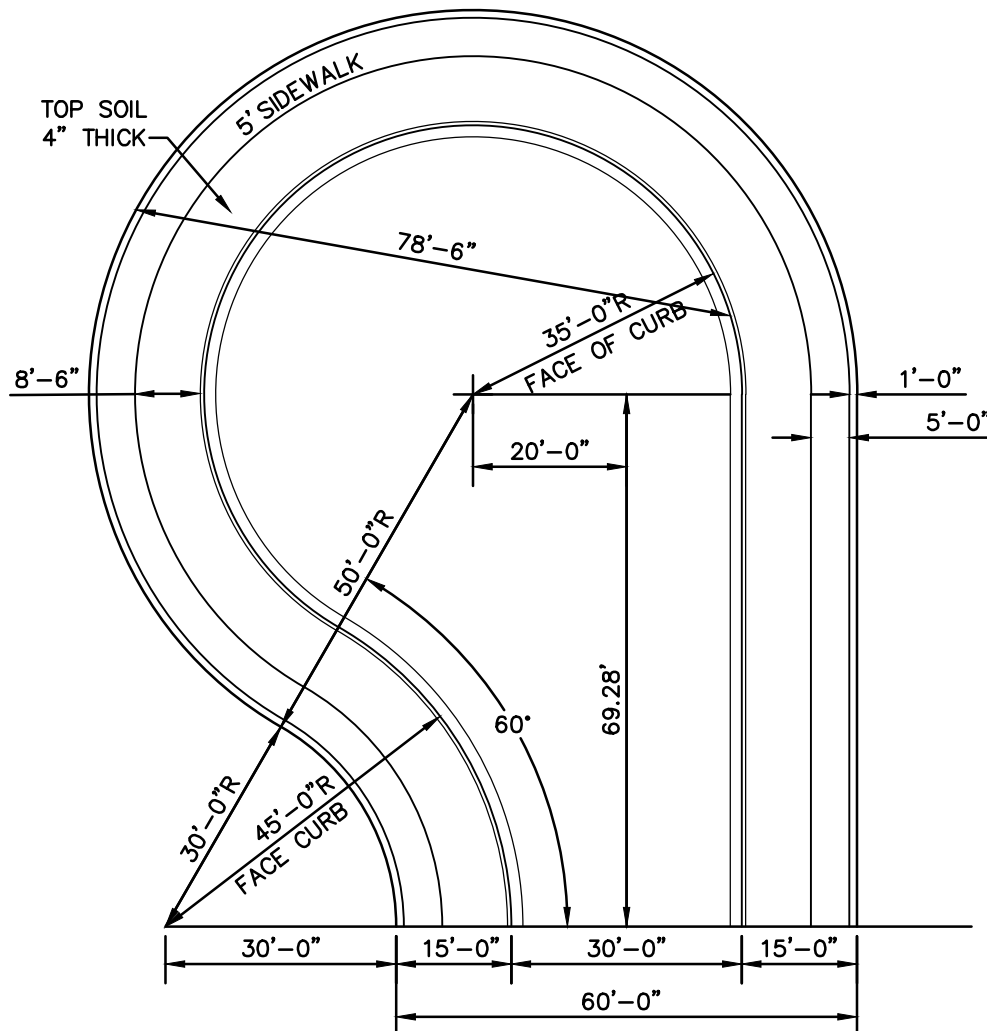
T. B. [Signature]
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P-13



ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

263.0 LFT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS

533.1 SQ. YDS. PAVEMENT

166.1 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE

36.3 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

UNSYMMETRICAL CUL-DE-SAC FOR
60' R.O.W. - 30' & 50' RADII

N.T.S.

APPROVED BY

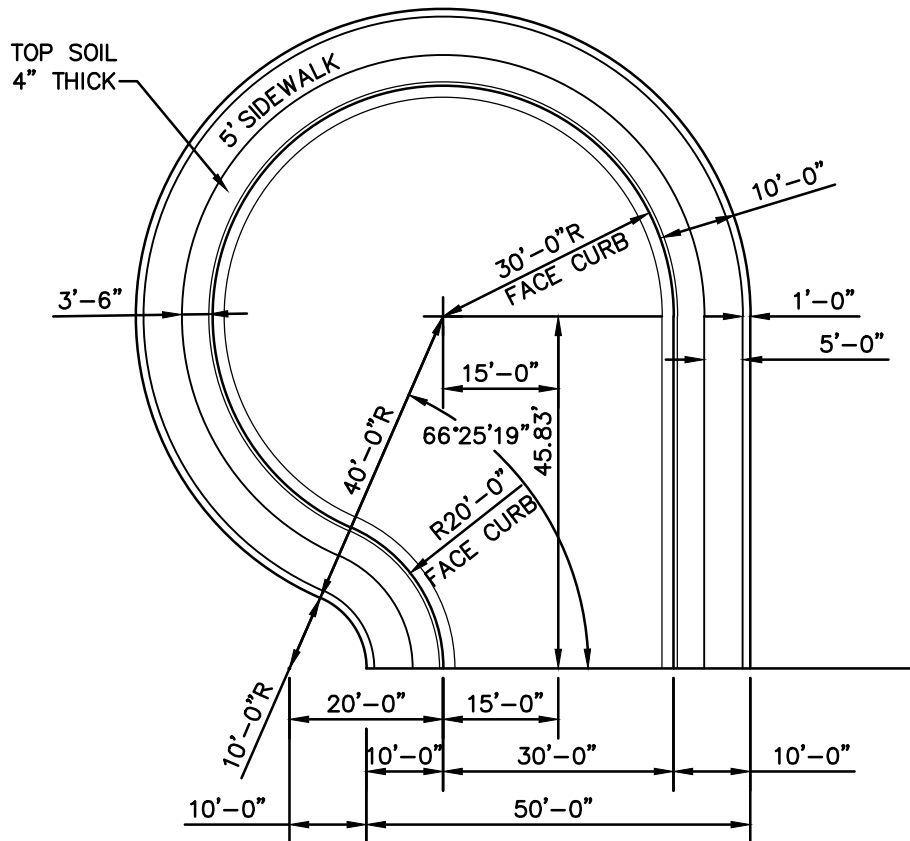
T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

LAST REVISION DATE
1/18/2022

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Public Services
Engineering Department

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ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

198.0 LFT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS

349.6 SQ. YDS. PAVEMENT

121.3 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE

11.1 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

UNSYMMETRICAL CUL-DE-SAC FOR 50' R.O.W. - 10' & 40' RADII

N.T.S.

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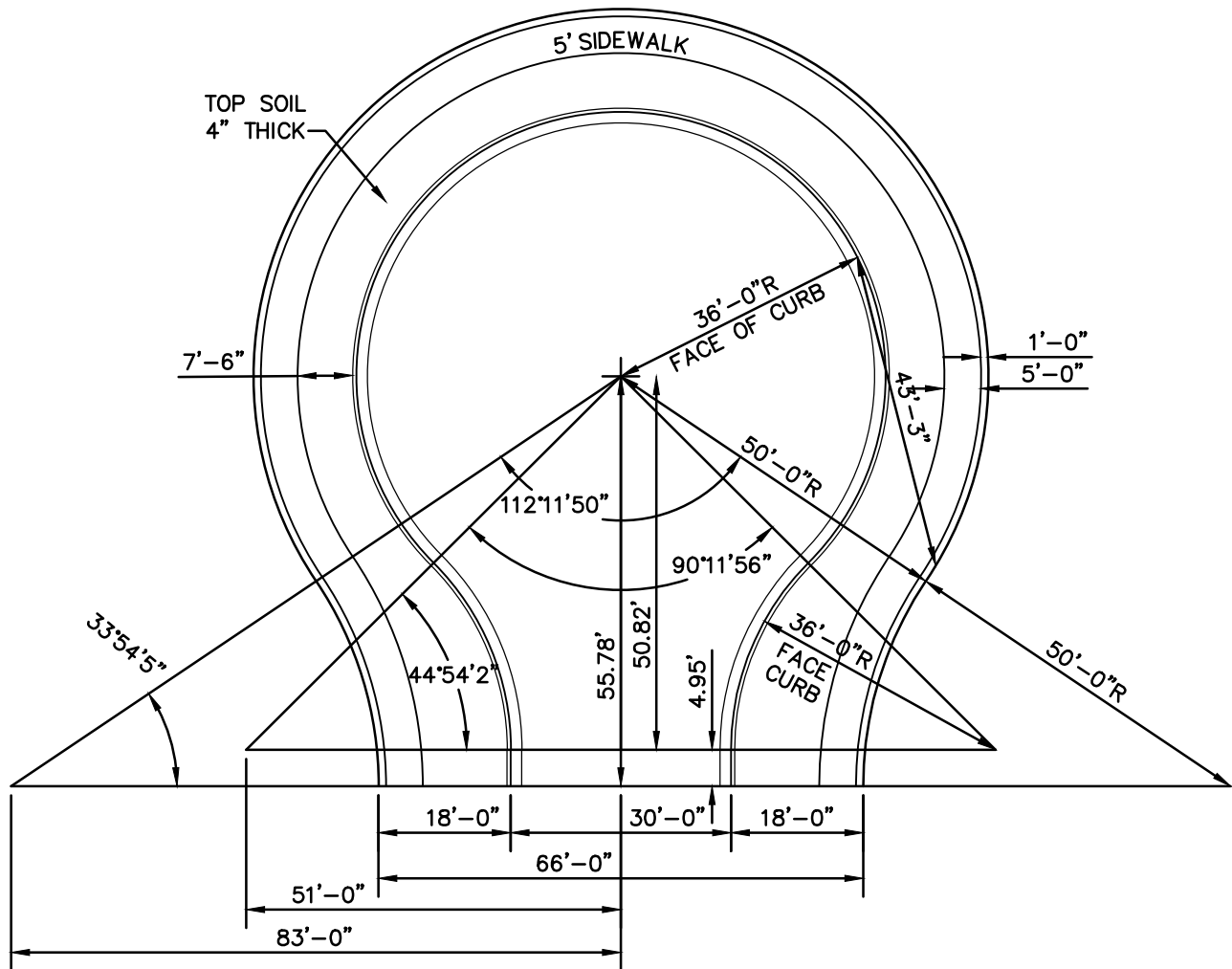
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ROAD AND SIDEWALK WIDTHS AND CUL-DE-SAC DESIGN DIMENSIONS SHOULD BE ADJUSTED IN ACCORDANCE WITH THE VITAL STREETS GUIDELINES

CONSTRUCTION QUANTITIES:

235.9 LFT. COMBINED CURB AND GUTTER INCLUDING DRIVEWAY RETURNS

472.0 SQ. YDS. PAVEMENT

146.9 SQ. YDS. CONCRETE WALK 4" AND 6" THICK, 5' WIDE

31.3 CU. YDS. TOP SOIL, 4" THICK, INCLUDING 25% FOR SHRINKAGE, NO DEDUCTION FOR DRIVEWAY RETURNS.

CUL-DE-SAC FOR
66' R.O.W. - 50' & 50' RADII

N.T.S.

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PLANE OF WEAKNESS JOINTS TO BE 12 FEET APART, AND THEY SHALL BE SET AT A DEPTH OF 1/3 OF THE THICKNESS OF THE PAVEMENT. JOINTS MAY BE TOOLED OR SAW CUT. COMPLETE SAW CUT JOINTS WITHIN 24 HOURS OF PLACING CONCRETE.

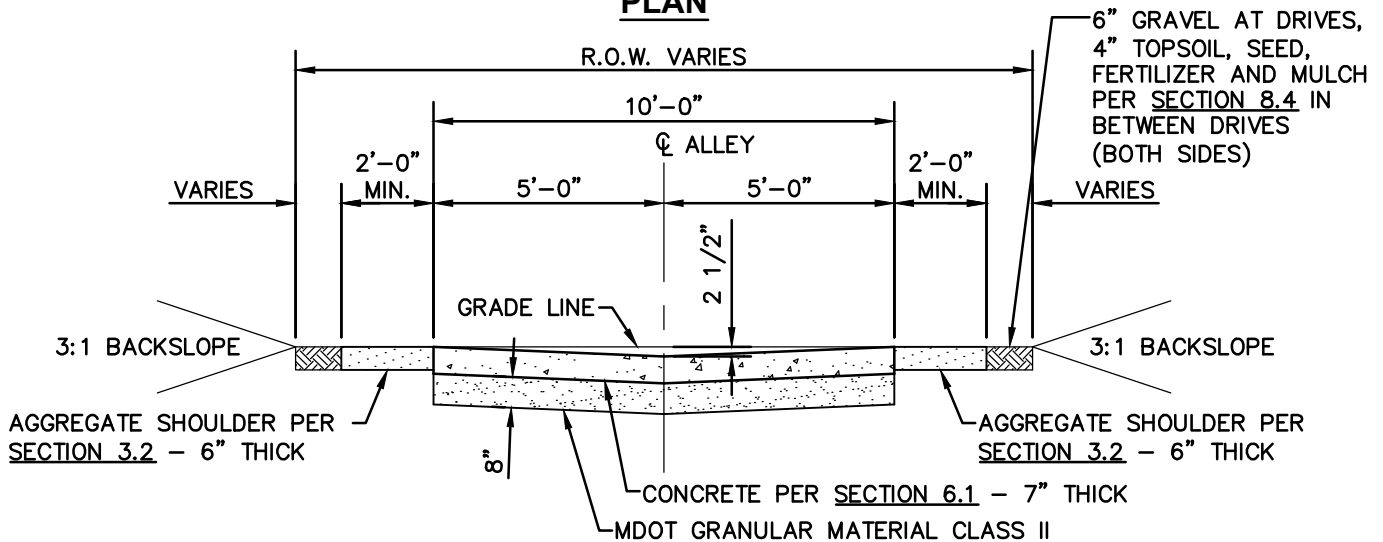
1/2" EXPANSION JOINTS EVERY 100 FT.

CL ALLEY

12'-0"

10'-0"

PLAN



SECTION A-A

ALLEY PAVEMENT

N.T.S.

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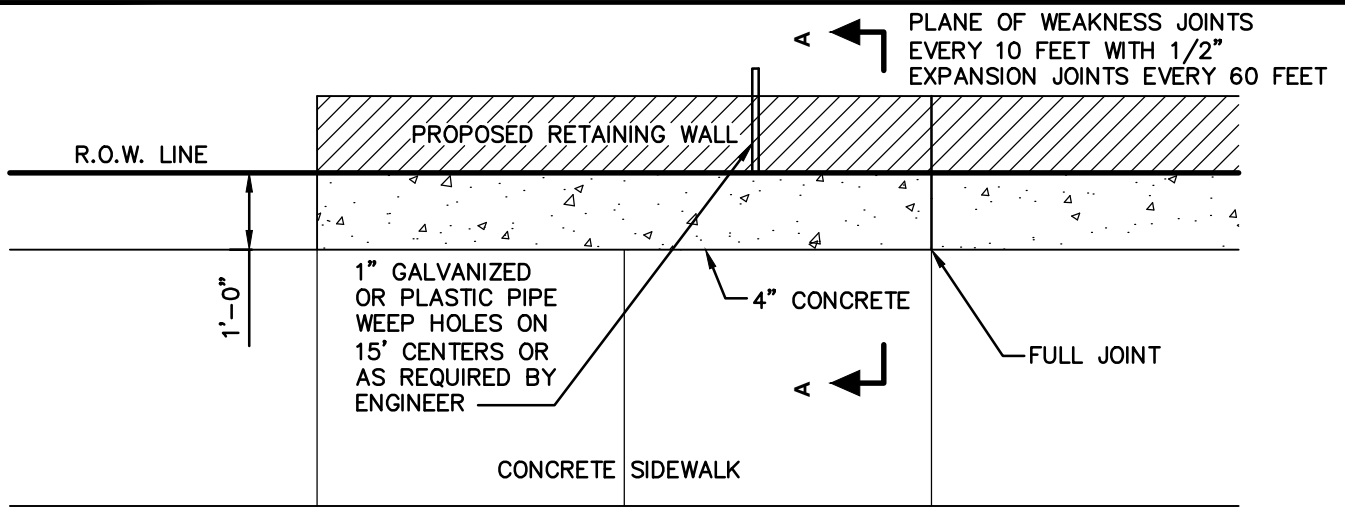
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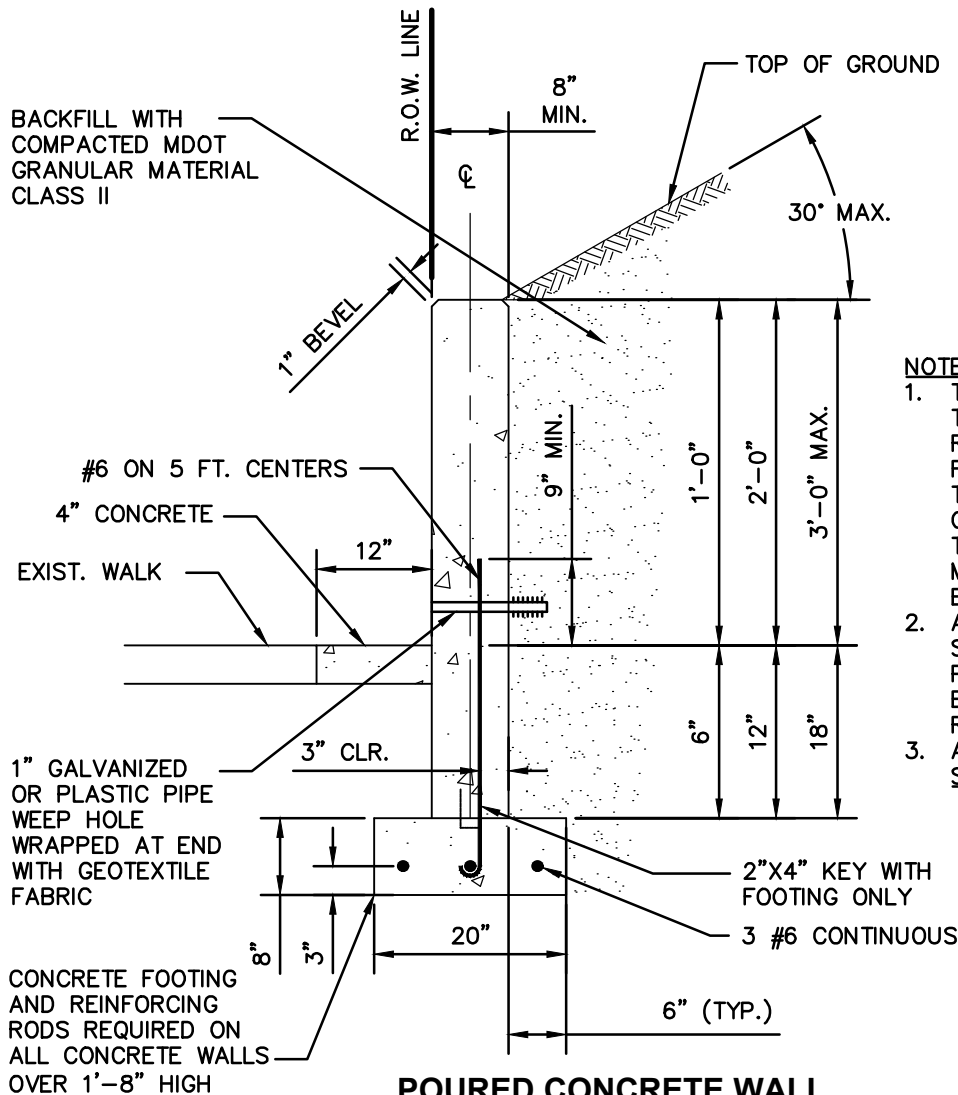
LAST REVISION DATE
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PLAN



**POURED CONCRETE WALL
SECTION A-A**

NOTES:

1. THIS SPECIFICATION GOVERNS THE CONSTRUCTION OF RETAINING WALLS UP TO 3 FEET HIGH MEASURED FROM THE TOP OF SIDEWALK. TO CONSTRUCT WALLS HIGHER THAN 3 FEET A DRAWING MUST BE SUBMITTED TO CITY ENGINEER FOR APPROVAL
2. ALL NEW RETAINING WALLS SHALL BE BUILT ON PRIVATE PROPERTY. REPAIR OF EXISTING WALLS DOES NOT REQUIRE RELOCATION
3. ALL CONCRETE TO BE SECTION 6.1

**CONCRETE RETAINING WALL
(MAXIMUM 3 FEET HIGH)**

N.T.S.

APPROVED BY

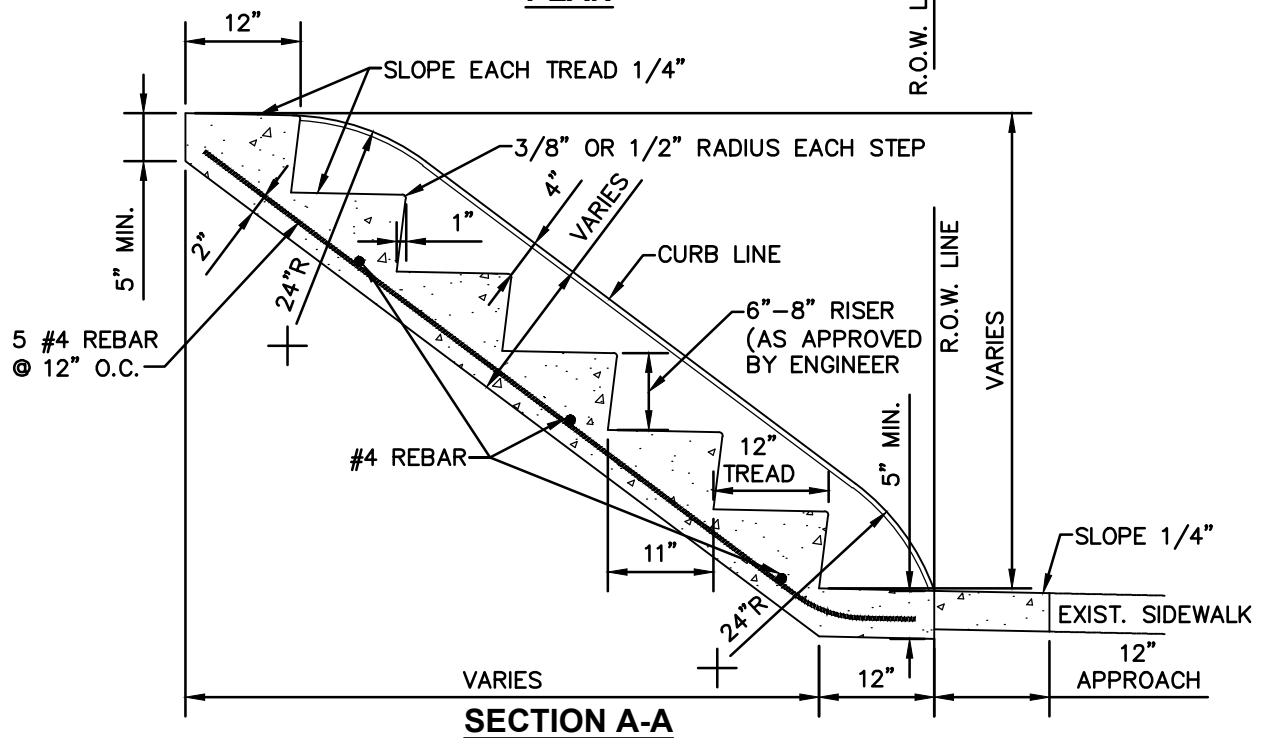
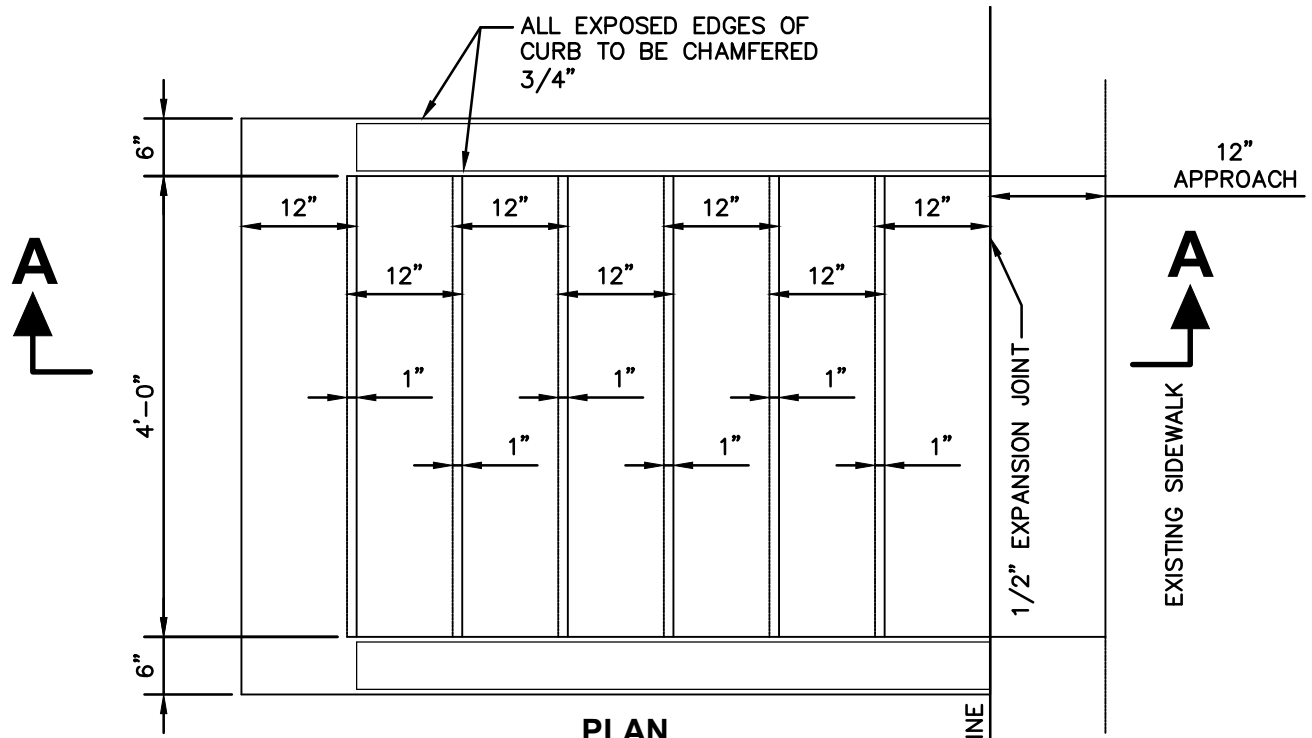
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Engineering Department

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NOTES:

1. THE NUMBER OF STEPS IN EACH SET OF STEPS SHALL BE AS SHOWN ON THE DRAWINGS, OR AS DIRECTED BY THE ENGINEER, BUT NOT MORE THAN SIX NOR LESS THAN THREE STEPS SHALL BE CONSTRUCTED ACCORDING TO THIS DESIGN.
2. STEPS SHALL BE CONSTRUCTED CONCRETE PER SECTION 6.1
2. APPROX. SLOPE IS 1.76:1. THE BANK SHALL BE TRIMMED TO FIT THE SLOPE OF THE STEPS FOR A DISTANCE OF NOT LESS THAN 10 FEET, EACH SIDE OF THE STEPS.
3. THE TREADS AND TOP OF CURB SHALL BE BRUSH-FINISHED AS REQUIRED FOR SIDEWALK. THE RISERS AND FACE OF CURBS SHALL BE RUBBED TO REMOVE FORM MARKS AND FILL THE PORES.

CONCRETE STEPS

N.T.S.

APPROVED BY

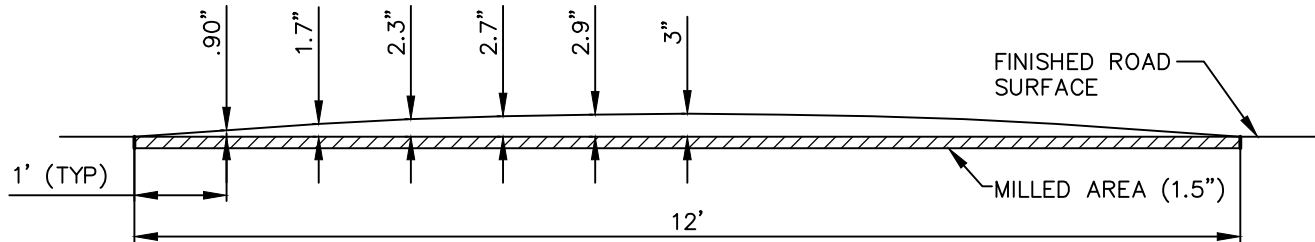
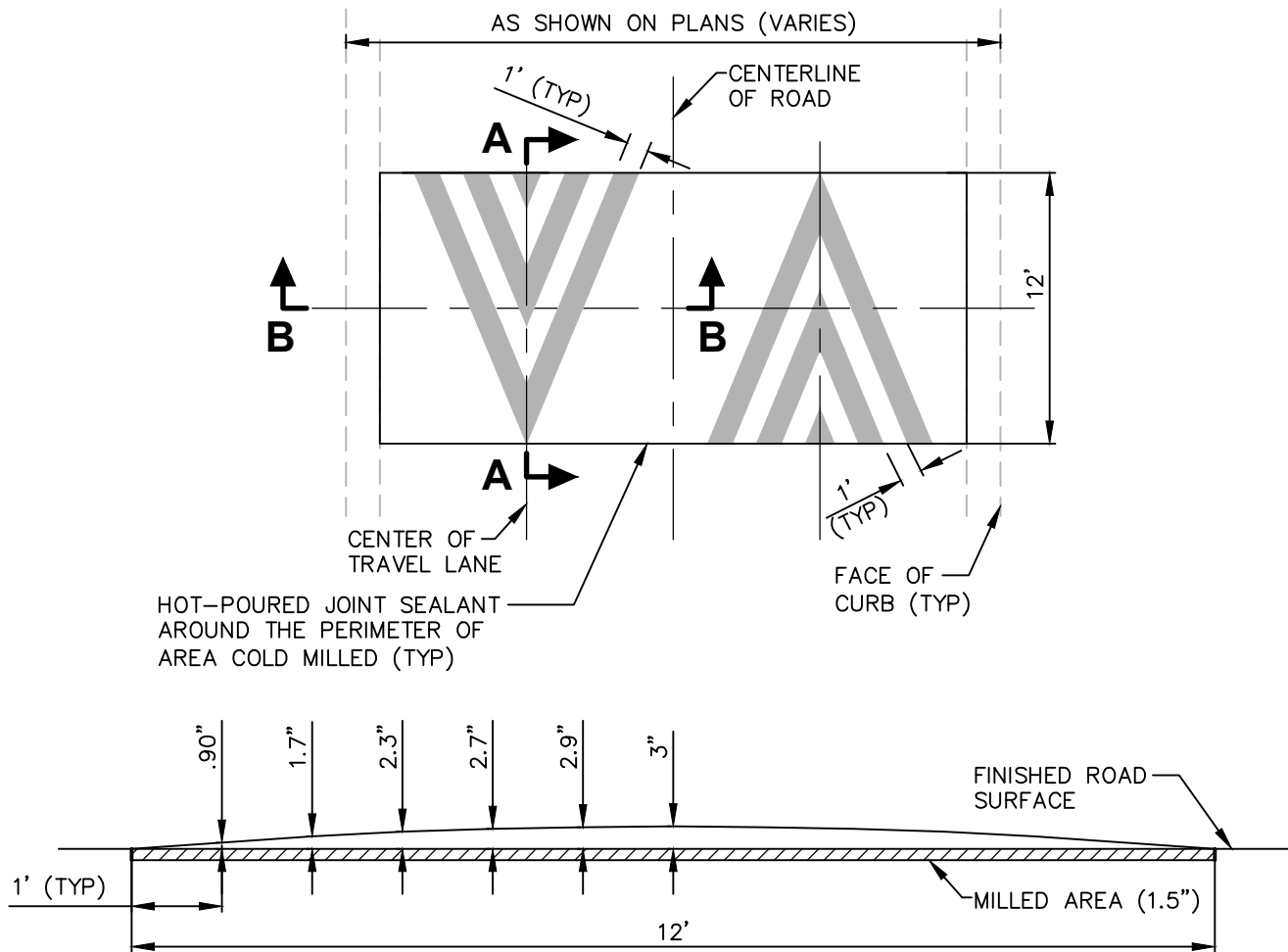
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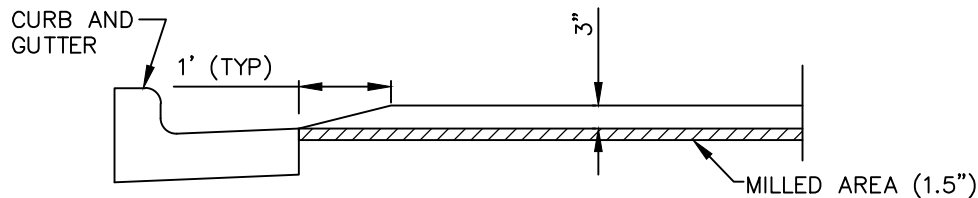
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SECTION A-A

TOLERANCES
 HEIGHT: +0.5" TO -0.5"
 WIDTH: ±1"
 LENGTH: ±1"



SECTION B-B

NOTES:

1. HMA MIXTURE SHALL BE LVSP AND BE PLACED IN 2 LIFTS OR AS APPROVED BY THE ENGINEER.
2. PAYMENT FOR "SPEED HUMP, PER DETAIL P-20" SHALL INCLUDE ALL LABOR, EQUIPMENT, MATERIALS, AND PAVEMENT MARKINGS REQUIRED TO CONSTRUCT EACH SPEED HUMP PER THIS DETAIL AND AS SHOWN ON DRAWINGS.
3. THE SPEED HUMP SHALL NOT BE INSTALLED LESS THAN 12 HOURS AFTER PLACEMENT TOP COURSE.
4. THE CONTRACTOR SHALL PLACE HOT-POURED JOINT SEALANT AROUND THE PERIMETER OF THE AREA COLD MILLED IN ACCORDANCE WITH SECTION 914 OF THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
5. COLD PLASTIC WHITE PAVEMENT MARKINGS (12-INCH) PER MUTCD FIGURE 3B-29 OPTION C.

SPEED HUMP

N.T.S.

APPROVED BY

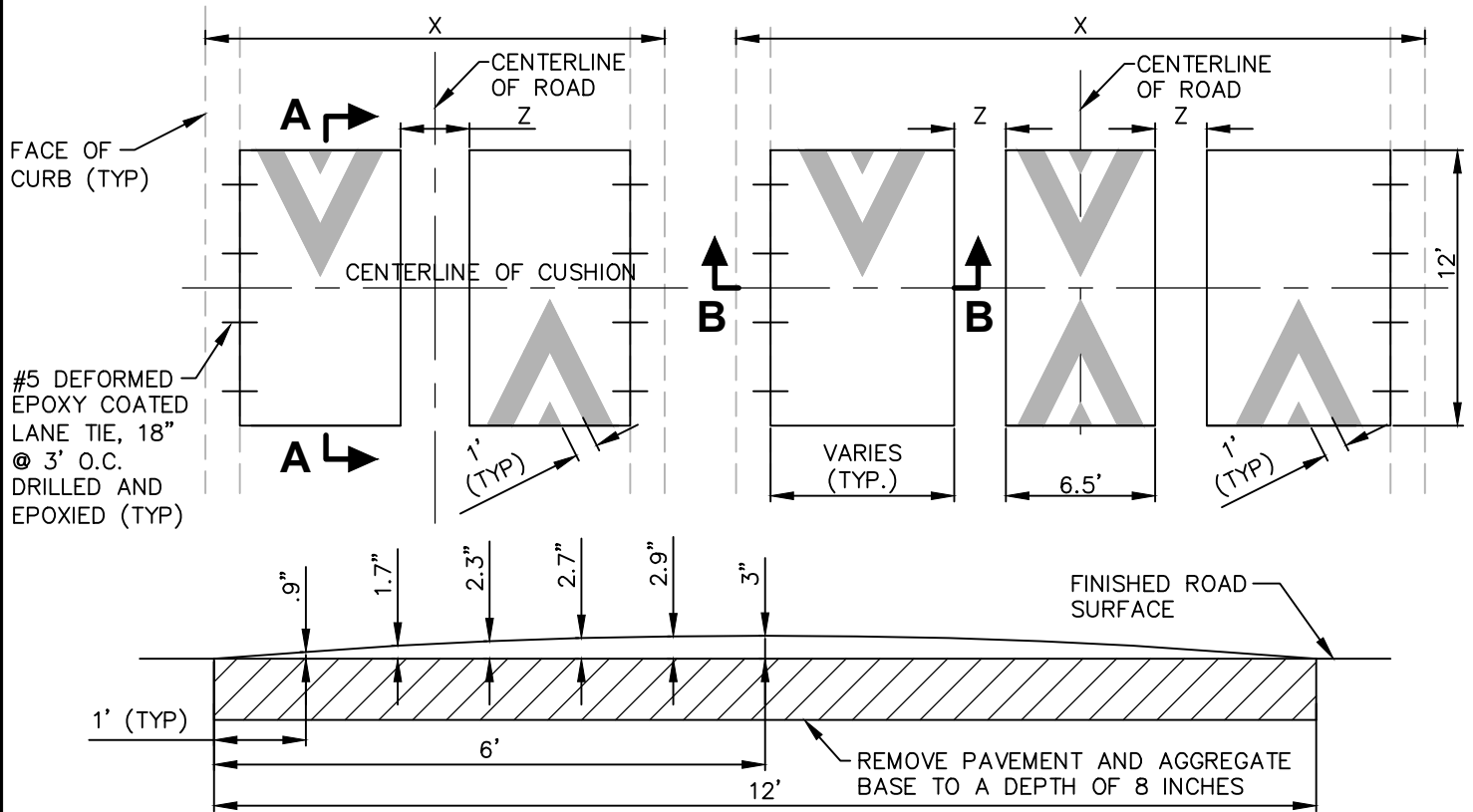
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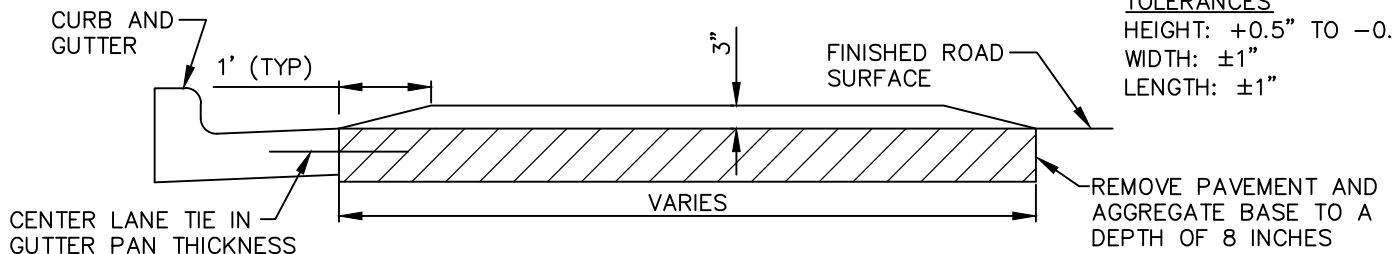
LAST REVISION DATE
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SECTION A-A



SECTION B-B

TOLERANCES

HEIGHT: +0.5" TO -0.5"
WIDTH: ±1"
LENGTH: ±1"

NOTES:

1. CONCRETE PLACED FOR SPEED CUSHION SHALL BE GRADE 3500 CONCRETE OR AS APPROVED BY THE ENGINEER. PAYMENT FOR "SPEED CUSHION, PER DETAIL P-20A" SHALL INCLUDE ALL LABOR, EQUIPMENT, MATERIALS, AND PAVEMENT MARKINGS REQUIRED TO CONSTRUCT EACH SPEED CUSHION (2-CUSHION OR 3-CUSHION) PER THIS DETAIL AND AS SHOWN ON DRAWINGS. PAYMENT FOR PAVEMENT REMOVAL TO CONSTRUCT EACH SPEED CUSHION SHALL BE INCLUDED IN THE PRICE OF THE CUSHION AND NOT PAID FOR SEPARATELY.
2. INSTALL SPEED CUSHIONS A MINIMUM OF 12 HOURS AFTER PLACEMENT TOP COURSE.
3. VIBRATE CONCRETE IN PLACE AT INTERVALS NO GREATER THAN 12 INCHES O.C. DO NOT DRAG VIBRATOR THROUGH CONCRETE. DO NOT OVER VIBRATE CONCRETE.
4. TINE FINISH CONCRETE FLUSH WITH THE SURROUNDING PAVEMENT.
5. PROTECT SURROUNDING PAVEMENT FROM CONCRETE SPLATTER AND CLEAN AREA OUTSIDE SPEED CUSHION AREA UPON COMPLETION.
6. DO NOT USE HIGH EARLY CONCRETE MIX.
7. APPLY CONCRETE CURE IMMEDIATELY UPON COMPLETION OF POURING AND FINISHING. REMOVE CURE UNDER PROPOSED PAVEMENT MARKINGS PRIOR TO INSTALLATION OF MARKINGS. REMOVAL OF CURE IS INCLUDED IN THE PRICE FOR "SPEED CUSHION, DETAIL P-20A".
8. PROTECT CONCRETE SPEED CUSHION FROM TRAFFIC AND EQUIPMENT FOR A MINIMUM OF 72 HOURS.
9. PLACE HOT-POURED JOINT SEALANT AROUND THE PERIMETER OF THE CUSHIONS AND ANY ACCIDENTAL OVERCUT IN ACCORDANCE WITH SECTION 914 OF THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
10. IF REQUIRED BY THE ENGINEER, ONE OF THE OUTSIDE CUSHIONS AT EACH LOCATION MAY BE REQUIRED TO BE INSTALLED A MINIMUM OF 72 HOURS AFTER THE OTHER CUSHIONS ARE INSTALLED TO ALLOW FOR TEMPORARY THROUGH TRAFFIC DURING CONSTRUCTION. THIS IS INCLUDED IN THE PRICE FOR "SPEED CUSHION, DETAIL P-20A".
11. WHITE WET RETROREFLECTIVE POLYUREA PAVEMENT MARKINGS (12-INCH) PER MMUTCD FIGURE 3B-29 OPTION A.
12. AT 34 FEET, WIDEN THE OUTSIDE CUSHIONS TO 7 FEET. AT 25 FEET, IF THERE IS CURB, PLACE 2 CUSHIONS, IF NO CURB, PLACE 3 CUSHIONS.

2-CUSHION SPACING	
X ROAD WIDTH (FT)	Z CUSHION SPACE
18	2'-3"
19	3'-0"
20	3'-0"
21	3'-0"
22	3'-0"
23	3'-6"
24	3'-6"
25	3'-6"

3-CUSHION SPACING	
X ROAD WIDTH (FT)	Z CUSHION SPACE
26	1'-9"
27	2'-0"
28	2'-6"
29	3'-0"
30	3'-0"
31	3'-6"
32	3'-6"
33	3'-6"
34	3'-6"
35	3'-6"

SPEED CUSHION

N.T.S.

APPROVED BY

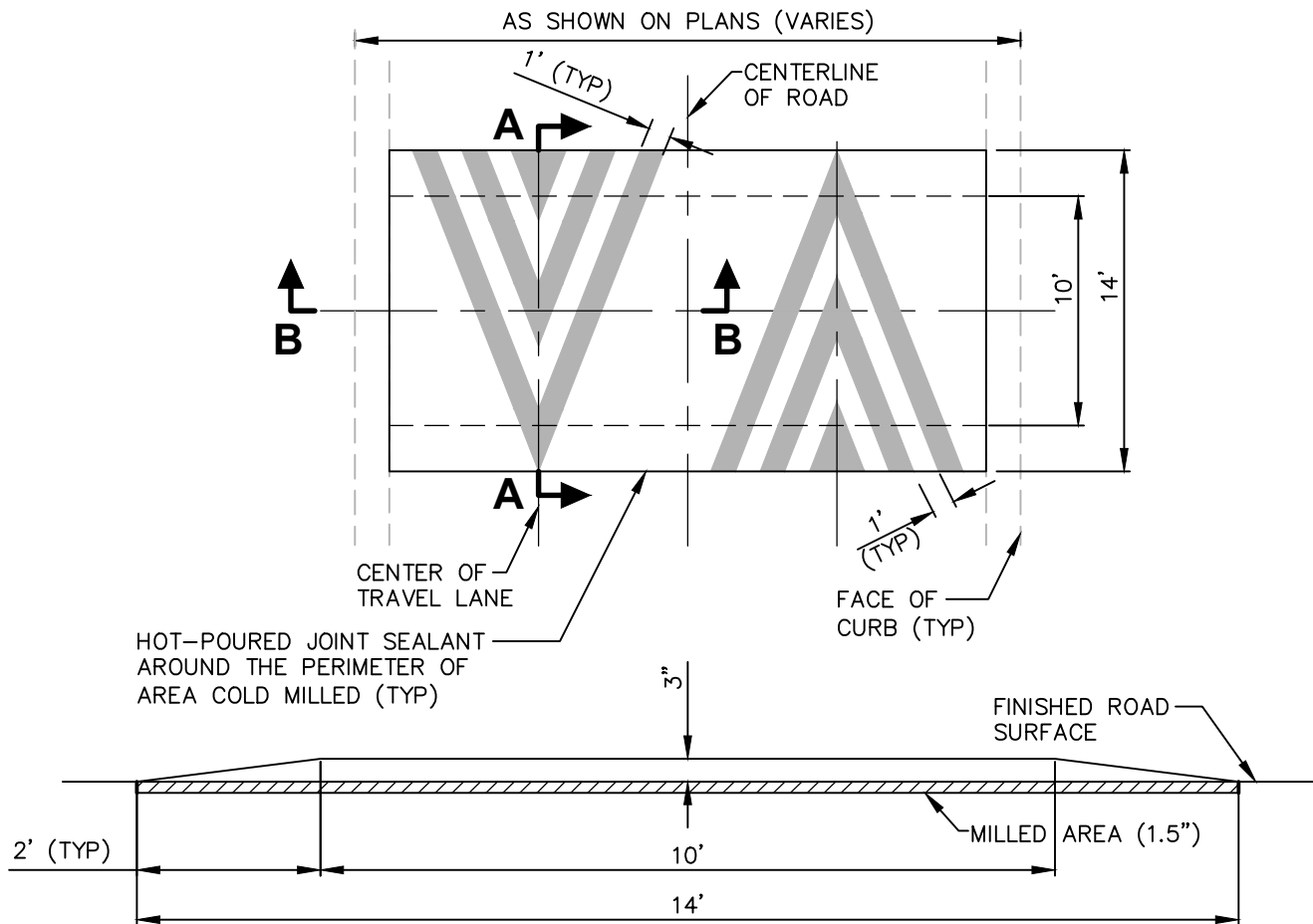
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P-20A



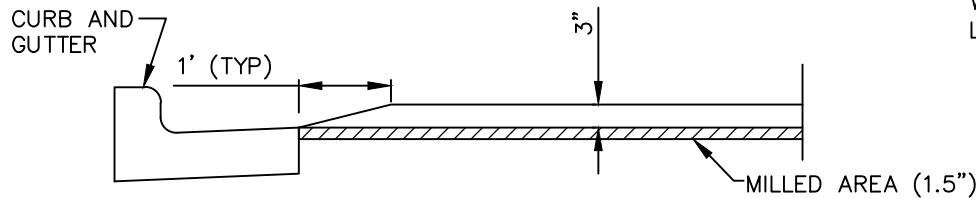
SECTION A-A

TOLERANCES

HEIGHT: +0.5" TO -0.5"

WIDTH: $\pm 1"$

LENGTH: $\pm 1"$



SECTION B-B

NOTES:

1. HMA MIXTURE SHALL BE LVSP AND BE PLACED IN 2 LIFTS OR AS APPROVED BY THE ENGINEER.
2. PAYMENT FOR "SPEED TABLE, PER DETAIL P-20B" SHALL INCLUDE ALL LABOR, EQUIPMENT, MATERIALS, AND PAVEMENT MARKINGS REQUIRED TO CONSTRUCT EACH SPEED TABLE PER THIS DETAIL AND AS SHOWN ON DRAWINGS.
3. THE SPEED TABLES SHALL NOT BE INSTALLED LESS THAN 12 HOURS AFTER PLACEMENT TOP COURSE.
4. THE CONTRACTOR SHALL PLACE HOT-POURED JOINT SEALANT AROUND THE PERIMETER OF THE AREA COLD MILLED IN ACCORDANCE WITH SECTION 914 OF THE CURRENT MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
5. COLD PLASTIC WHITE PAVEMENT MARKINGS (12-INCH) PER MUTCD FIGURE 3B-29 OPTION C.

SPEED TABLE

N.T.S.

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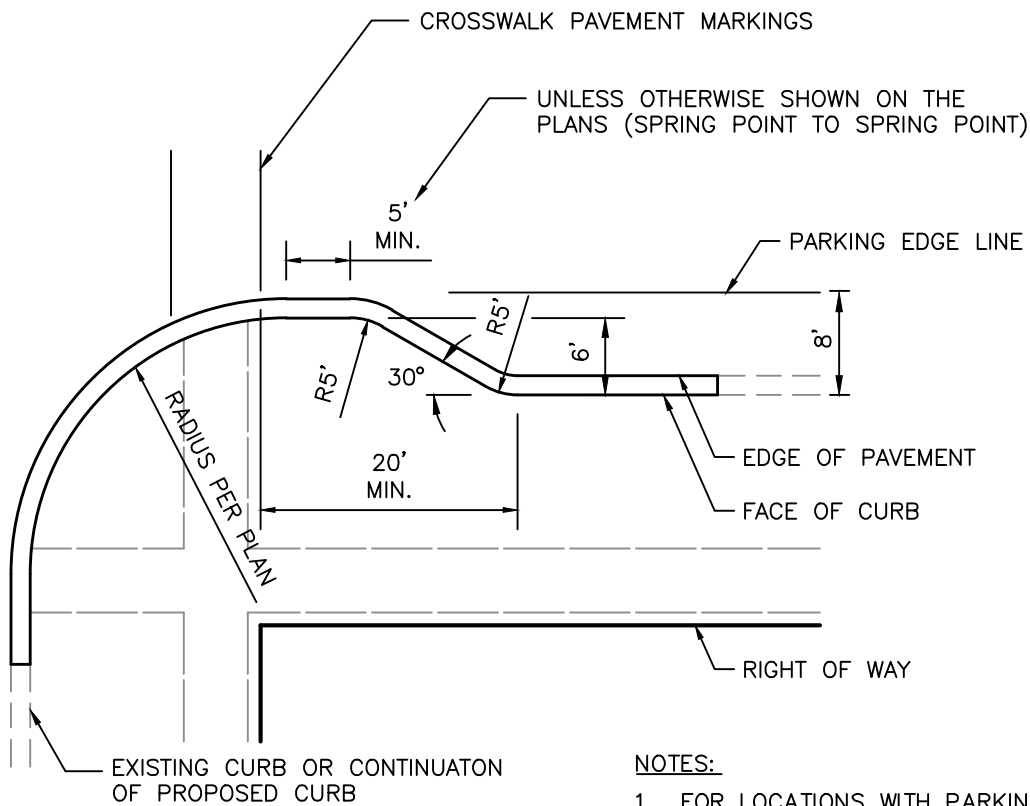
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1/4/2021

LAST REVISION DATE
1/23/2023

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Engineering Department

P-20B



NOTES:

1. FOR LOCATIONS WITH PARKING. CROSSWALK TO PARKING DISTANCE TO BE 20 FOOT MINIMUM.

BULB-OUT DETAIL

N.T.S.

APPROVED BY

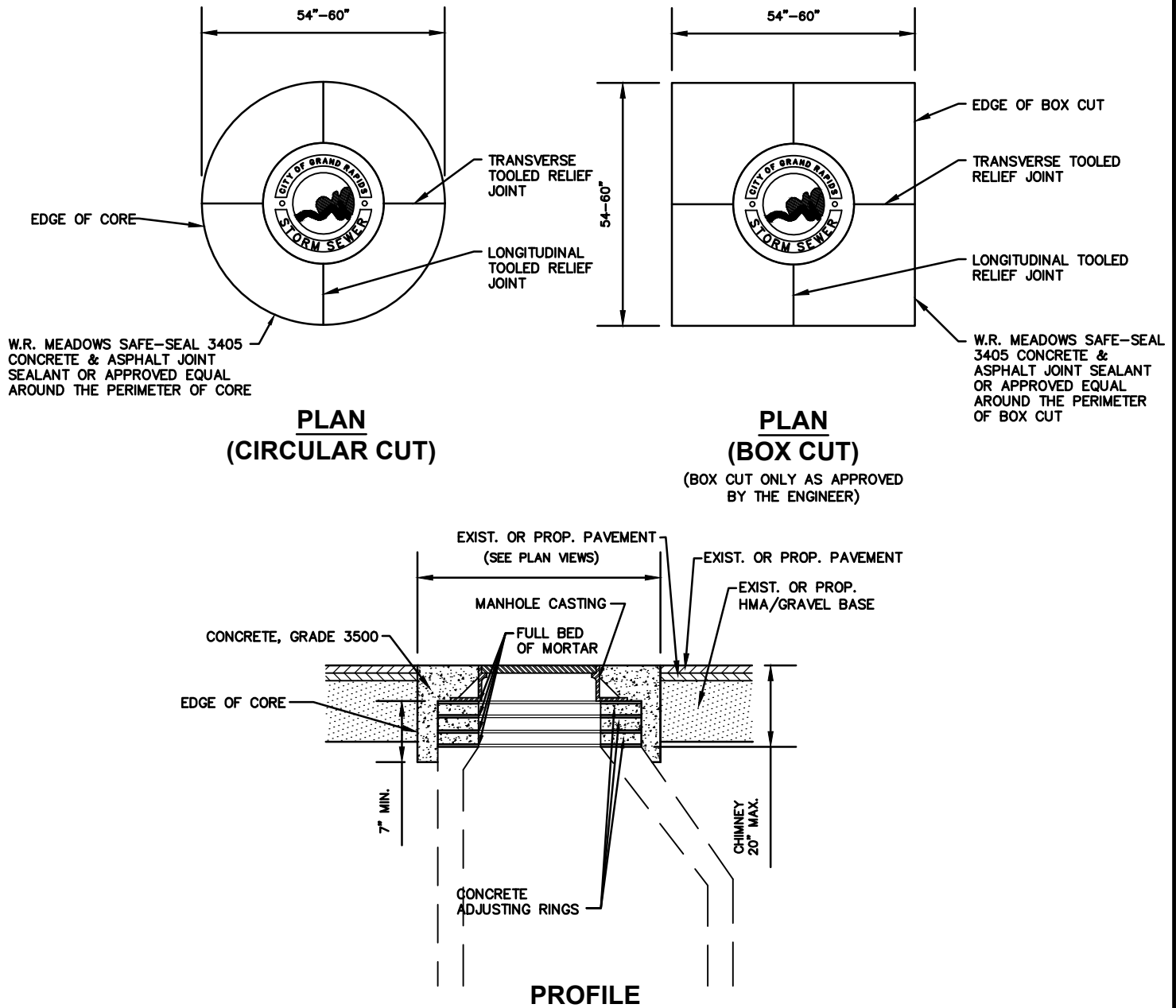
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APPROVED AFTER THIS DATE
01/10/2025

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NOTES:

1. THE CONTRACTOR SHALL PAVE ALL LIFTS OF HMA (BASE, LEVELING, AND TOP) BEFORE RAISING THE CASTINGS.
2. ALL STRUCTURES SHALL BE WITNESSED AND LOGGED UTILIZING GPS PRIOR TO REMOVING EXISTING CASTINGS.
3. BOX CUTS MAY BE PERMITTED IN SPECIAL CIRCUMSTANCE, AS APPROVED BY THE ENGINEER. EXCESS SAW CUTS (OVERCUT) SHALL BE SEALED UPON COMPLETION.
4. ONLY SAW CUTTING AND HOLE CUTS SHALL BE ALLOWED. JACKHAMMERING MAY ONLY BE ALLOWED TO REMOVE PAVEMENT WITHIN THE PRECUT PAVEMENT.
5. EDGE OF CORE SHALL BE A CONTINUOUS VERTICAL EDGE THROUGH THE FULL DEPTH OF PAVEMENT. CONTRACTOR SHALL GRIND SMOOTH ANY LIPS OR LEDGES THAT REMAIN AFTER INITIAL CORE OR CUT AND BEFORE PLACEMENT OF CONCRETE.
6. CONCRETE SHALL BE VIBRATED IN PLACE. VIBRATOR SHALL BE INSERTED AT 12" INTERVALS AND SHALL NOT BE DRAGGED THROUGH CONCRETE. CARE SHALL BE TAKEN AS TO NOT OVER VIBRATE CONCRETE.
7. THE TOP OF THE CONCRETE SHALL BE BROOM FINISHED FLUSH WITH THE SURROUNDING HMA.
8. CASTINGS SHALL BE PROTECTED FROM CONCRETE SPLATTER AND SHALL ALSO BE CLEANED UPON COMPLETION.
9. NO HIGH EARLY CONCRETE MIX SHALL BE ALLOWED.
10. APPLY CURE IMMEDIATELY UPON COMPLETION.
11. THE CONTRACTOR SHALL CLEAN THE AREA OUTSIDE THE HOLE CUT TO ELIMINATE CONCRETE SPLATTER ON THE PAVEMENT.
12. THE CONTRACTOR SHALL PROTECT THE CONCRETE AROUND THE CASTING FROM TRAFFIC AND EQUIPMENT FOR A MINIMUM OF 72 HOURS.
13. THE CONTRACTOR SHALL PLACE W.R. MEADOWS - SAFE-SEAL 3405 - CONCRETE & ASPHALT JOINT SEALANT OR APPROVED EQUAL AROUND THE PERIMETER OF CORE/BOX CUT IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

ADJUSTMENT OF MANHOLE CASTING

N.T.S.

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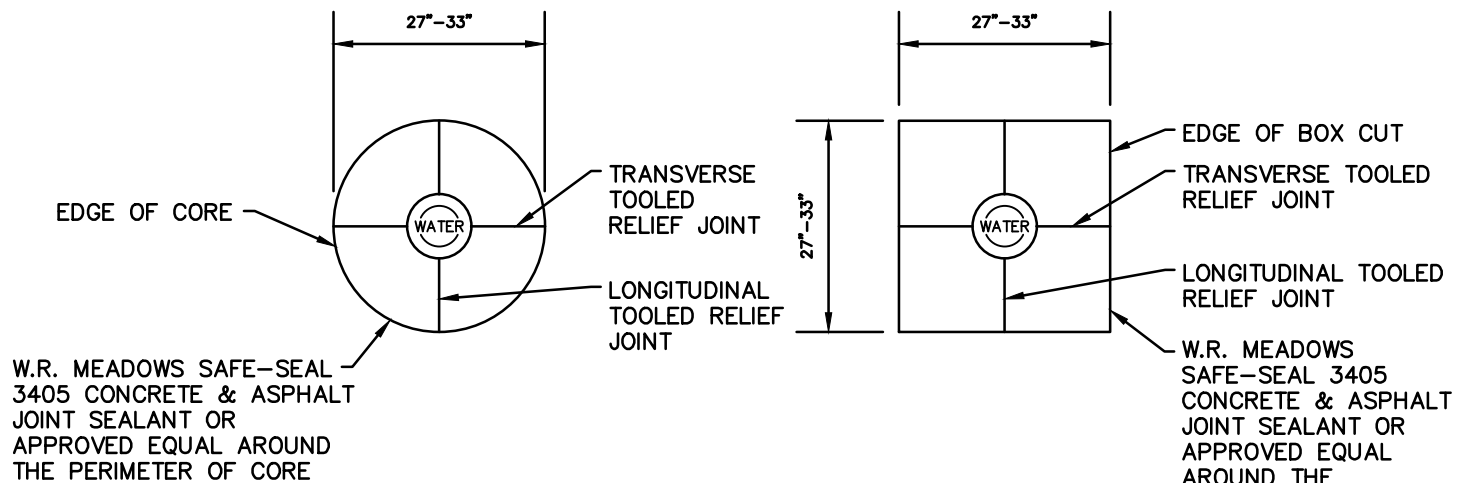
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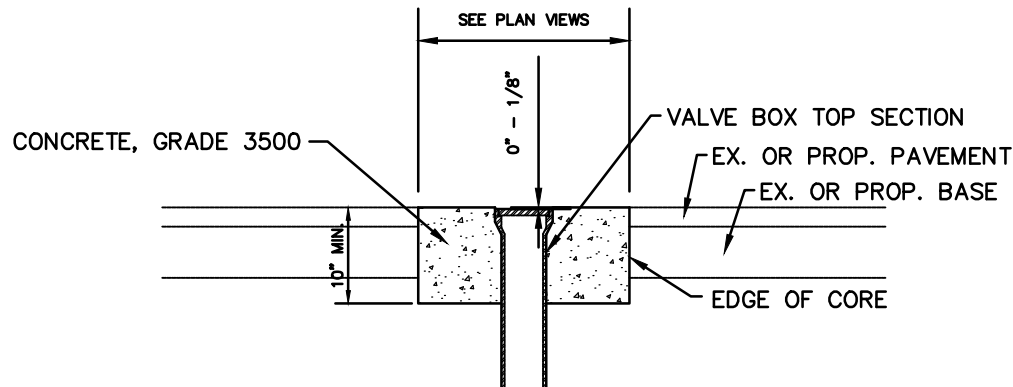
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**PLAN
(CIRCULAR CUT)**

**PLAN
(BOX CUT)**
(BOX CUT ONLY AS
APPROVED BY THE ENGINEER)



PROFILE

NOTES:

1. THE CONTRACTOR SHALL PAVE ALL LIFTS OF HMA (BASE, LEVELING, AND TOP) BEFORE RAISING THE CASTINGS.
2. ALL STRUCTURES SHALL BE WITNESSED AND LOGGED UTILIZING GPS PRIOR TO REMOVING EXISTING CASTINGS.
3. BOX CUTS MAY BE PERMITTED IN SPECIAL CIRCUMSTANCE, AS APPROVED BY THE ENGINEER. EXCESS SAW CUTS (OVERCUT) SHALL BE SEALED UPON COMPLETION.
4. ONLY SAW CUTTING AND HOLE CUTS SHALL BE ALLOWED. JACKHAMMERING MAY ONLY BE ALLOWED TO REMOVE PAVEMENT WITHIN THE PRECUT PAVEMENT.
5. EDGE OF CORE SHALL BE A CONTINUOUS VERTICAL EDGE THROUGH THE FULL DEPTH OF PAVEMENT. CONTRACTOR SHALL GRIND SMOOTH ANY LIPS OR LEDGES THAT REMAIN AFTER INITIAL CORE OR CUT AND BEFORE PLACEMENT OF CONCRETE.
6. CONCRETE SHALL BE VIBRATED IN PLACE. VIBRATOR SHALL BE INSERTED AT 12" INTERVALS AND SHALL NOT BE DRAGGED THROUGH CONCRETE. CARE SHALL BE TAKEN AS TO NOT OVER VIBRATE CONCRETE.
7. THE TOP OF THE CONCRETE SHALL BE BROOM FINISHED FLUSH WITH THE SURROUNDING HMA.
8. CASTINGS SHALL BE PROTECTED FROM CONCRETE SPLATTER AND SHALL ALSO BE CLEANED UPON COMPLETION.
9. NO HIGH EARLY CONCRETE MIX SHALL BE ALLOWED.
10. APPLY CURE IMMEDIATELY UPON COMPLETION.
11. THE CONTRACTOR SHALL CLEAN THE AREA OUTSIDE THE HOLE CUT TO ELIMINATE CONCRETE SPLATTER ON THE PAVEMENT.
12. THE CONTRACTOR SHALL PROTECT THE CONCRETE AROUND THE CASTING FROM TRAFFIC AND EQUIPMENT FOR A MINIMUM OF 72 HOURS.
13. THE CONTRACTOR SHALL PLACE W.R. MEADOWS - SAFE-SEAL 3405 - CONCRETE & ASPHALT JOINT SEALANT OR APPROVED EQUAL AROUND THE PERIMETER OF CORE/BOX CUT IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

ADJUSTMENT OF VALVE BOX CASTING

N.T.S.

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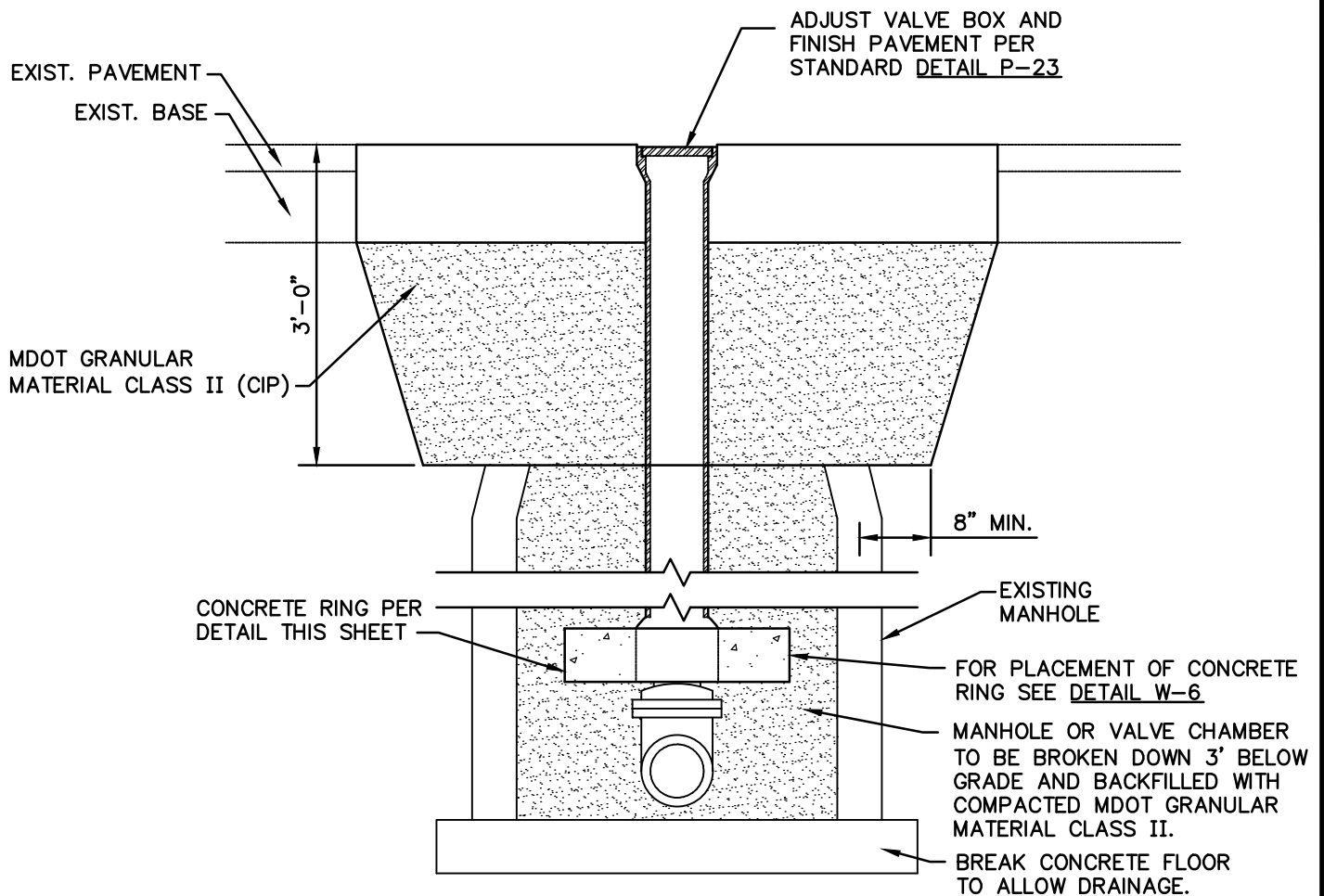
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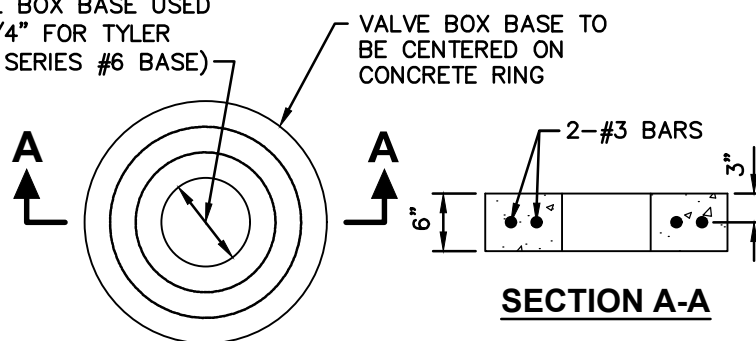
LAST REVISION DATE
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P-23



DIAMETER TO BE AS NEEDED FOR SIZE OF VALVE BOX BASE USED (9-1/4" FOR TYLER 6860 SERIES #6 BASE)



CONCRETE RING DETAIL

ABANDON VALVE CHAMBER AND PLACE VALVE BOX

N.T.S.

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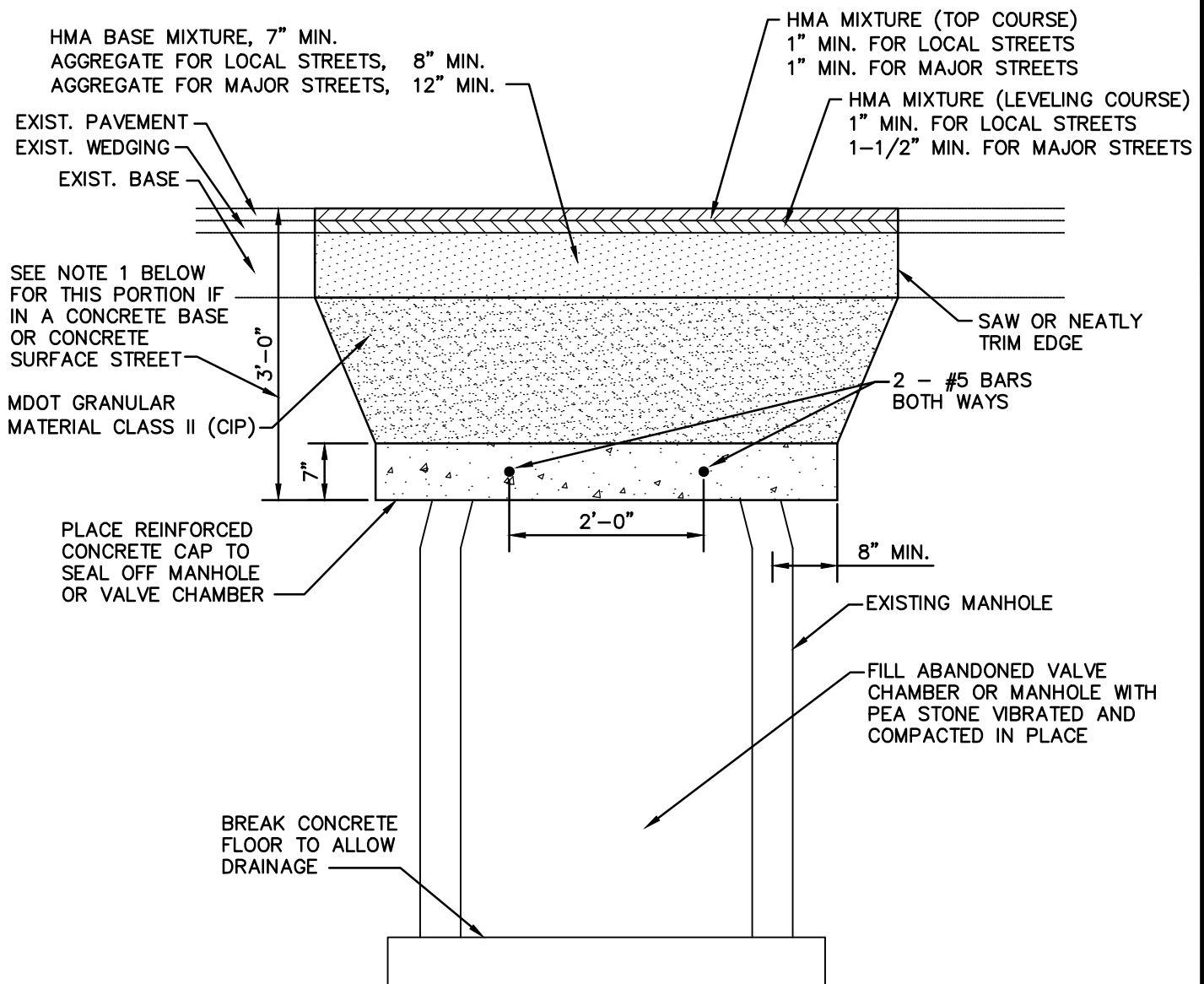
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P-23A



NOTES:

1. IF EXIST. PAVEMENT IS CONCRETE, DELETE HMA AND AGGREGATE BASE AND PLACE CONCRETE AT SAME THICKNESS AS THE EXISTING PAVEMENT (7" MIN.). IF EXIST. BASE IS CONCRETE DELETE HMA AND PLACE CONCRETE BASE AT SAME THICKNESS AS THE EXISTING BASE (7" MIN.) LEAVE BASE DOWN 2-1/2" (MIN.) BELOW EXISTING SURFACE.
2. MANHOLE, CATCH BASIN OR VALVE CHAMBER MAY BE BROKEN DOWN 3' BELOW GRADE AND BACKFILLED WITH COMPACTED MDOT GRANULAR MATERIAL CLASS II OR THESE STRUCTURES MAY BE REMOVED ENTIRELY AND BACKFILLED WITH COMPACTED MDOT GRANULAR MATERIAL CLASS II. IN LIEU OF BACKFILLING WITH PEA STONE AND SEALING WITH THE REINFORCED CONCRETE CAP.

CLEAN AND REMOVE MANHOLE, VALVE CHAMBER OR CATCH BASIN

N.T.S.

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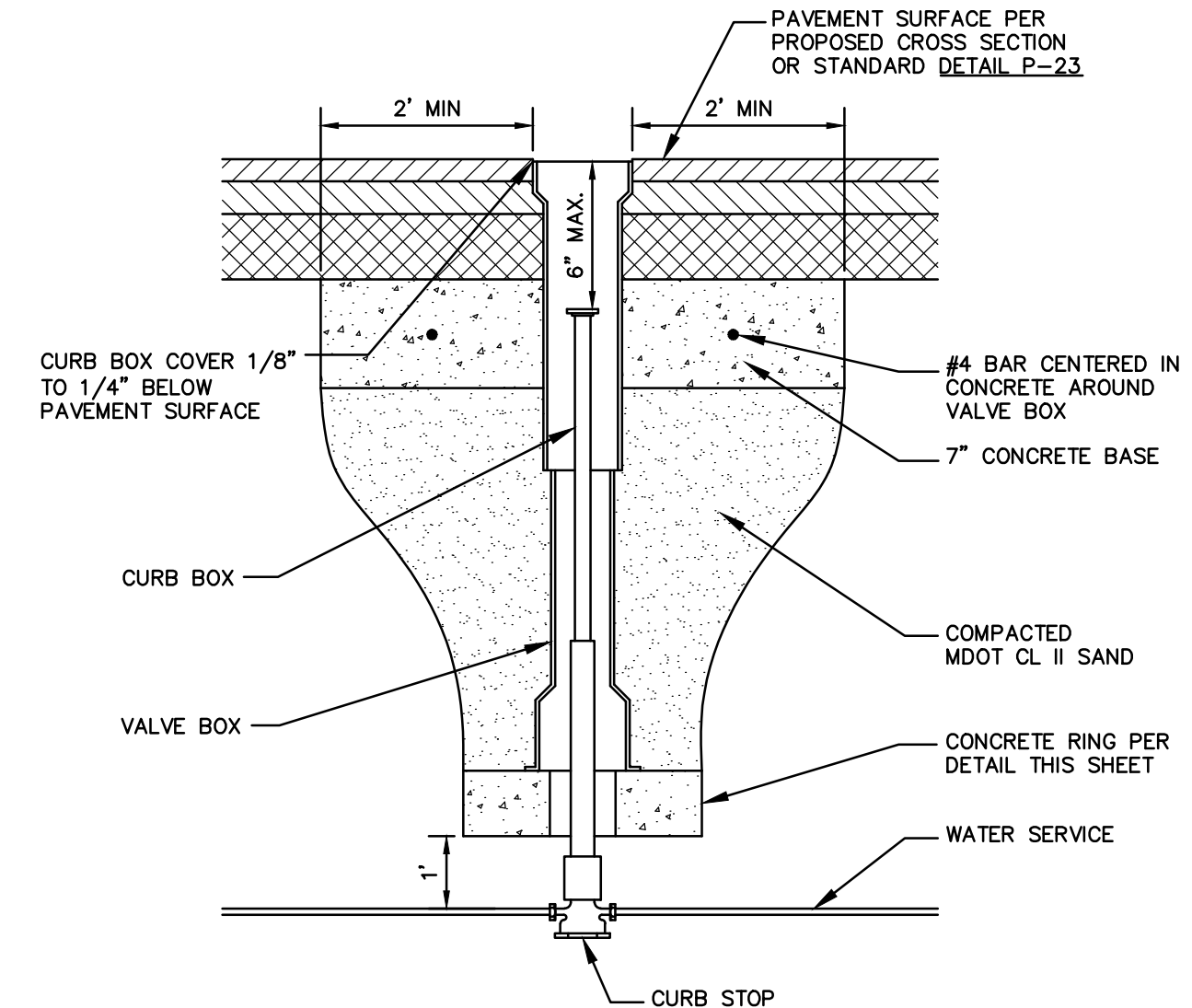
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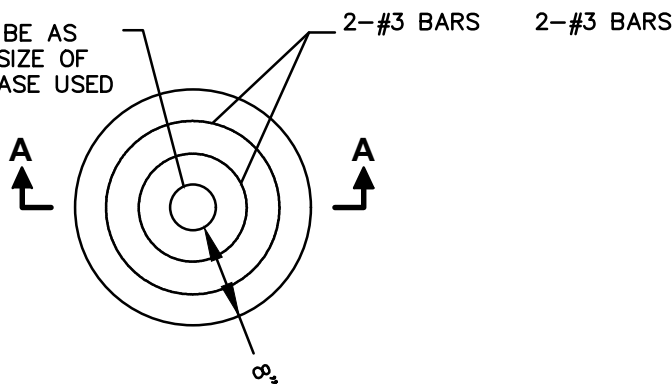
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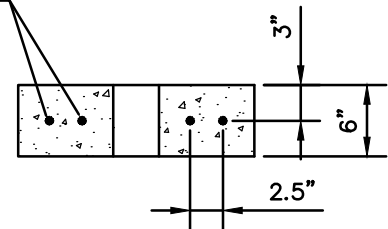
P-23B



DIAMETER TO BE AS
NEEDED FOR SIZE OF
VALVE BOX BASE USED



**CONCRETE
RING DETAIL**



SECTION A-A

NOTE: FOR USE IN PRIVATE DRIVES
WITH COMMERCIAL TRAFFIC AND
COMMERCIAL DRIVEWAYS. NOT FOR
USE IN RESIDENTIAL DRIVEWAYS.

CURB BOX IN PAVEMENT

N.T.S.

APPROVED BY

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P-23C

STANDARD GRAND RAPIDS
MANHOLE CASTING AND COVER
DETAIL S-13; USE S-13A AND
S-14 WHEN SPECIFIED OR
SHOWN ON DRAWINGS; WHEN
S-13A IS REQUIRED, ADJUST
CONE ACCORDINGLY

SURFACE OF GROUND
OR STREET

STEPS MAY BE
STAGGERED
OR STRAIGHT

SET IN A FULL
BED OF MORTAR

PORTLAND CEMENT BRICK
OR BLOCK, OR CONCRETE
PRECAST ADJUSTING
RING(S), AS REQUIRED

ASTM C-478
RISER SECTION
WITH 5" WALL

MANHOLE STEPS TO BE
PLASTIC COATED STEEL
PER THE SPECIFIED
PRODUCTS INDEX 4.5.B

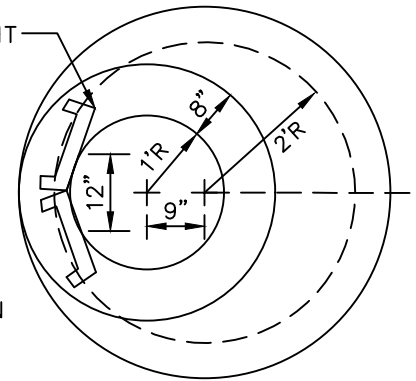
ALL JOINTS BETWEEN
SECTIONS SHALL INCLUDE
AN BUTYL RUBBER GASKET,
CONFORMING TO ASTM
C-443 PER THE SPECIFIED
PRODUCTS INDEX 4.5.B

MORTAR, TYPE R-2 OR
CONCRETE, GRADE 3500

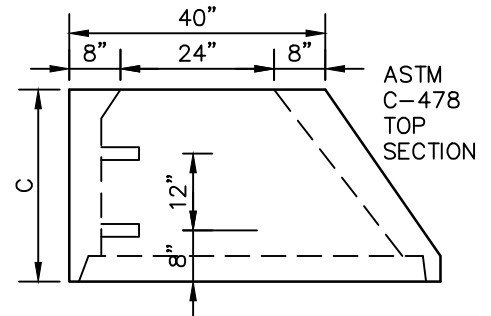
4" MIN.

SEWER
PIPE

PRECAST
CONCRETE
BASE

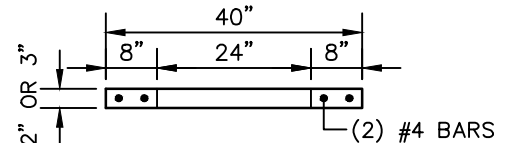


TOP VIEW



TYPICAL RING

(FOR DETAIL S-13 AND S-14 CASTING AND COVER)

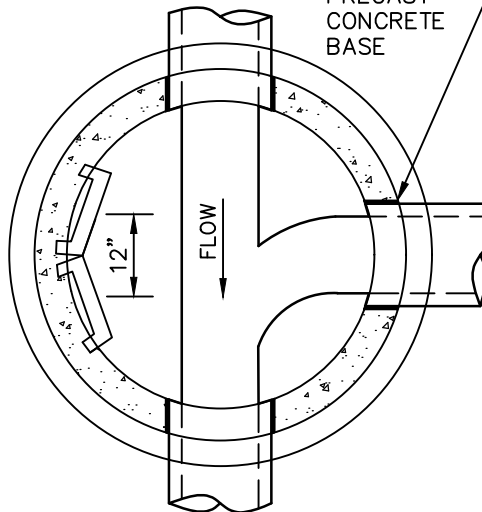


TYPICAL ADJUSTING CONE

NOTES:

1. MANHOLE MAY BE CONSTRUCTED OF ANY COMBINATION OF THE ABOVE NOTED SECTIONS, PROVIDED HOWEVER, THAT THE TOTAL NUMBER OF SECTIONS ARE KEPT TO A MINIMUM.
2. L SECTIONS AND C SECTION TO BE USED IN COMBINATION SO THAT 20" IS THE MAXIMUM DIMENSION BETWEEN THE TOP OF CONE AND FINISHED GRADE.

ALL OPENINGS FOR PIPE UP TO AND INCLUDING 24" DIAMETER SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS PER SPECIFIED THE PRODUCTS INDEX 4.5.D. FOR PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS.



TYPICAL CHANNEL PLAN

TYPE	HEIGHT IN FT.
CONE (C)	2, 3, 4 & 5
BARREL (L)	MIN. 1'-4" & MAX. 8'-0" AT INCREMENTS OF 1'-4"

SECTION DIMENSION

STANDARD PRECAST MANHOLE

N.T.S.

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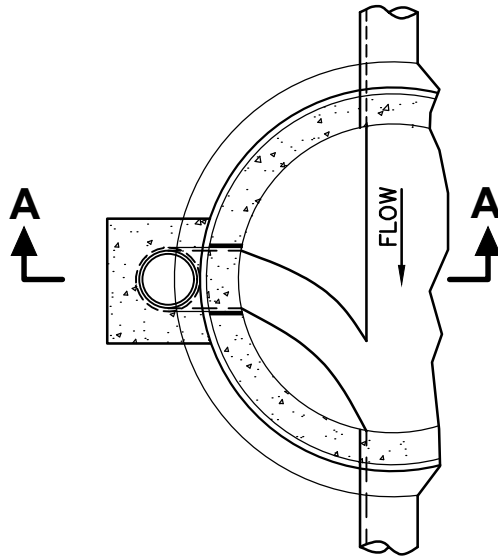
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S-1

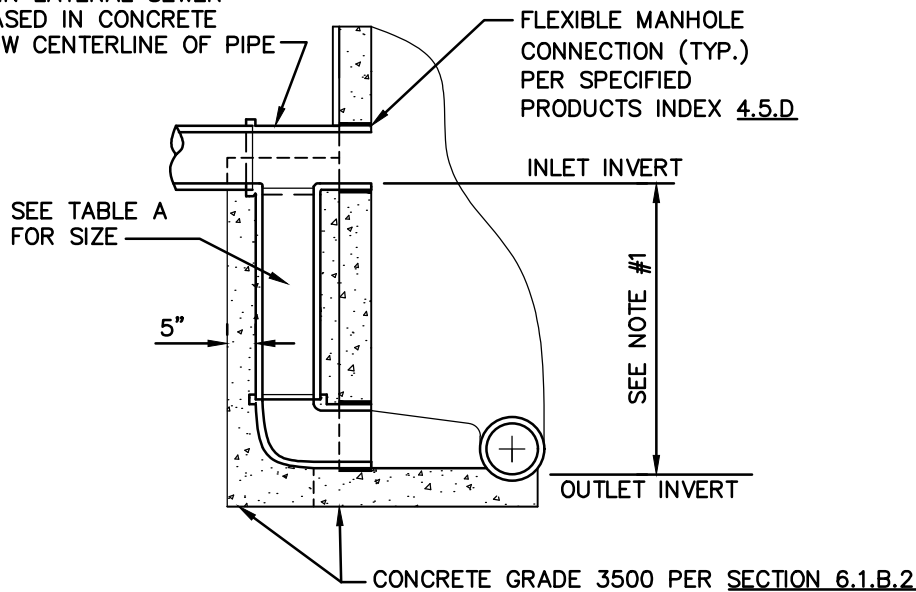


SECTIONAL PLAN

NOTES:

1. ALL INLET INVERTS GREATER THAN 2'-0" ABOVE THE OUTLET INVERT WILL REQUIRE A DROP CONNECTION CONSTRUCTED PER THIS DETAIL.
2. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).
3. OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).

TEE IN LATERAL SEWER
ENCASED IN CONCRETE
BELOW CENTERLINE OF PIPE



SECTION A-A

TABLE A

SIZE OF SEWER	DROP CONNECTION
8"	8"
10"	8"
12"	8"
15"	10"
18"	10"
21"	12"
24"	12"
27"	12"
30"	15"
36"	15"

DROP CONNECTION

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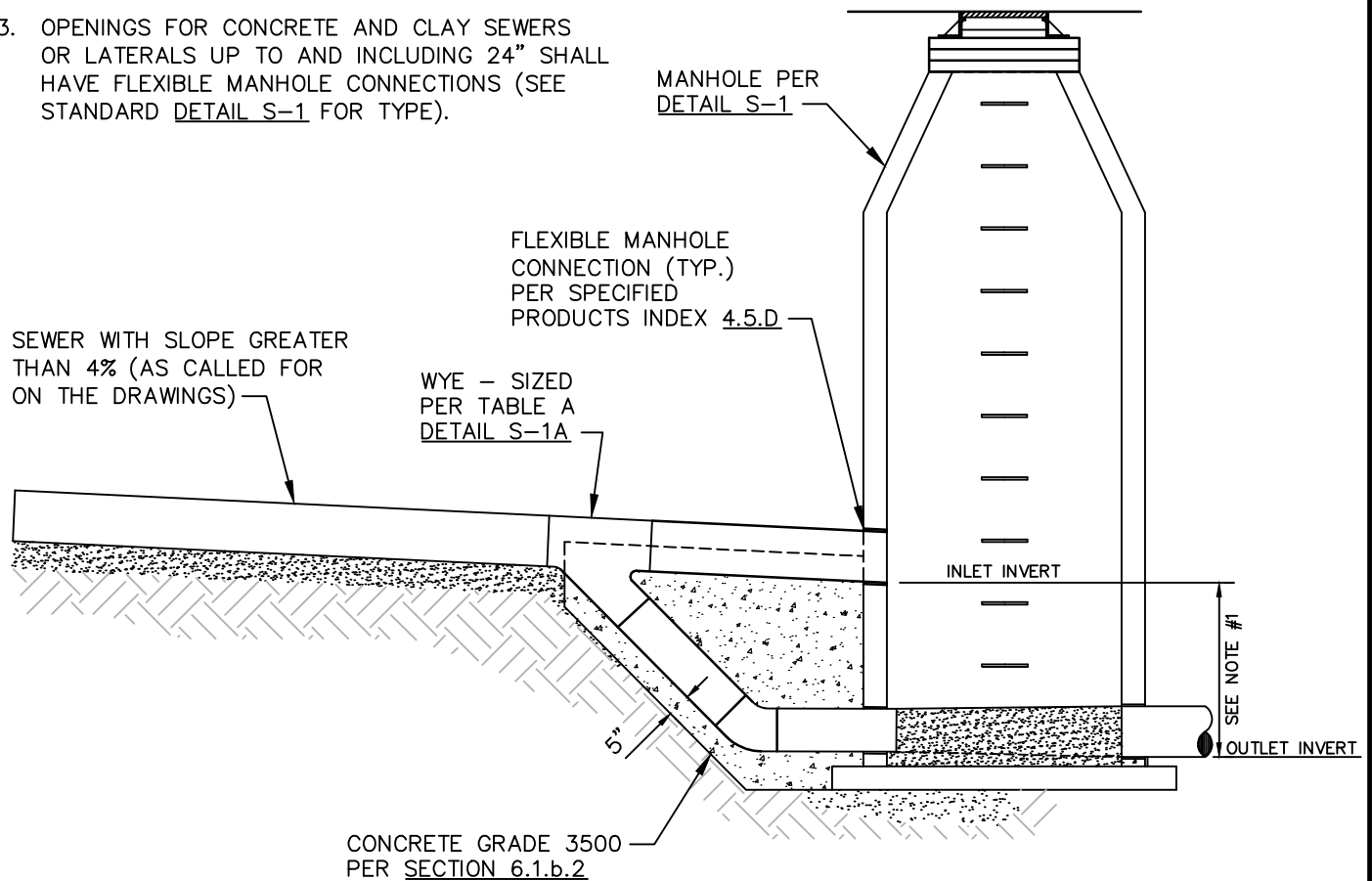
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S-1A

NOTES:

1. ALL INLET INVERTS GREATER THAN 2'-0" ABOVE THE OUTLET INVERT WILL REQUIRE A DROP CONNECTION CONSTRUCTED PER THIS DETAIL.
2. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).
3. OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).



HIGH SPEED DROP INLET TO MANHOLE

N.T.S.

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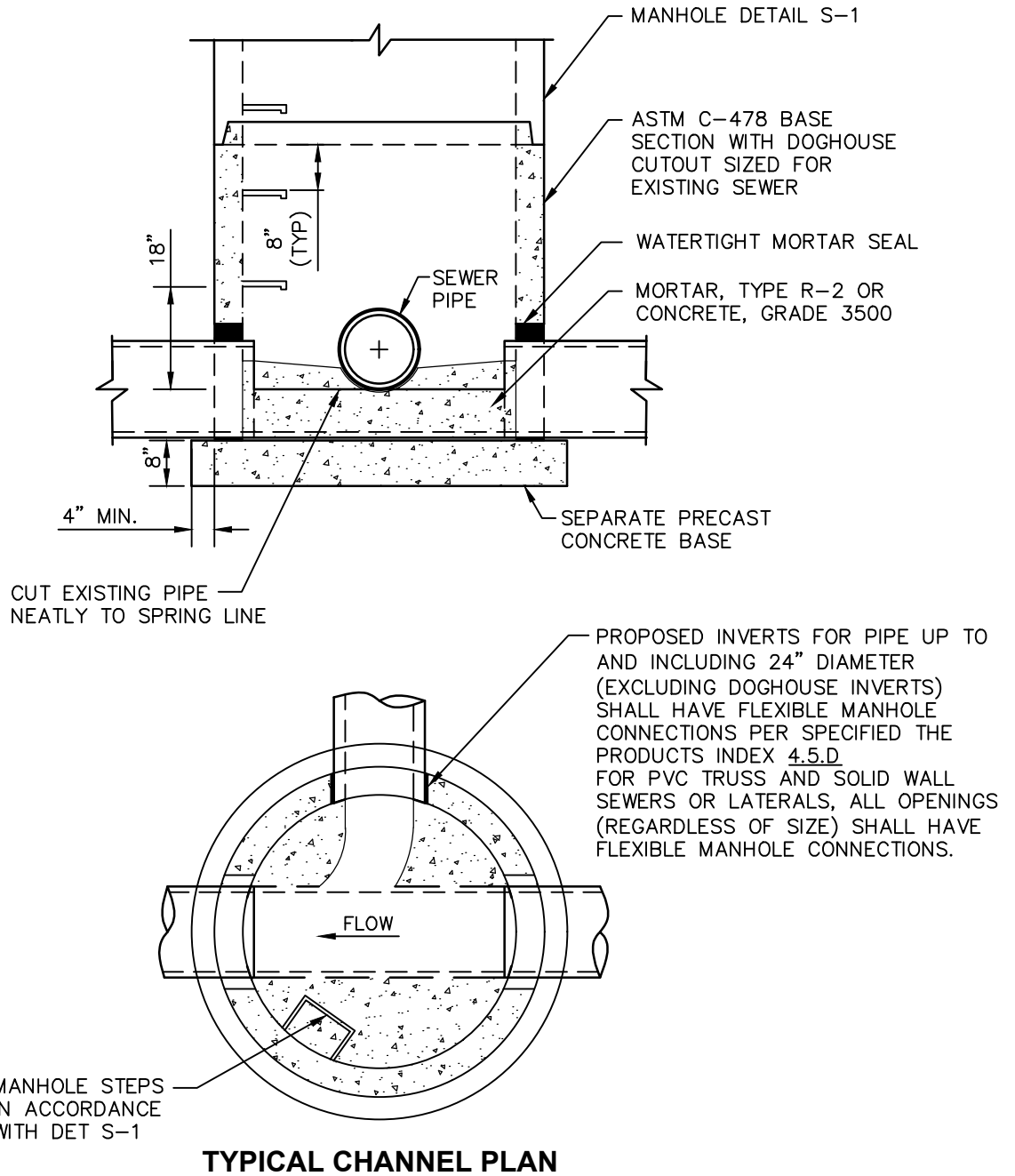
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S-1B



STANDARD PRECAST MANHOLE OVER EXISTING SEWER

N.T.S.

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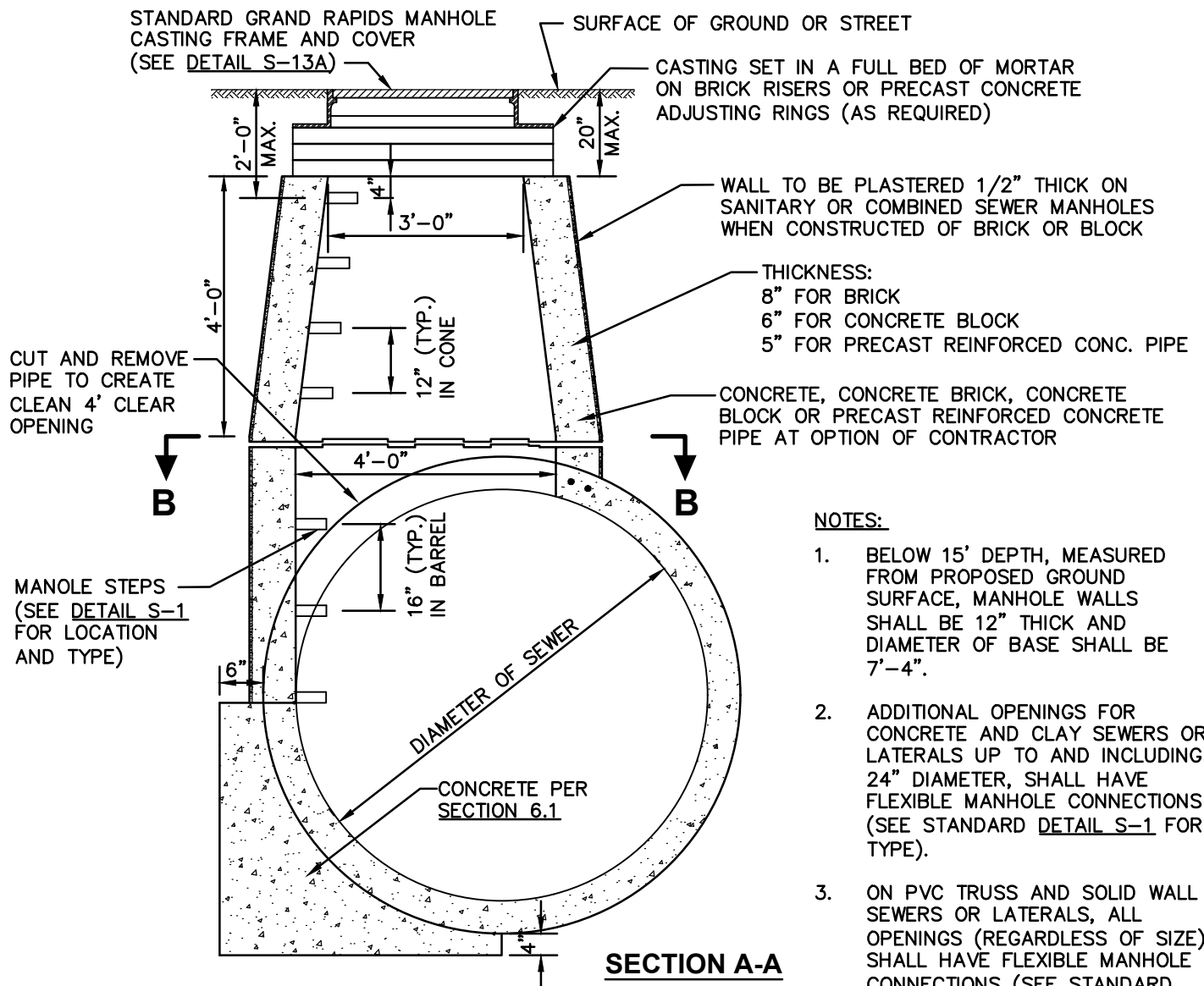
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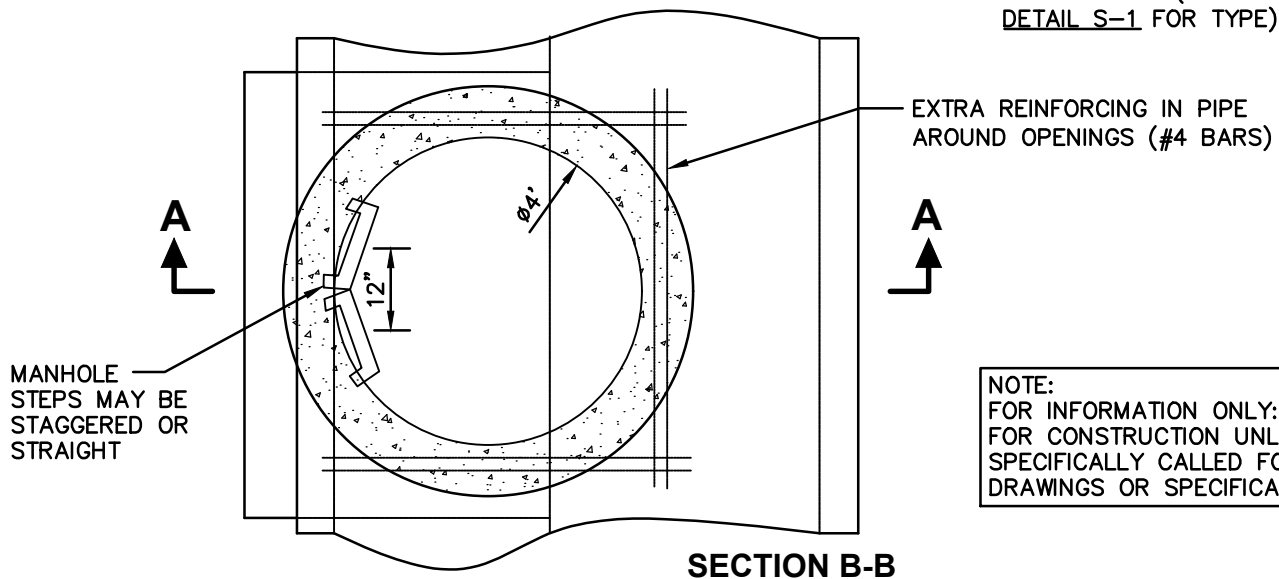
S-1C

S-2



NOTES:

1. BELOW 15' DEPTH, MEASURED FROM PROPOSED GROUND SURFACE, MANHOLE WALLS SHALL BE 12" THICK AND DIAMETER OF BASE SHALL BE 7'-4".
2. ADDITIONAL OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS UP TO AND INCLUDING 24" DIAMETER, SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).
3. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).



NOTE:
FOR INFORMATION ONLY: NOT FOR CONSTRUCTION UNLESS SPECIFICALLY CALLED FOR ON DRAWINGS OR SPECIFICATIONS.

S-2A MANHOLE FOR LARGE DIAMETER SEWER

N.T.S.

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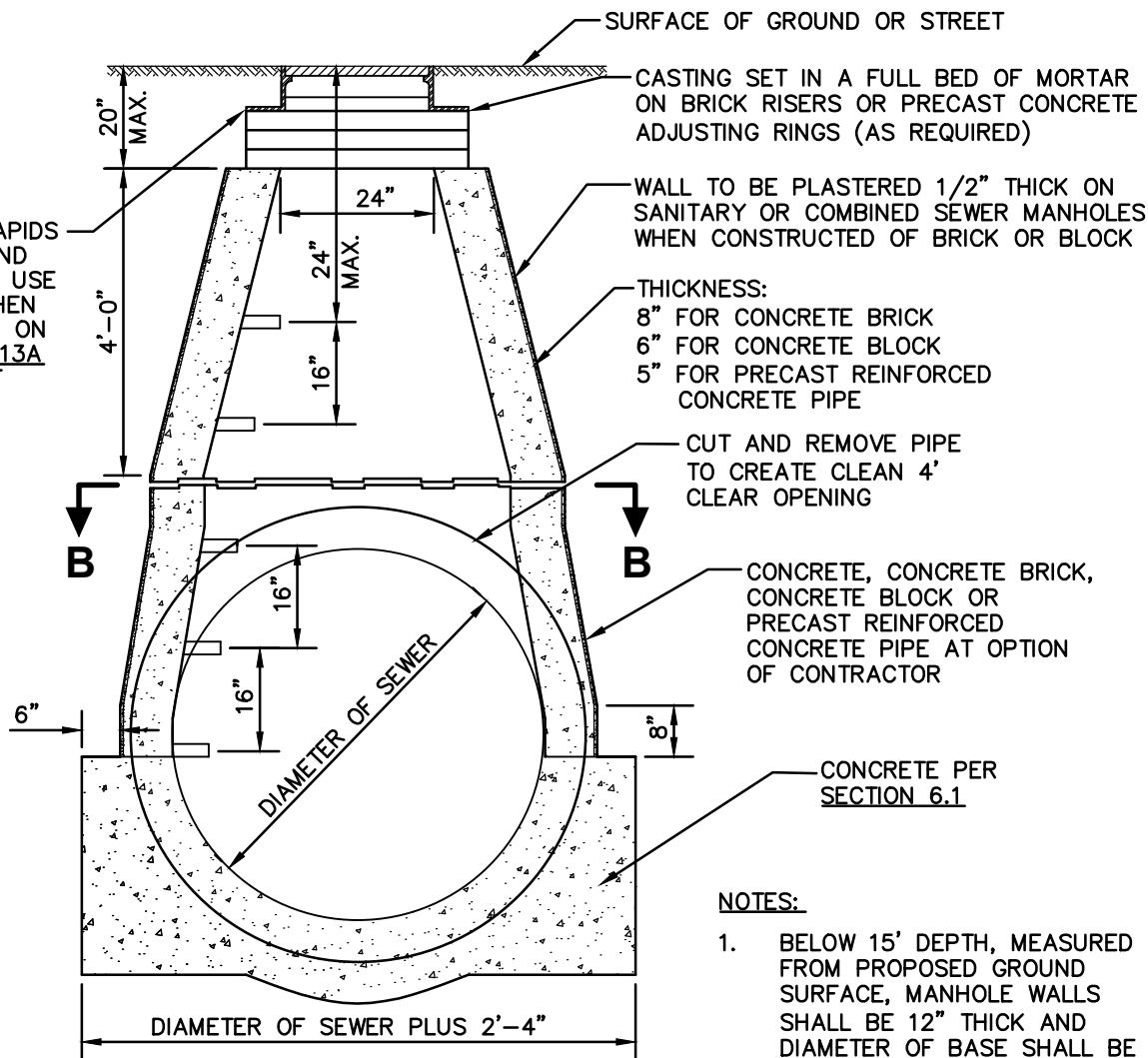
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S-2A

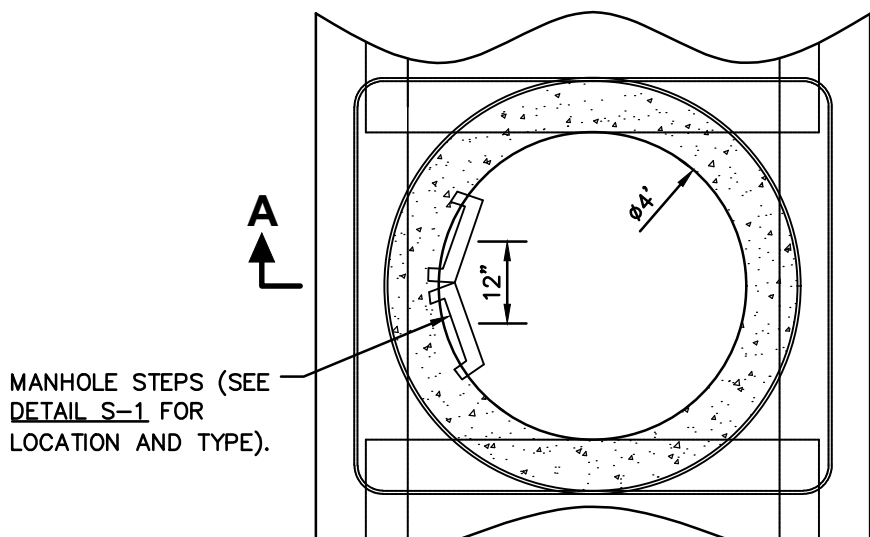
STANDARD GRAND RAPIDS
MANHOLE CASTING AND
COVER DETAIL S-13; USE
S-13A AND S-14 WHEN
SPECIFIED OR SHOWN ON
DRAWINGS; WHEN S-13A
IS REQUIRED, ADJUST
CONE ACCORDINGLY.



NOTES:

1. BELOW 15' DEPTH, MEASURED FROM PROPOSED GROUND SURFACE, MANHOLE WALLS SHALL BE 12" THICK AND DIAMETER OF BASE SHALL BE 7'-4".
2. ADDITIONAL OPENINGS FOR CONCRETE AND CLAY SEWERS OR LATERALS, UP TO AND INCLUDING 24" DIAMETER, SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).
3. ON PVC TRUSS AND SOLID WALL SEWERS OR LATERALS, ALL OPENINGS (REGARDLESS OF SIZE) SHALL HAVE FLEXIBLE MANHOLE CONNECTIONS (SEE STANDARD DETAIL S-1 FOR TYPE).

NOTE: FOR INFORMATION ONLY:
NOT FOR CONSTRUCTION UNLESS
SPECIFICALLY CALLED FOR ON
DRAWINGS OR SPECIFICATIONS.



STANDARD MANHOLE ON EXISTING SEWER

N.T.S.

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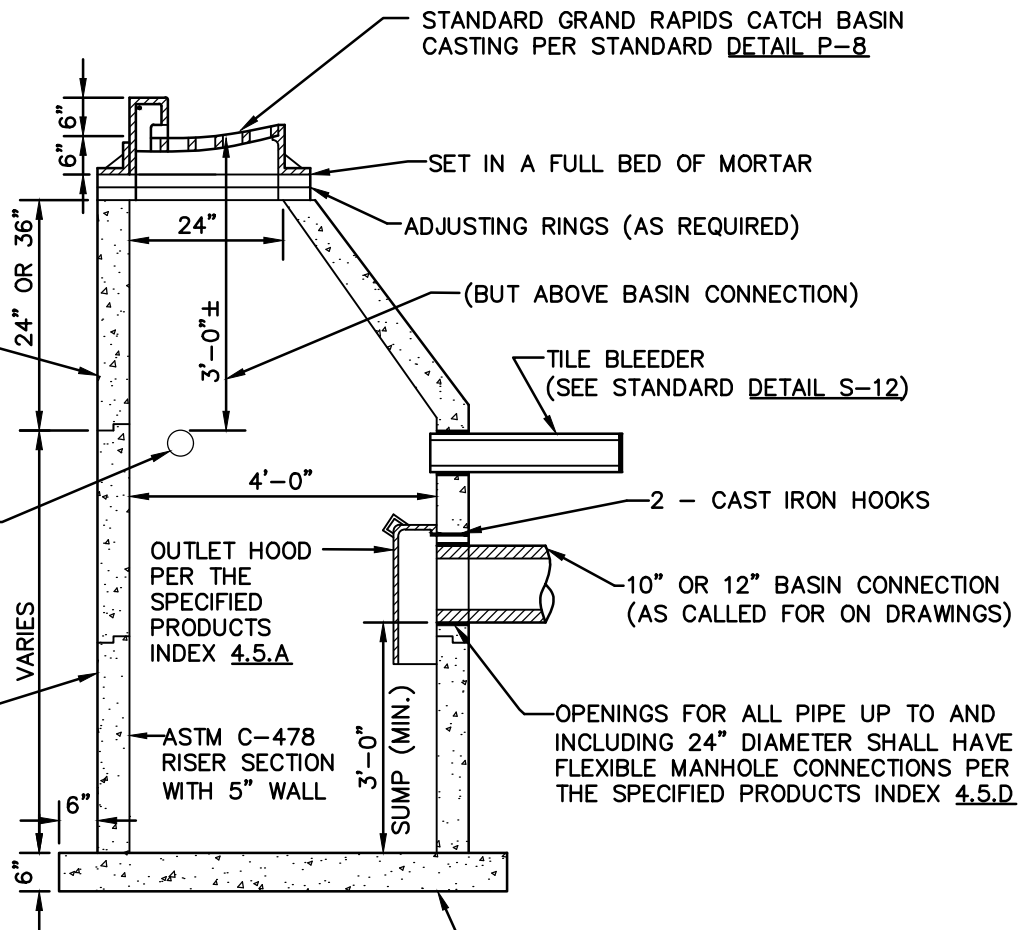
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S-2B

5" PRECAST CONCRETE (ASTM C-478), 8" BRICK OR 6" CONCRETE BLOCK MAY BE USED IN LIEU OF PRECAST CONCRETE ONLY WHEN SPECIFICALLY CALLED FOR ON THE DRAWINGS OR WHEN APPROVED BY THE ENGINEER.

UNDERDRAIN AS SHOWN ON DRAWINGS OR WHEN DIRECTED BY ENGINEER (SEE STANDARD DETAIL S-12 FOR CONNECTIONS)

WALLS TO BE PLASTERED 1/2" THICK WHEN CONSTRUCTED OF BRICK OR BLOCK (TYP.)



SECTION A-A

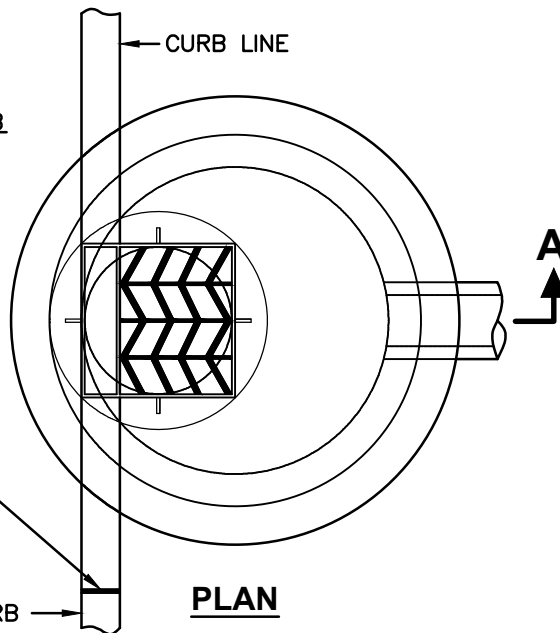
PRECAST CONCRETE BASE

NOTE:

ALL JOINTS BETWEEN SECTIONS SHALL INCLUDE AN BUTYL RUBBER GASKET, CONFORMING TO ASTM C-443 PER THE SPECIFIED PRODUCTS INDEX 4.5.B

1/2" EXPANSION JOINT TO BE INSTALLED AT CLOSEST JOINT ON EITHER SIDE OF BASIN. CLOSEST JOINT NOT TO EXCEED 10' (MAX.).

STANDARD CONCRETE CURB



PLAN

NOTE:

FLAT TOP CATCH BASIN AS SHOWN IN STANDARD DETAIL S-4 MAY BE USED WITH S-3 CASTING IN LIEU OF THE S-3 BASIN WHEN APPROVED BY THE ENGINEER.

**STANDARD PRECAST CATCH BASIN
IN STANDARD OR ROLL CURB**

N.T.S.

APPROVED BY

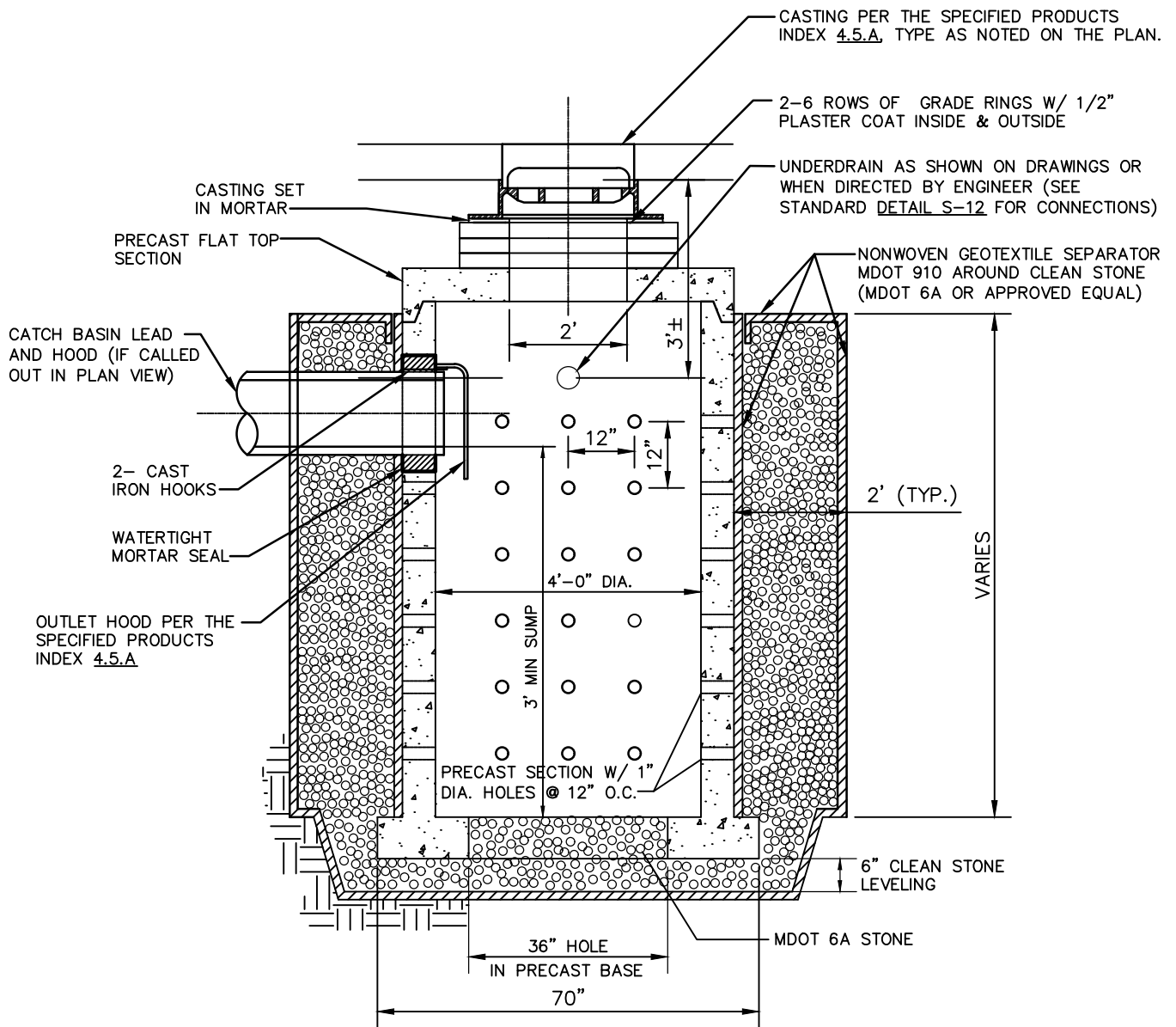
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S-3



NOTES:

1. ALL JOINTS BETWEEN SECTIONS SHALL INCLUDE AN BUTYL RUBBER GASKET, CONFORMING TO ASTM C-443 PER THE SPECIFIED PRODUCTS INDEX 4.5.B

STANDARD INFILTRATION BASIN

N.T.S.

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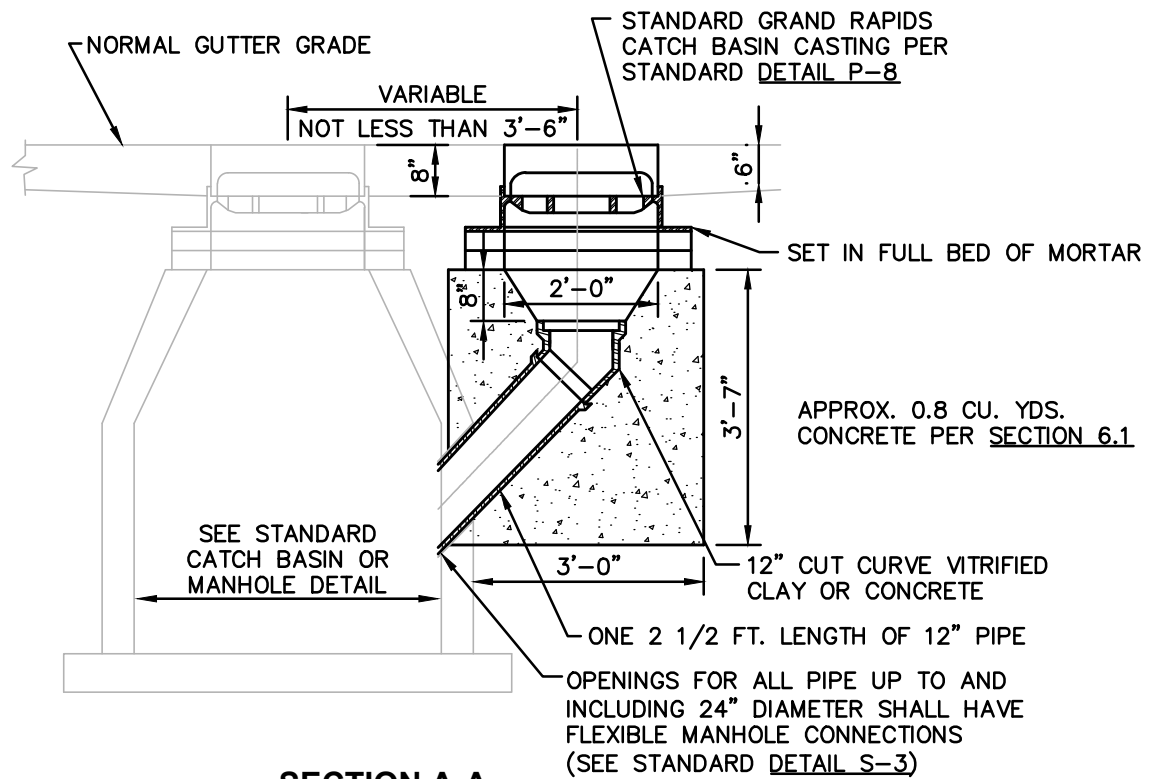
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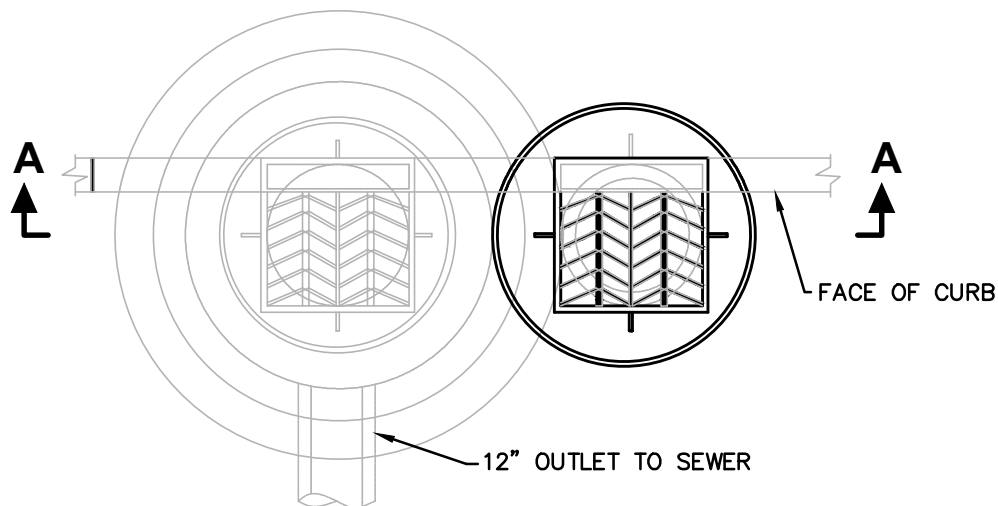
LAST REVISION DATE
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S-5



SECTION A-A



PLAN

STANDARD DROP INLET TO CATCH BASIN OR MANHOLE

N.T.S.

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CITY ENGINEER

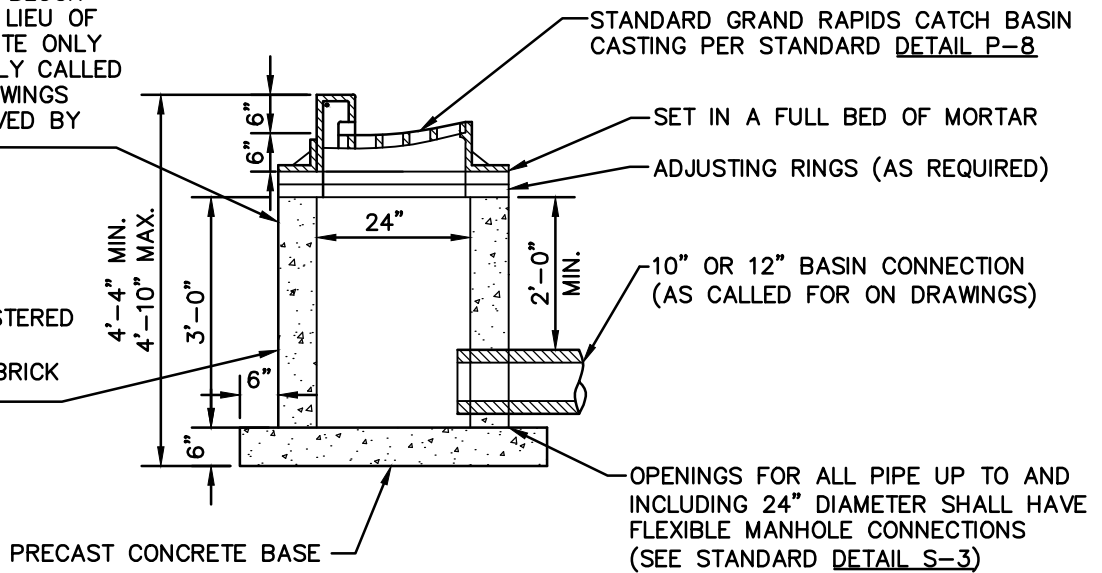
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S-6

WALLS TO BE PLASTERED
1/2" THICK WHEN
CONSTRUCTED OF BRICK
OR BLOCK (TYP.) _____



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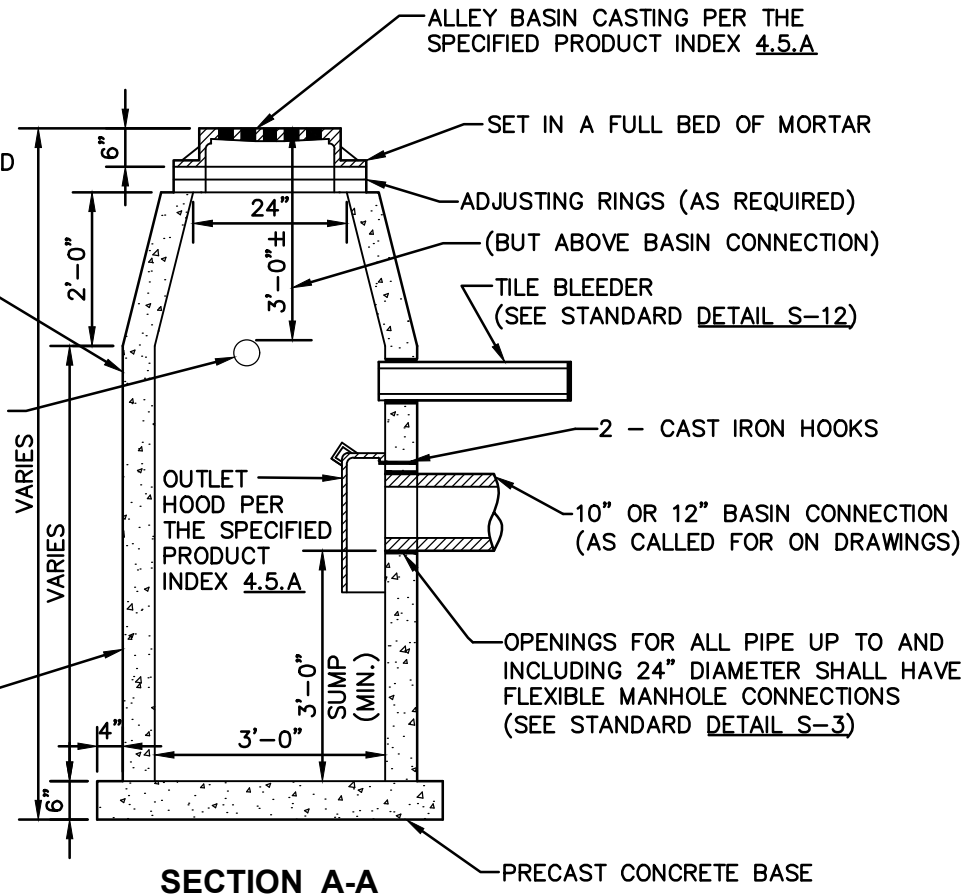
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Public Services
Engineering Department

S-6A

5" PRECAST CONCRETE (ASTM C-478), 8" BRICK OR 6" CONCRETE BLOCK MAY BE USED IN LIEU OF PRECAST CONCRETE ONLY WHEN SPECIFICALLY CALLED FOR ON THE DRAWINGS OR WHEN APPROVED BY THE ENGINEER.

UNDERDRAIN AS SHOWN ON DRAWINGS OR WHEN DIRECTED BY ENGINEER (SEE STANDARD DETAIL S-12 FOR CONNECTIONS)

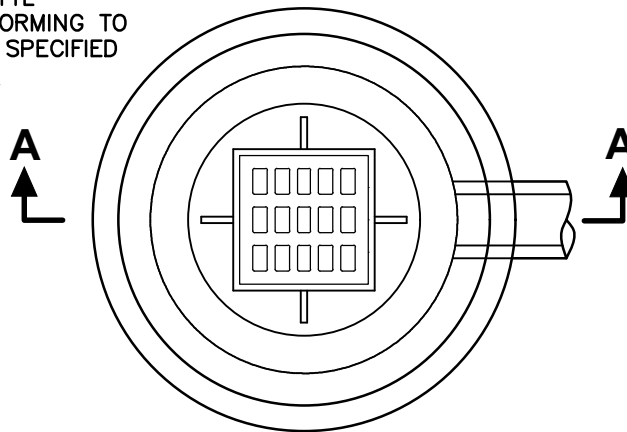
WALLS TO BE PLASTERED 1/2" THICK WHEN CONSTRUCTED OF BRICK OR BLOCK (TYP.)



SECTION A-A

NOTE:

ALL JOINTS BETWEEN SECTIONS SHALL INCLUDE AN BUTYL RUBBER GASKET, CONFORMING TO ASTM C-443 PER THE SPECIFIED PRODUCTS INDEX 4.5.B



PLAN

STANDARD PRECAST ALLEY BASIN

N.T.S.

APPROVED BY

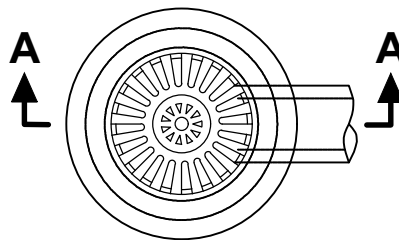
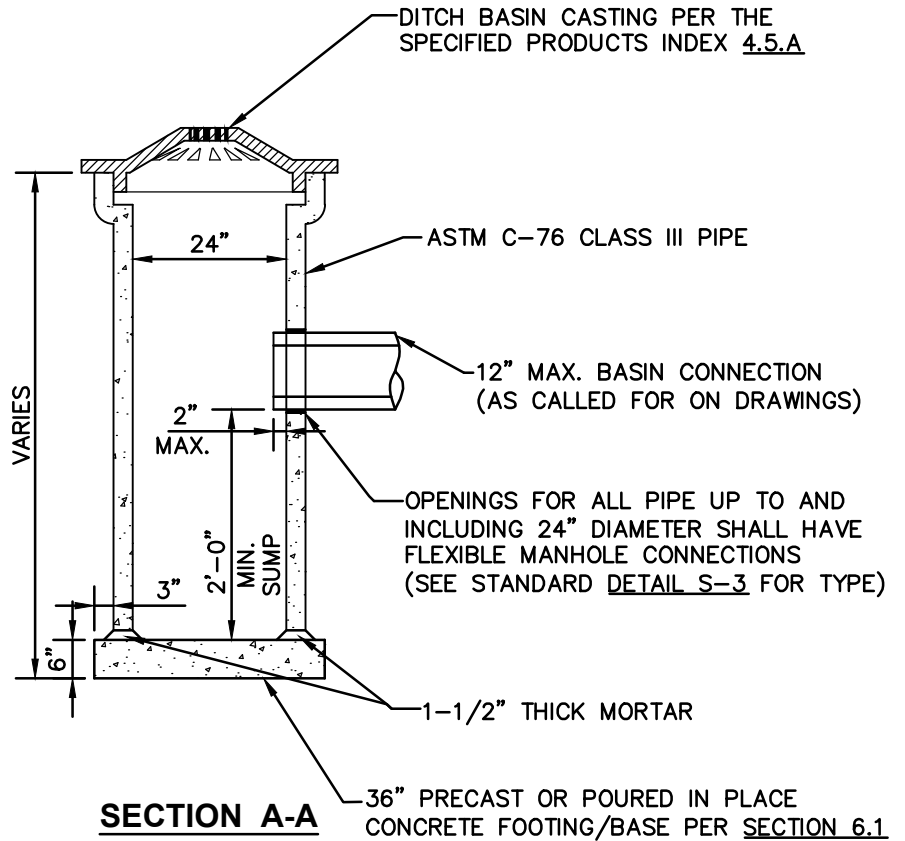
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Public Services
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S-7



PLAN

DITCH BASIN

N.T.S.

APPROVED BY

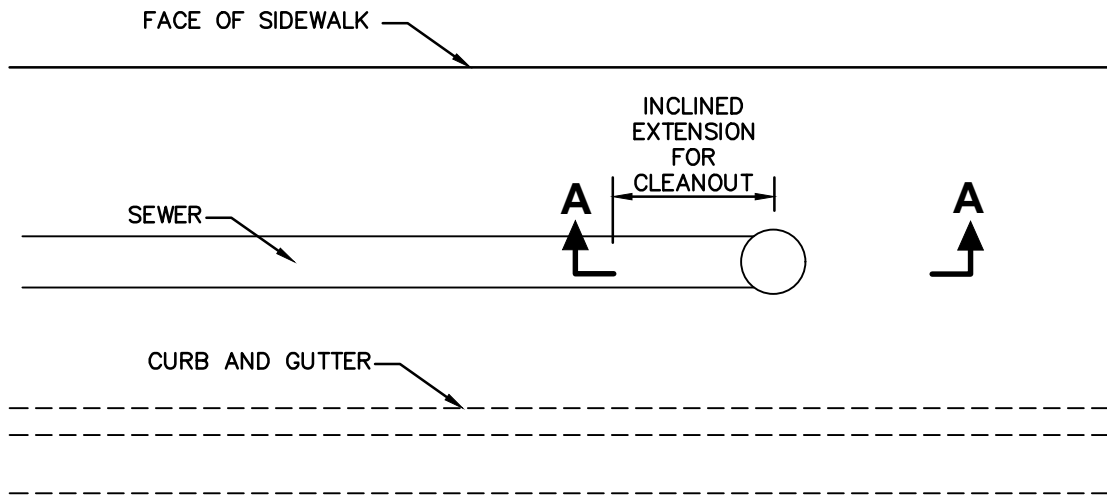
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CITY ENGINEER

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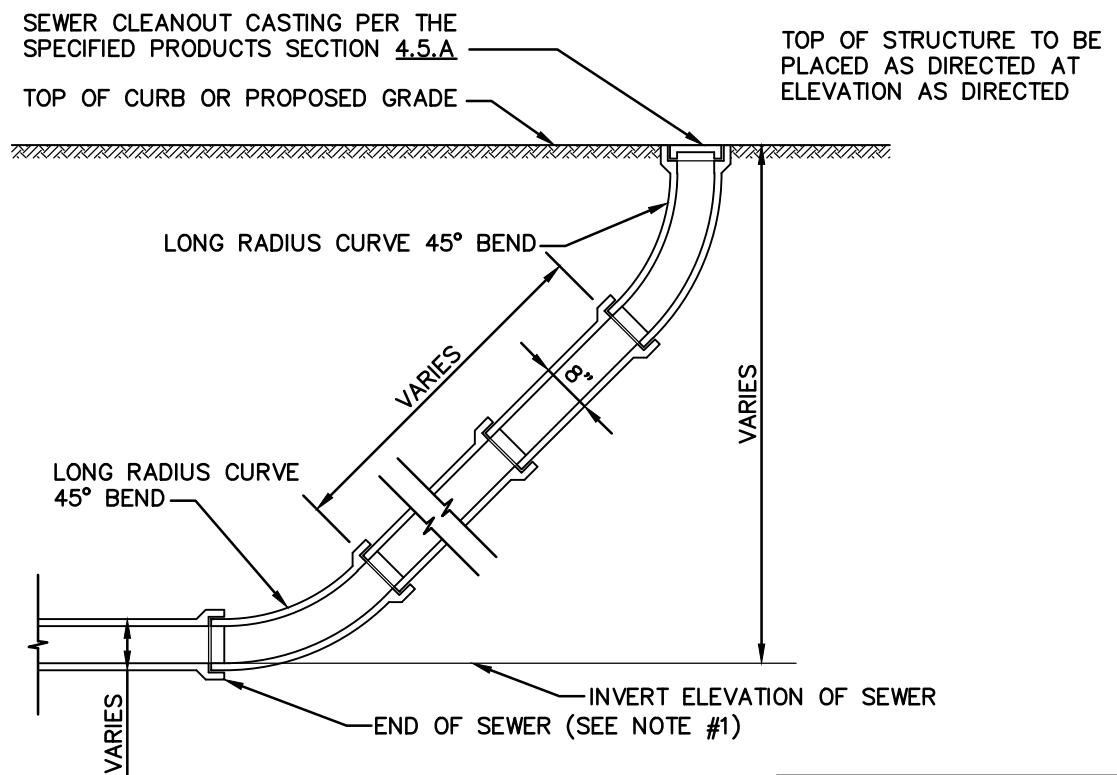
LAST REVISION DATE

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Public Services
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S-8



PLAN



VERTICAL SECTION A-A

NOTE: NOT APPROVED FOR
USE ON MAIN LINE SEWERS,
USE ONLY AS APPROVED
BY CITY ENGINEER'S OFFICE.

NOTES:

1. THE TILE OR PIPE FOR THE INCLINED EXTENSION FOR CLEANOUT SHALL BE 8" DIAMETER. IF THE SEWER IS LARGER THAN 8" A REDUCER SHALL BE INSTALLED BETWEEN THE END OF SEWER AND THE LONG RADIUS CURVE.
2. JOINTS SHALL BE THE SAME AS SPECIFIED FOR SEWER CONSTRUCTION IN SECTION 4.1
3. CLEANOUT COVER MUST BE METAL EVEN IF PVC PIPE IS USED IN ORDER TO LOCATE WITH A METAL DETECTOR.

SEWER CLEANOUT

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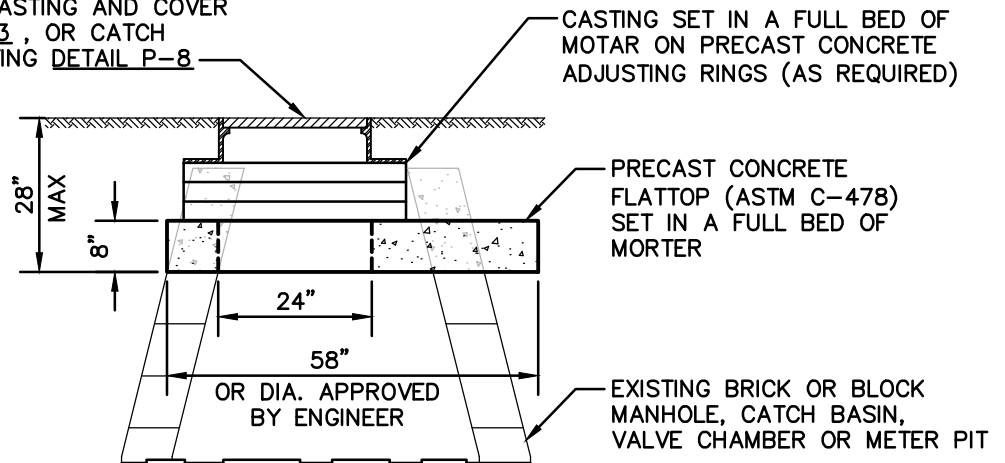
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S-9

STANDARD GRAND RAPIDS
MANHOLE CASTING AND COVER
DETAIL S-13, OR CATCH
BASIN CASTING DETAIL P-8



NOTES:

1. REMOVE DAMAGED BRICK OR BLOCK FROM EXISTING STRUCTURE TO SOLID MATERIAL AS APPROVED BY THE ENGINEER.
2. PAYMENT FOR "CHAMBER OR PIT, REBUILD WITH FLATTOP, PER DETAIL S-10" OR "MANHOLE OR CATCH BASIN, REBUILD WITH FLATTOP, PER DETAIL S-10" SHALL INCLUDE ALL LABOR, EQUIPMENT, AND MATERIALS REQUIRED TO RECONSTRUCT STRUCTURE AS SHOWN, INCLUDING FLATTOP, GRADE RINGS AND CASTING.

MANHOLE OR CATCH BASIN, REBUILD

N.T.S.

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CITY ENGINEER

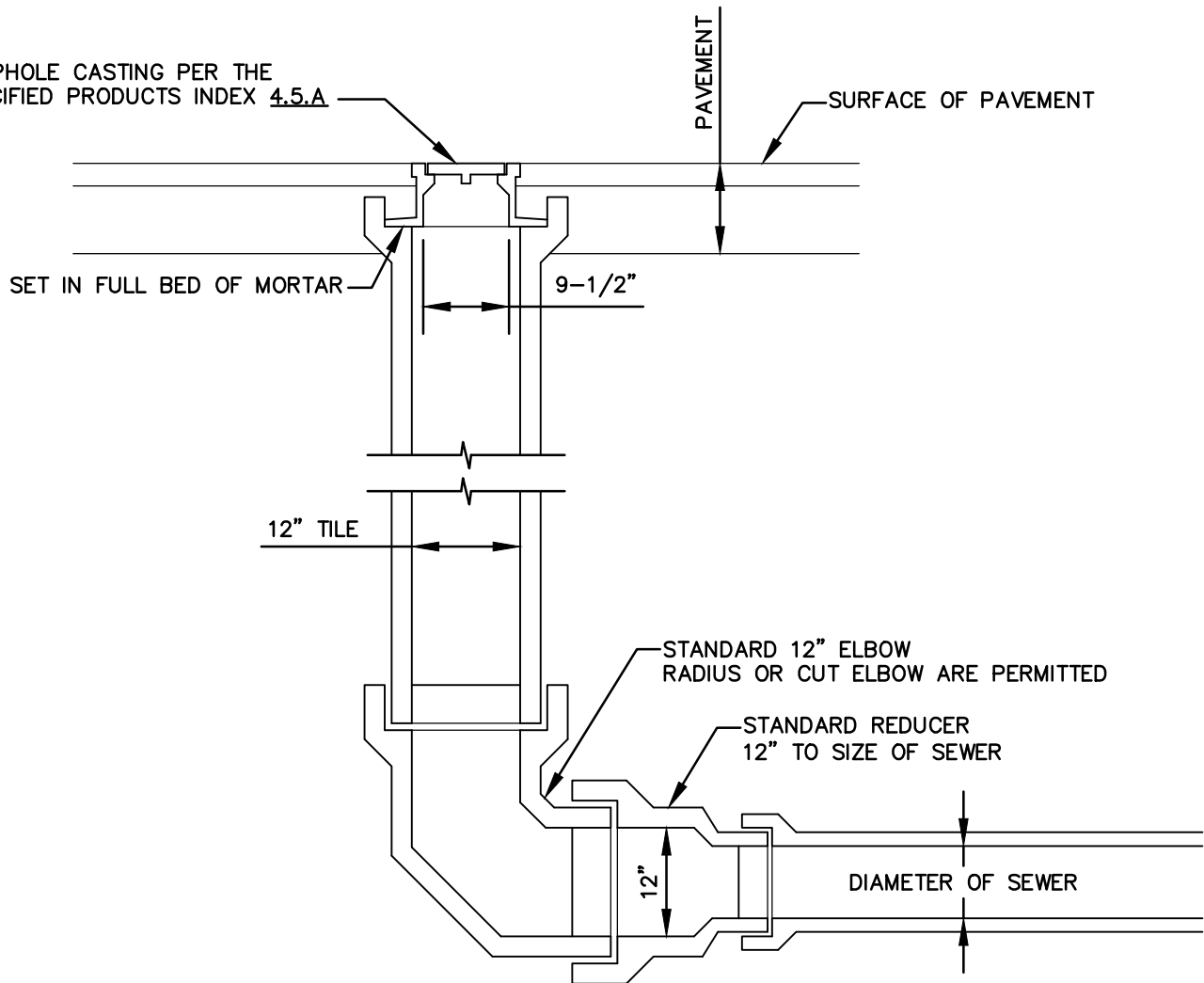
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Public Services
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S-10

LAMPHOLE CASTING PER THE
SPECIFIED PRODUCTS INDEX 4.5.A



NOTES:

1. EITHER CLAY TILE OR CONCRETE PIPE IS PERMITTED IN THIS STRUCTURE.
2. ALL JOINTS SHALL BE MADE AS SPECIFIED FOR SEWER JOINTS. THE PIPE BELL CONTAINING THE CAST IRON RING SHALL BE COMPLETELY FILLED WITH THE JOINTING MATERIALS AS SHOWN IN DRAWING.

LAMP HOLE

N.T.S.

NOTE: FOR INFORMATION ONLY:
THIS TYPE OF CONSTRUCTION IS
NOT PERMITTED. (SEE DETAIL S-9)

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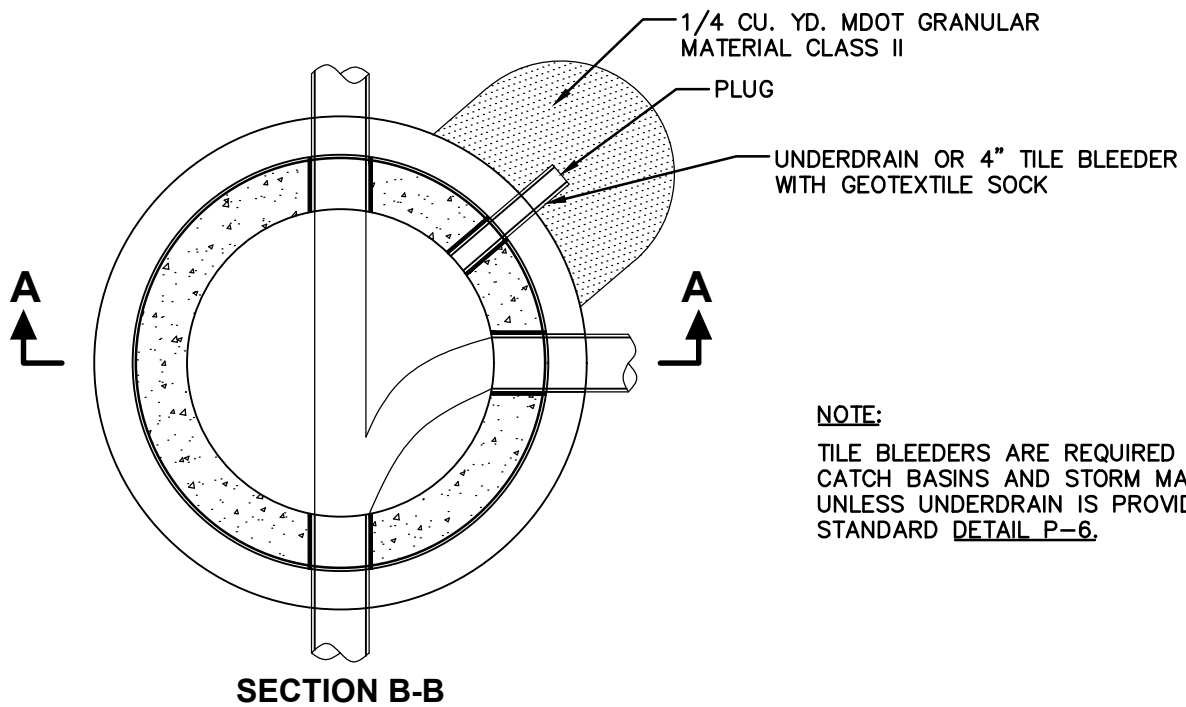
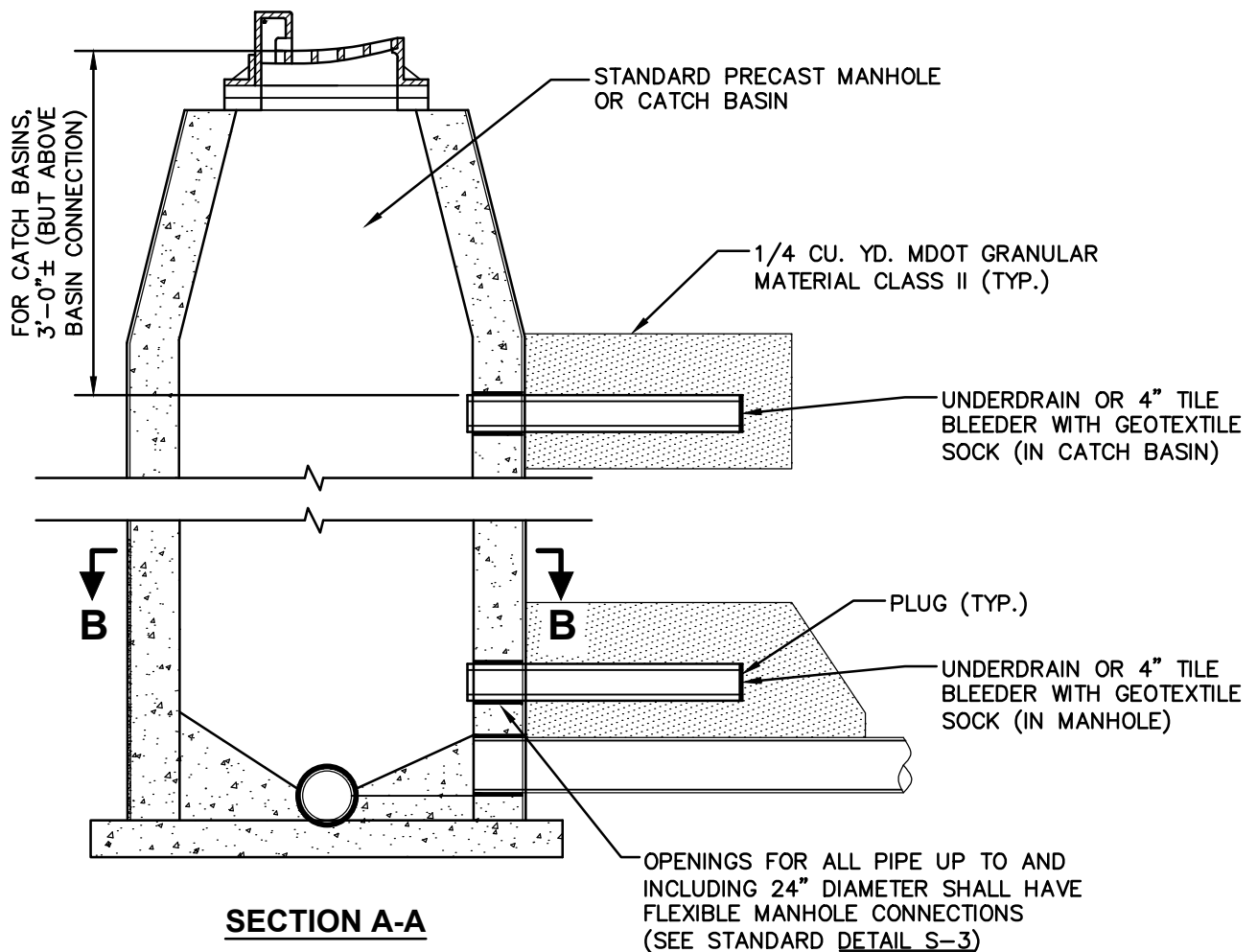
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S-11



NOTE:

TILE BLEEDERS ARE REQUIRED FOR ALL CATCH BASINS AND STORM MANHOLES UNLESS UNDERDRAIN IS PROVIDED PER STANDARD DETAIL P-6.

**TILE BLEEDER IN STORM
MANHOLE OR CATCH BASIN**

N.T.S.

APPROVED BY

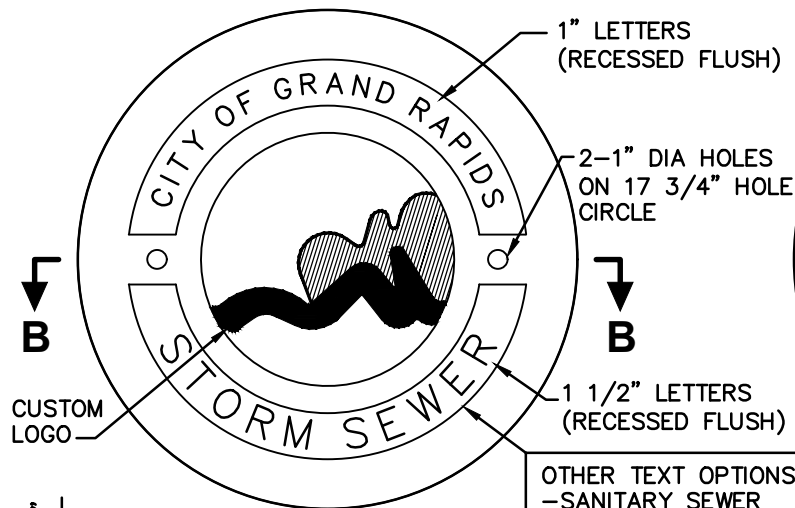
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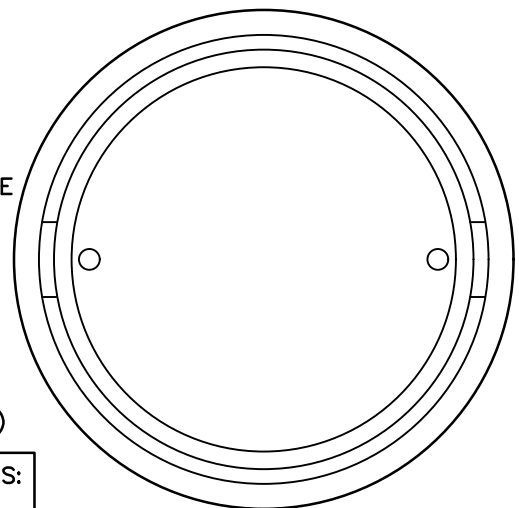
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S-12

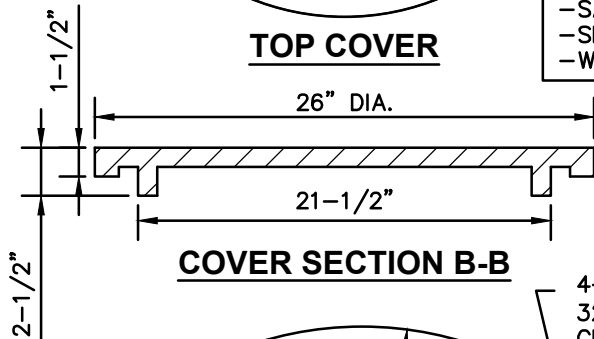


TOP COVER

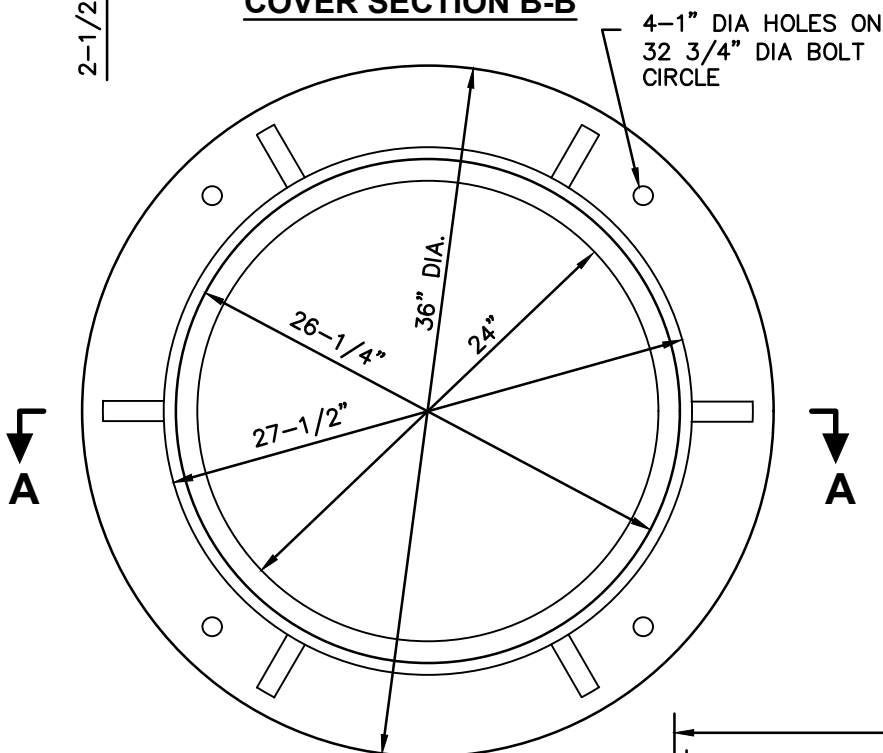
OTHER TEXT OPTIONS:
-SANITARY SEWER
-SIGNALS & LIGHTING
-WATER



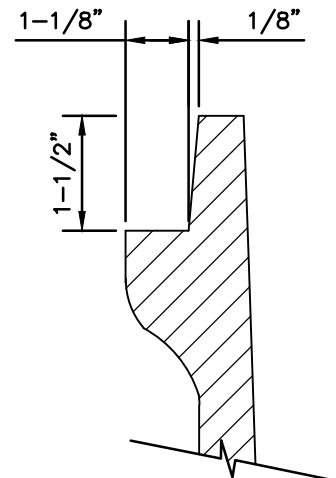
BOTTOM COVER



COVER SECTION B-B



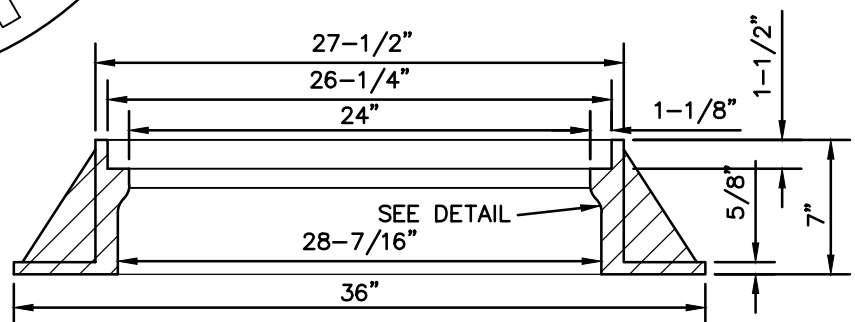
FRAME PLAN VIEW



HALF SIZE SEAT DETAIL

NOTE:

STORM, SANITARY, WATER AND SIGNALS
& LIGHTING MANHOLE CASTINGS PER
THE SPECIFIED PRODUCTS INDEX 4.5.A



FRAME SECTION A-A

26" MANHOLE CASTING

N.T.S.

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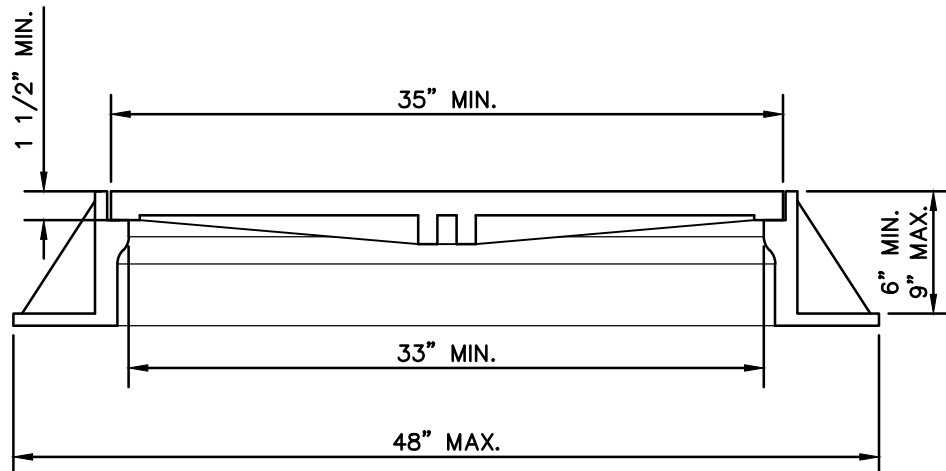
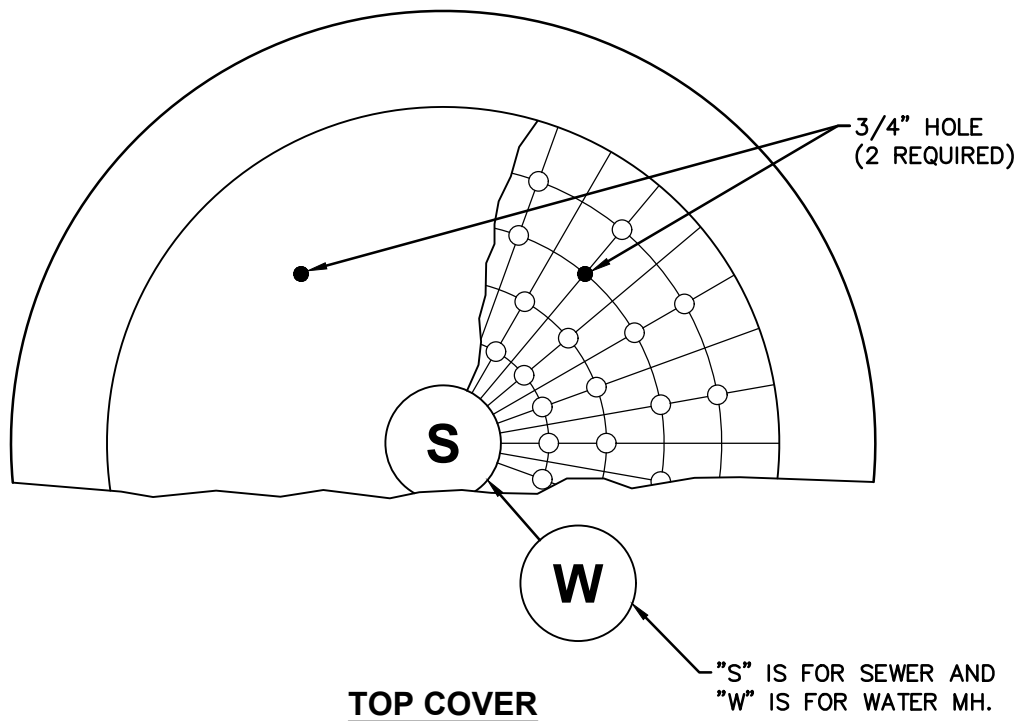
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Engineering Department

S-13



NOTES:

1. STORM SEWER, SANITARY, WATER AND SIGNALS AND LIGHTING CASTINGS PER THE SPECIFIED PRODUCTS INDEX 4.5.A
2. PLACE MANUFACTURER'S NAME ON BACK SIDE OF COVER.

35" MANHOLE CASTING

N.T.S.

APPROVED BY

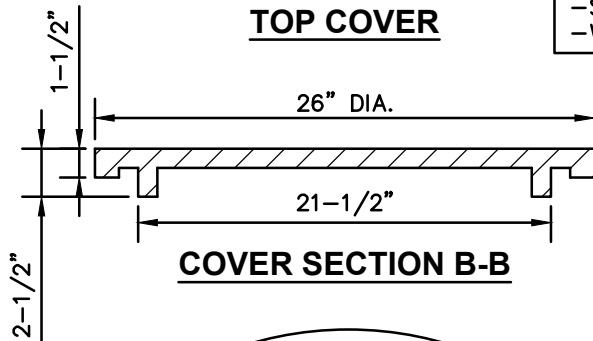
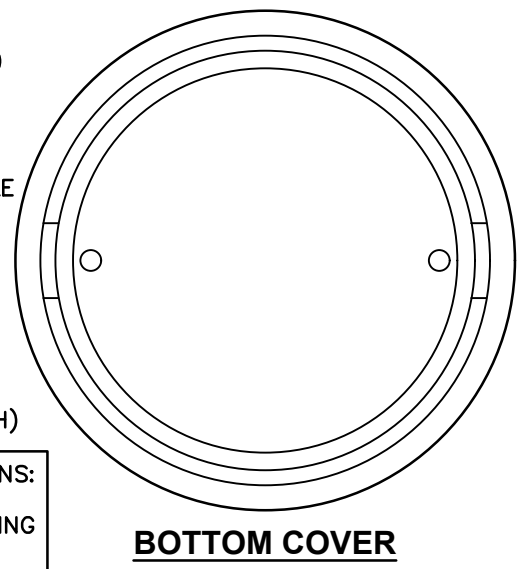
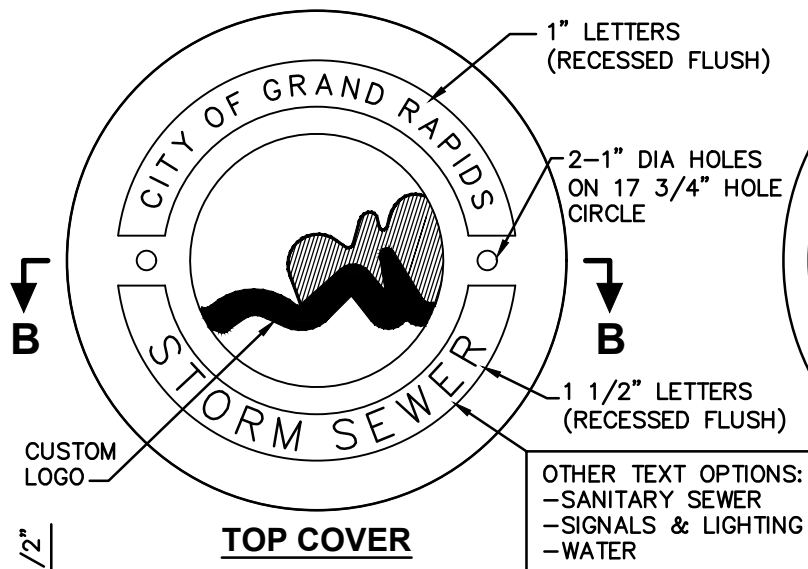
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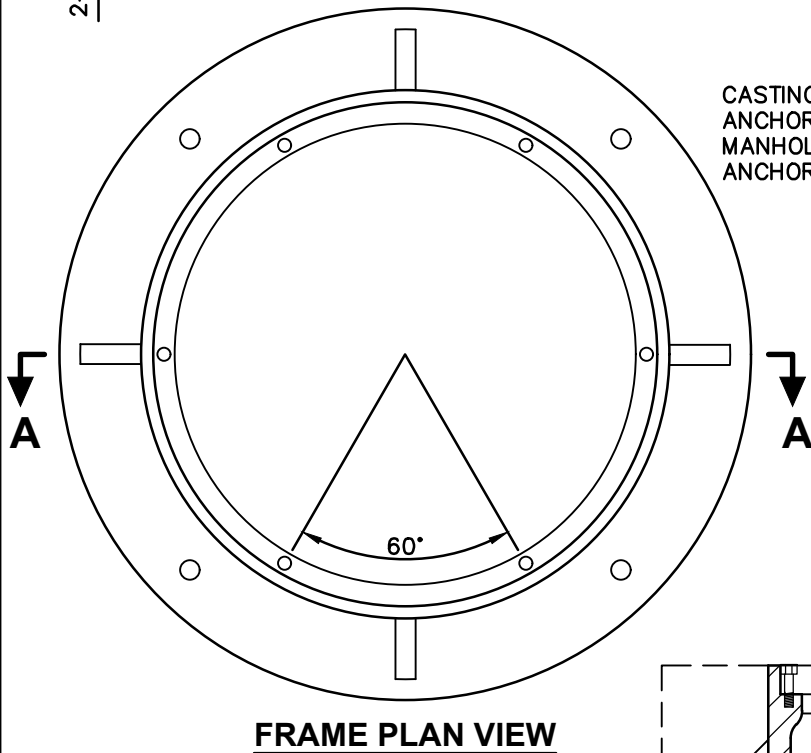
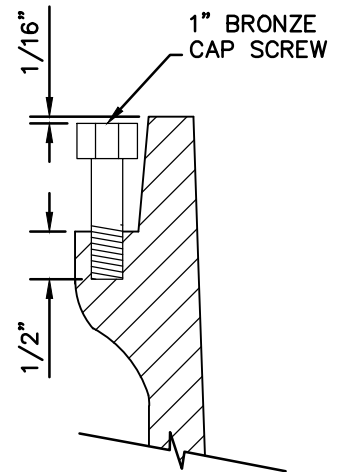
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S-13A



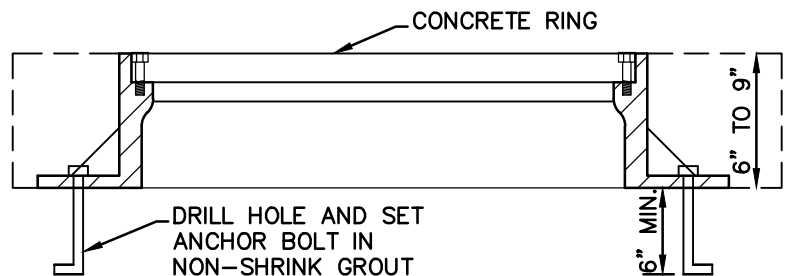
COVER TO EXTEND ONE
FOOT ABOVE GRADE IN
FLOOD PLAIN AREAS



CASTING TO BE
ANCHORED TO
MANHOLE WITH 4
ANCHOR BOLTS

NOTES:

1. STORM AND SANITARY MANHOLE CASTING, BOLT DOWN, PER THE SPECIFIED PRODUCTS INDEX. 4.5.A
2. ALL OTHER DETAILS AND DIMENSIONS ARE SHOWN ON DRAWING FOR STANDARD 26" MANHOLE CASTINGS.



S-14 MANHOLE CASTING BOLT-DOWN COVER

N.T.S.

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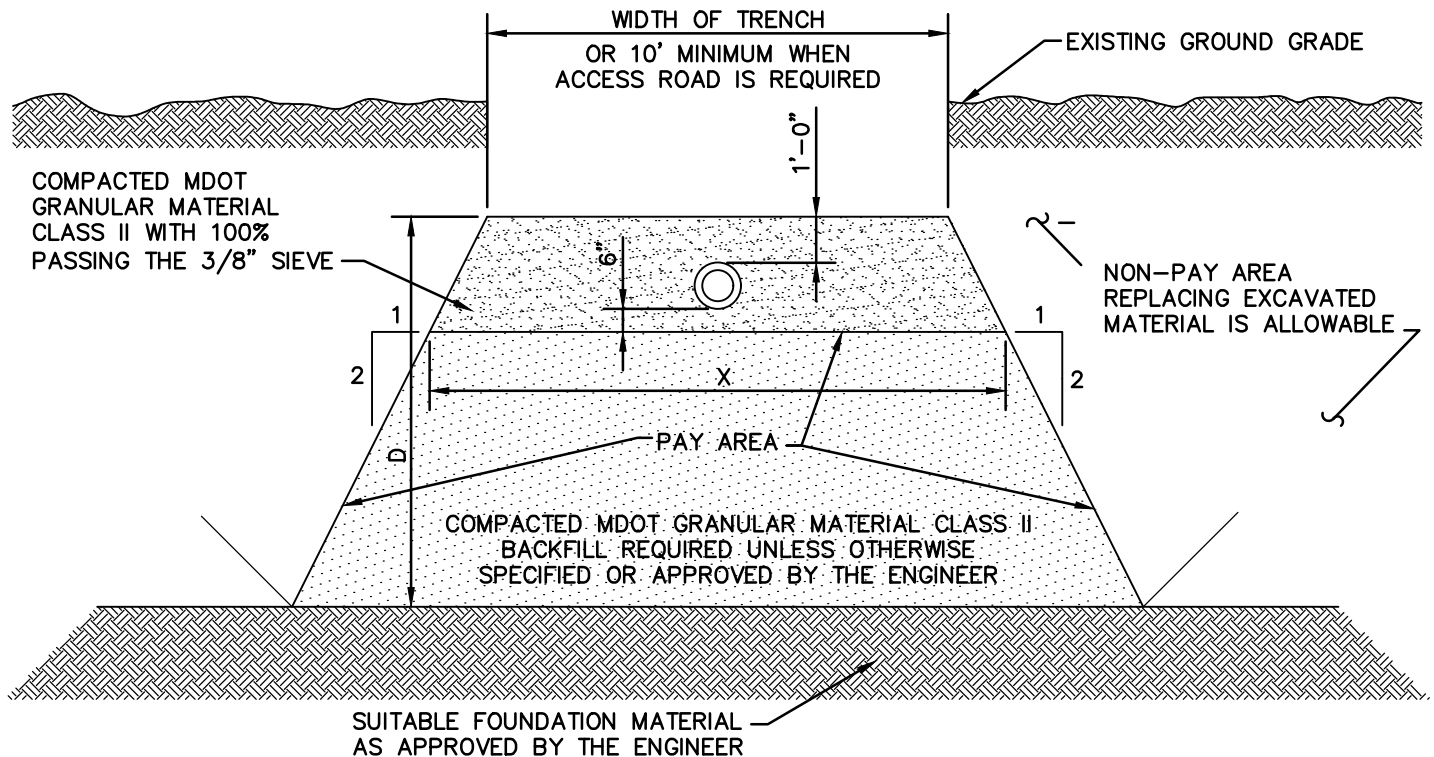
S-14

$$\text{VOL} = L(X+D)D/27$$

L = LENGTH OF THE UNSUITABLE AREA (IN FEET)

X = WIDTH OF TRENCH + 2(1.5+DIAMETER OF PIPE) (IN FEET)

D = DEPTH FROM INVERT OF PIPE TO THE SUITABLE FOUNDATION LESS 6" (IN FEET)



UNSUITABLE SOIL, REMOVAL AND REPLACEMENT

N.T.S.

APPROVED BY

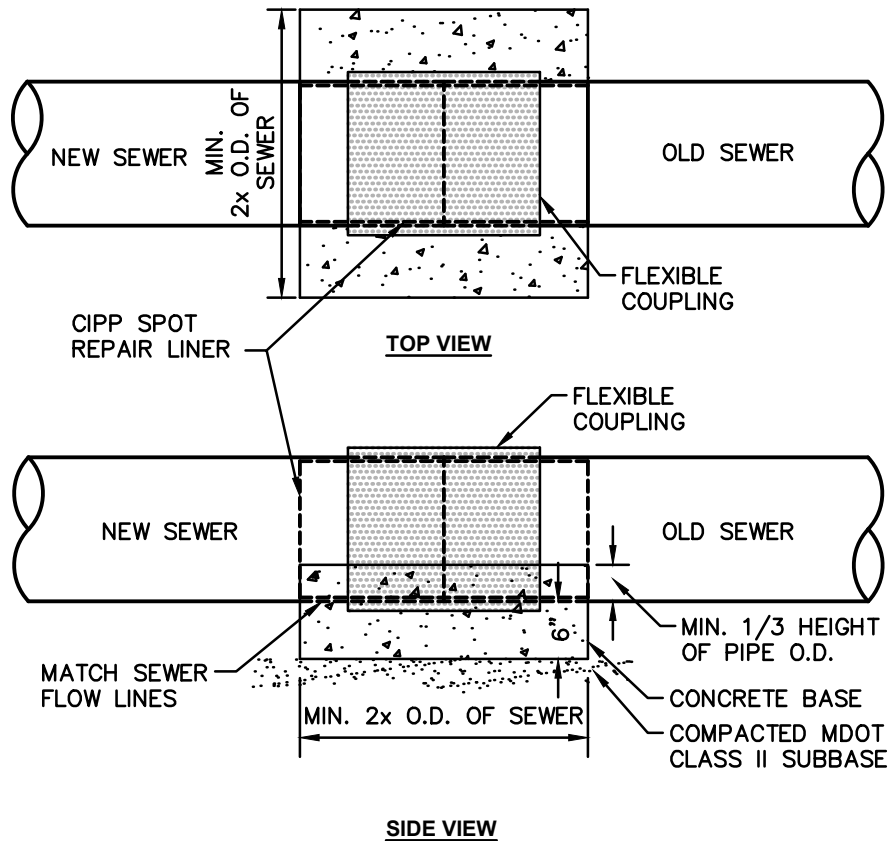
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S-15



BURIED SEWER CONNECTION

N.T.S.

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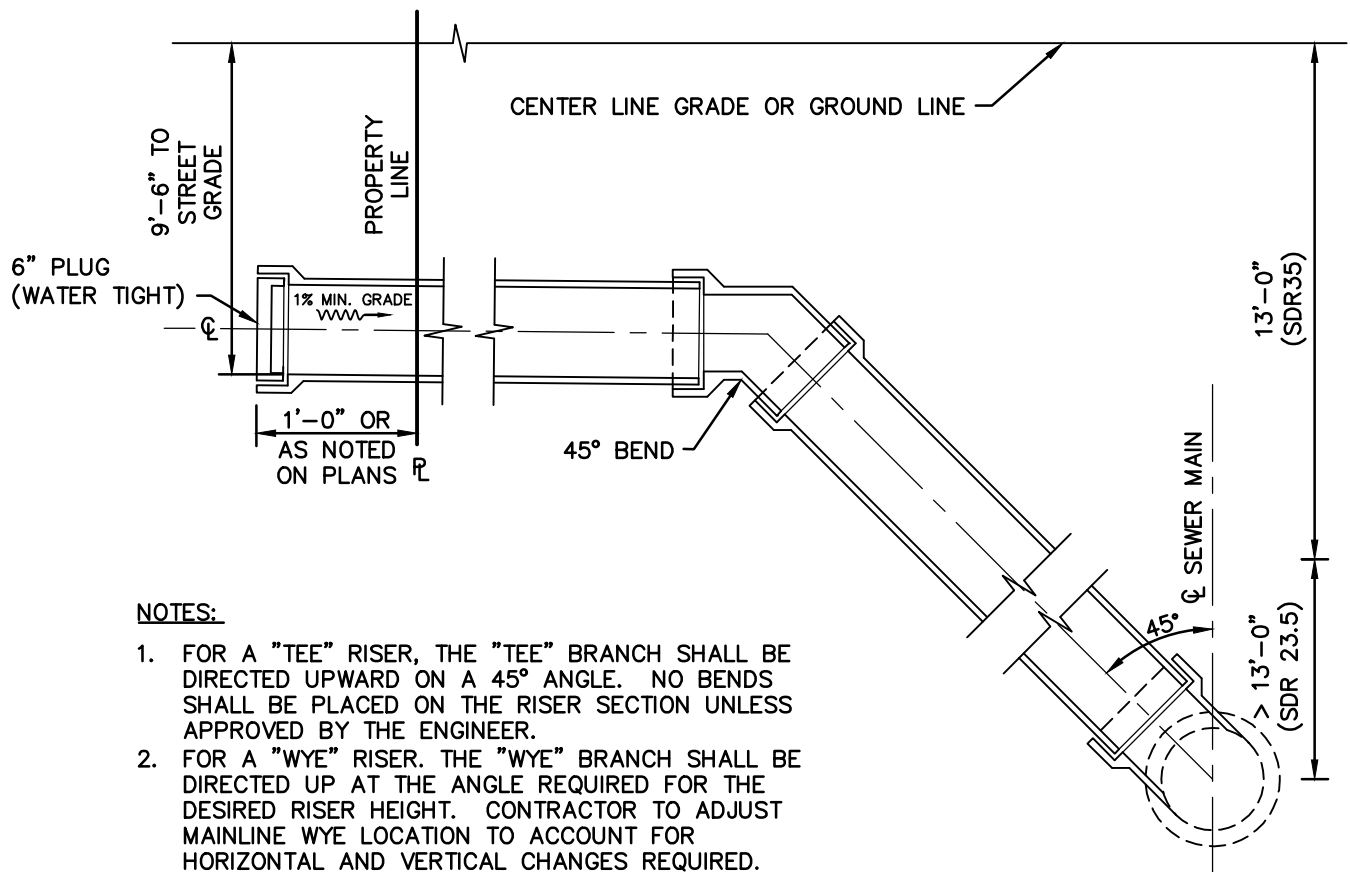
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S-16



NOTES:

1. FOR A "TEE" RISER, THE "TEE" BRANCH SHALL BE DIRECTED UPWARD ON A 45° ANGLE. NO BENDS SHALL BE PLACED ON THE RISER SECTION UNLESS APPROVED BY THE ENGINEER.
2. FOR A "WYE" RISER, THE "WYE" BRANCH SHALL BE DIRECTED UP AT THE ANGLE REQUIRED FOR THE DESIRED RISER HEIGHT. CONTRACTOR TO ADJUST MAINLINE WYE LOCATION TO ACCOUNT FOR HORIZONTAL AND VERTICAL CHANGES REQUIRED. NO BENDS SHALL BE PLACED ON THE RISER SECTION UNLESS APPROVED BY THE ENGINEER.
3. LATERAL TO BE 9'-6" BELOW CENTERLINE GRADE OR CENTERLINE GROUND AT PROPERTY LINE UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

MAIN LINE SEWER LATERAL RISER

N.T.S.

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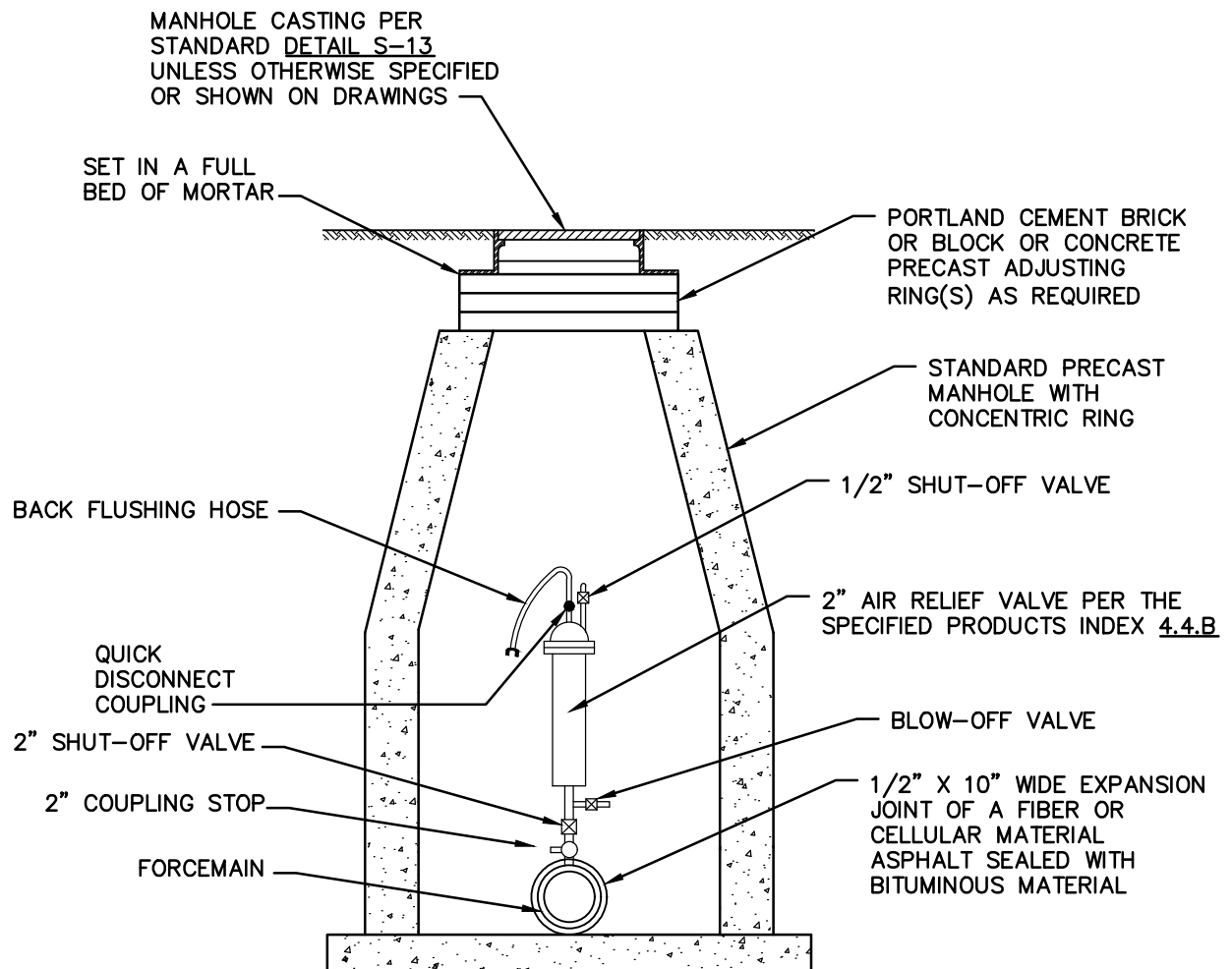
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S-17



FORCEMAIN AIR RELIEF VALVE AND CHAMBER

N.T.S.

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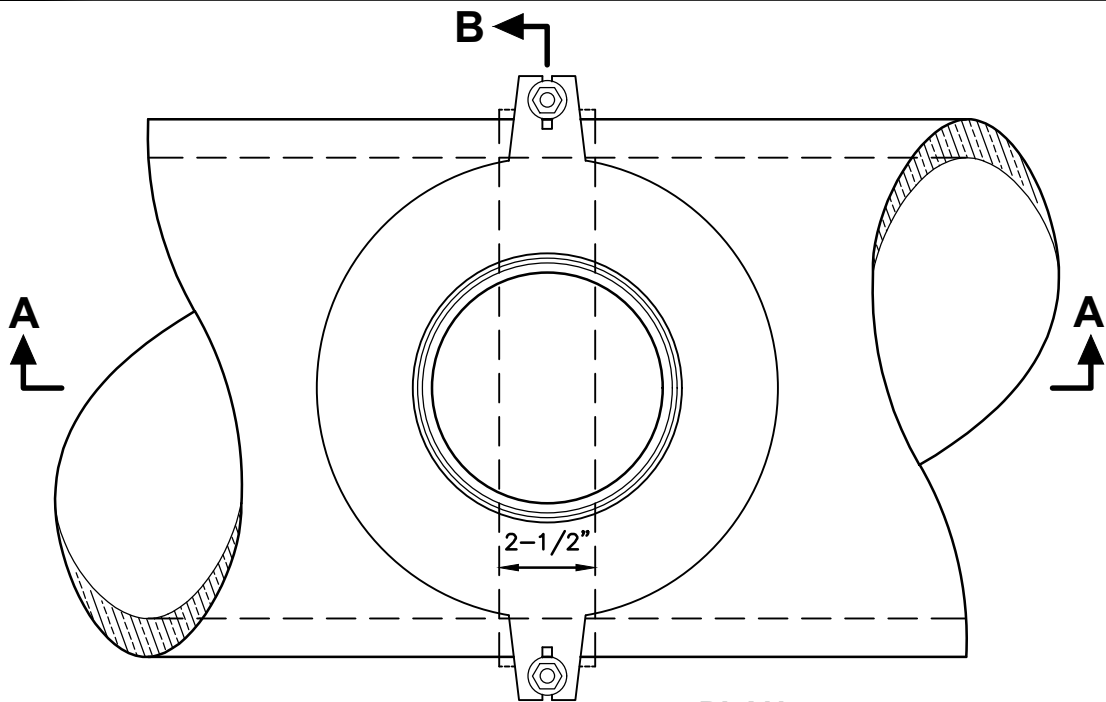
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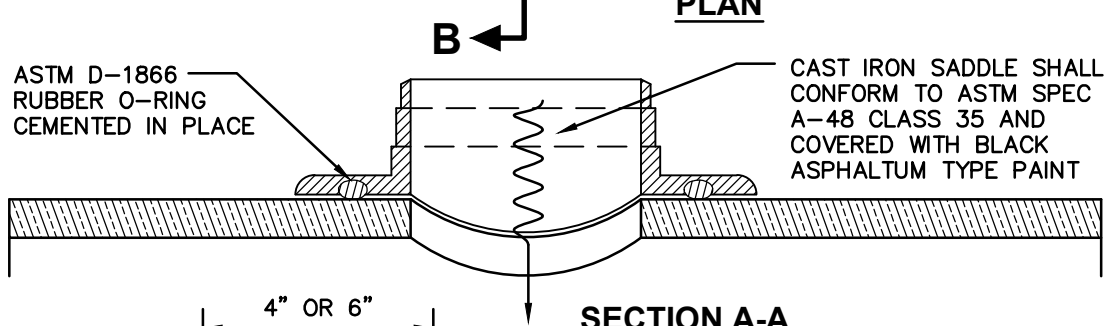
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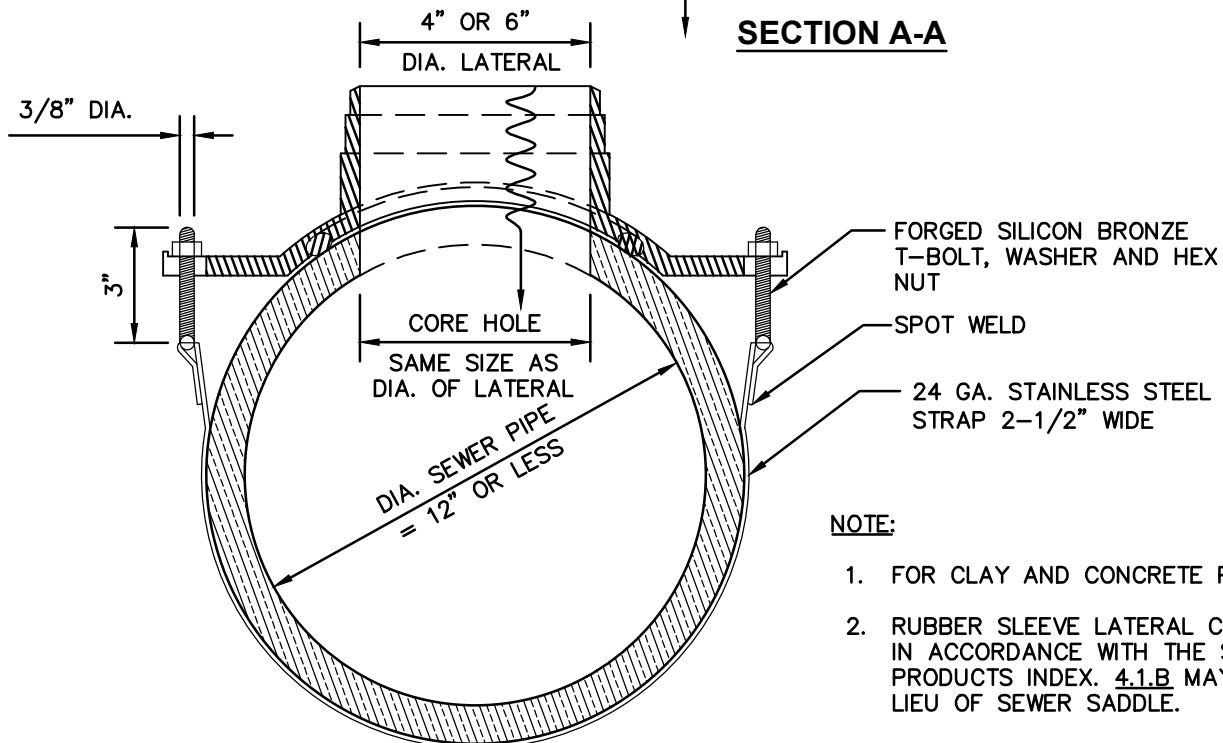
S-18



PLAN



SECTION A-A



SECTION B-B

NOTE:

1. FOR CLAY AND CONCRETE PIPE.
2. RUBBER SLEEVE LATERAL CONNECTIONS IN ACCORDANCE WITH THE SPECIFIED PRODUCTS INDEX. 4.1.B MAY BE USED IN LIEU OF SEWER SADDLE.

SEWER SADDLE FOR 12" DIAMETER OR LESS

N.T.S.

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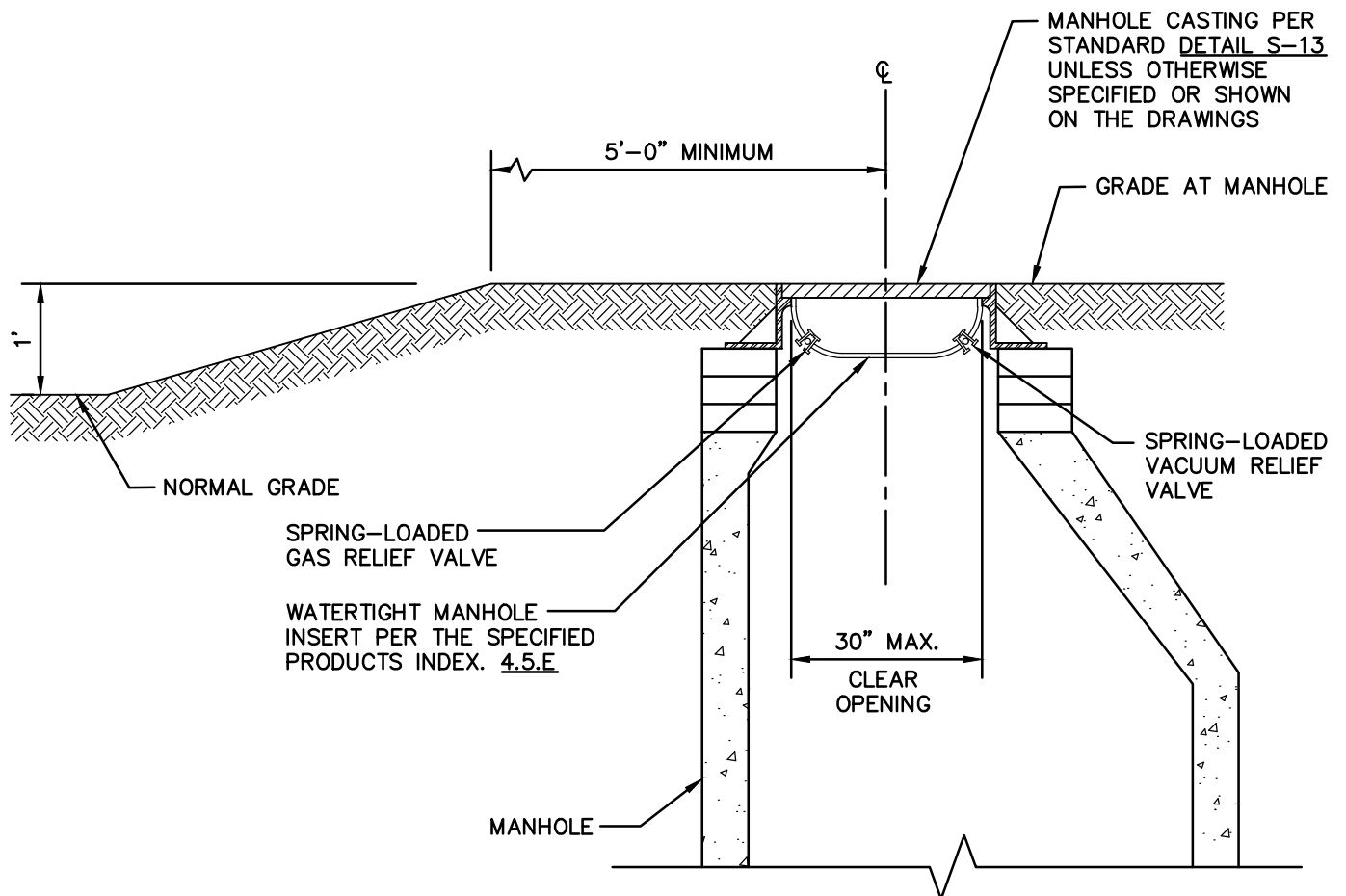
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S-20



WATERTIGHT MANHOLE INSERT

N.T.S.

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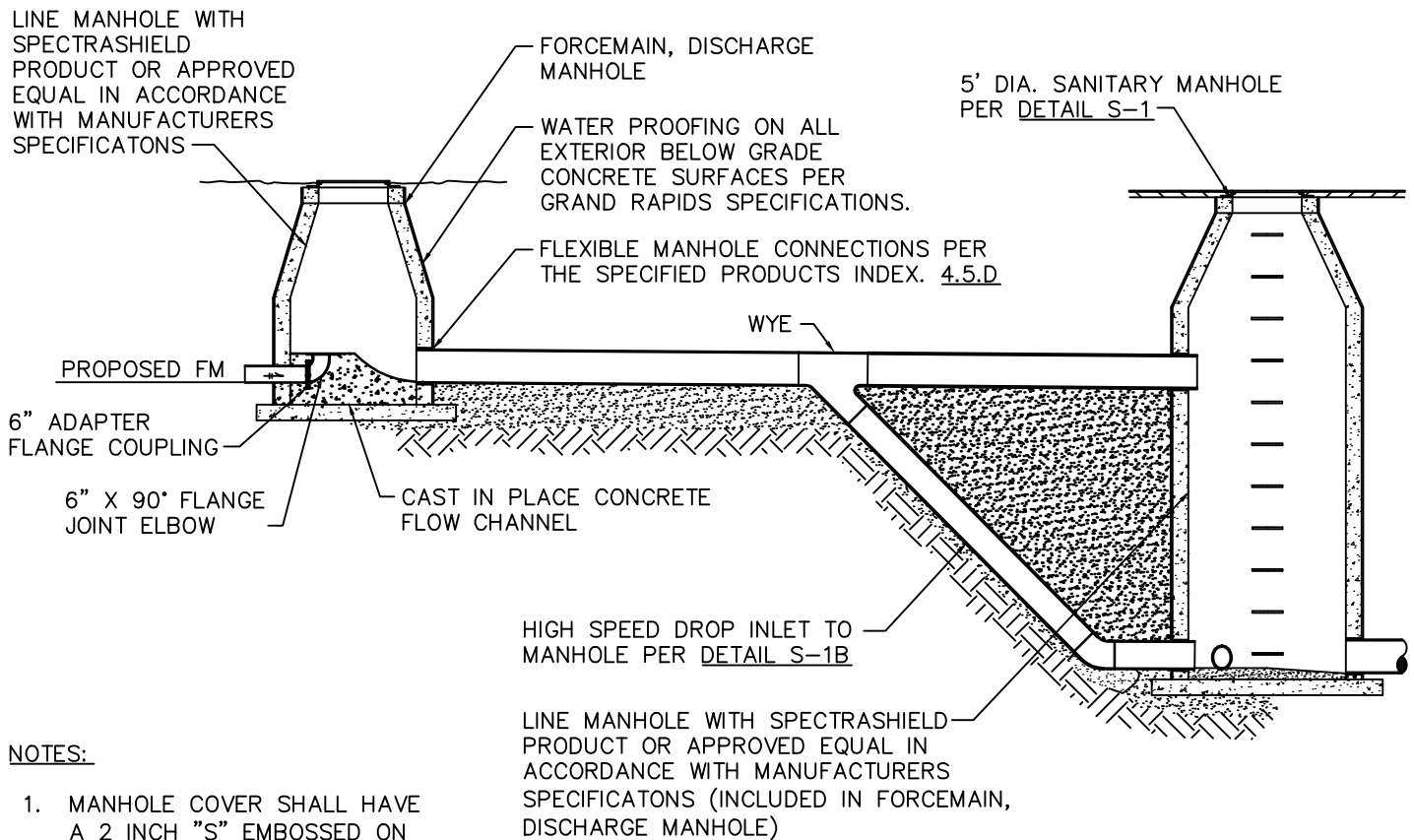
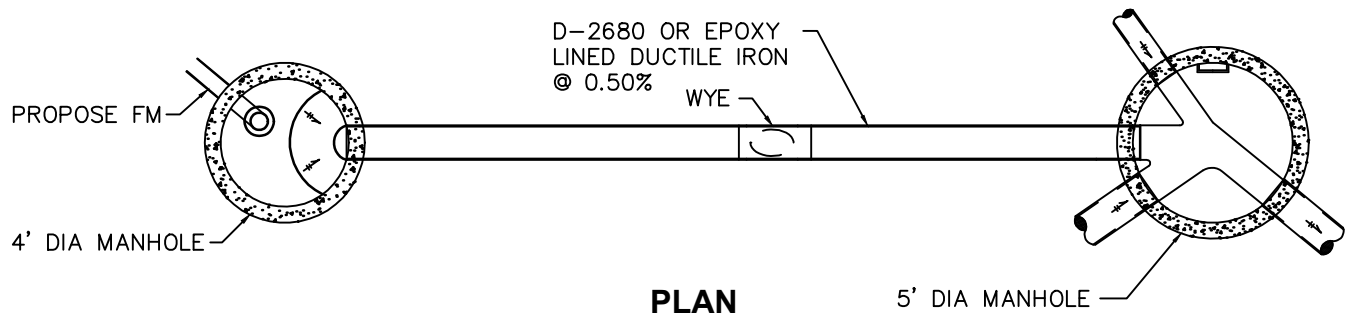
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PROFILE

FORCEMAIN DISCHARGE MANHOLE

N.T.S.

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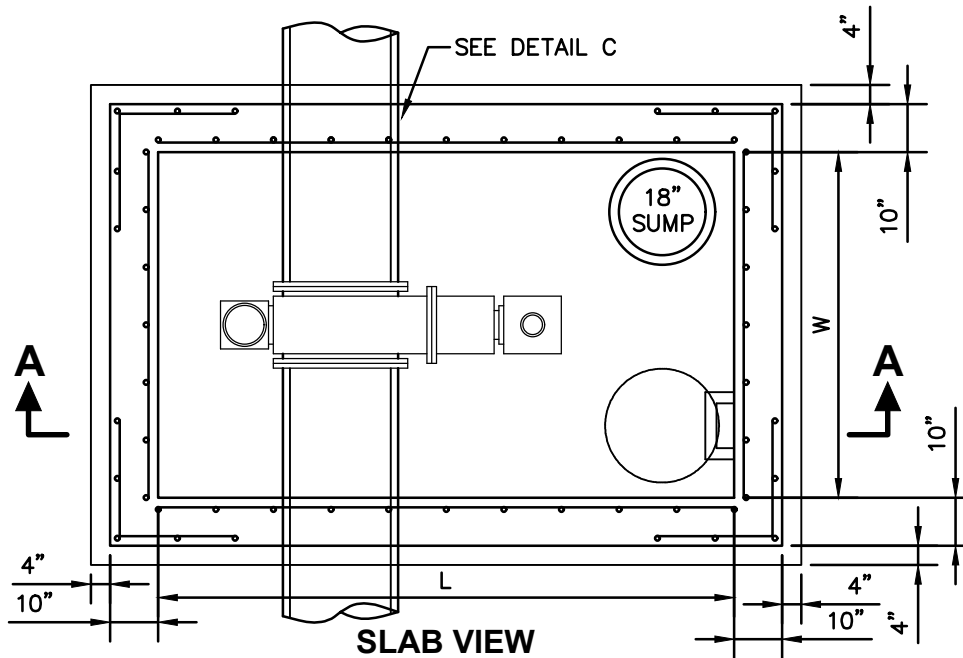
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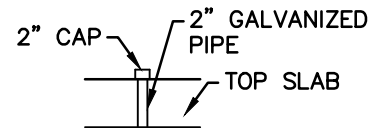
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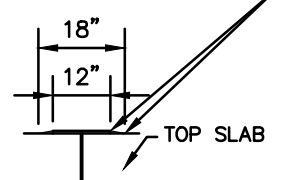


SLAB VIEW

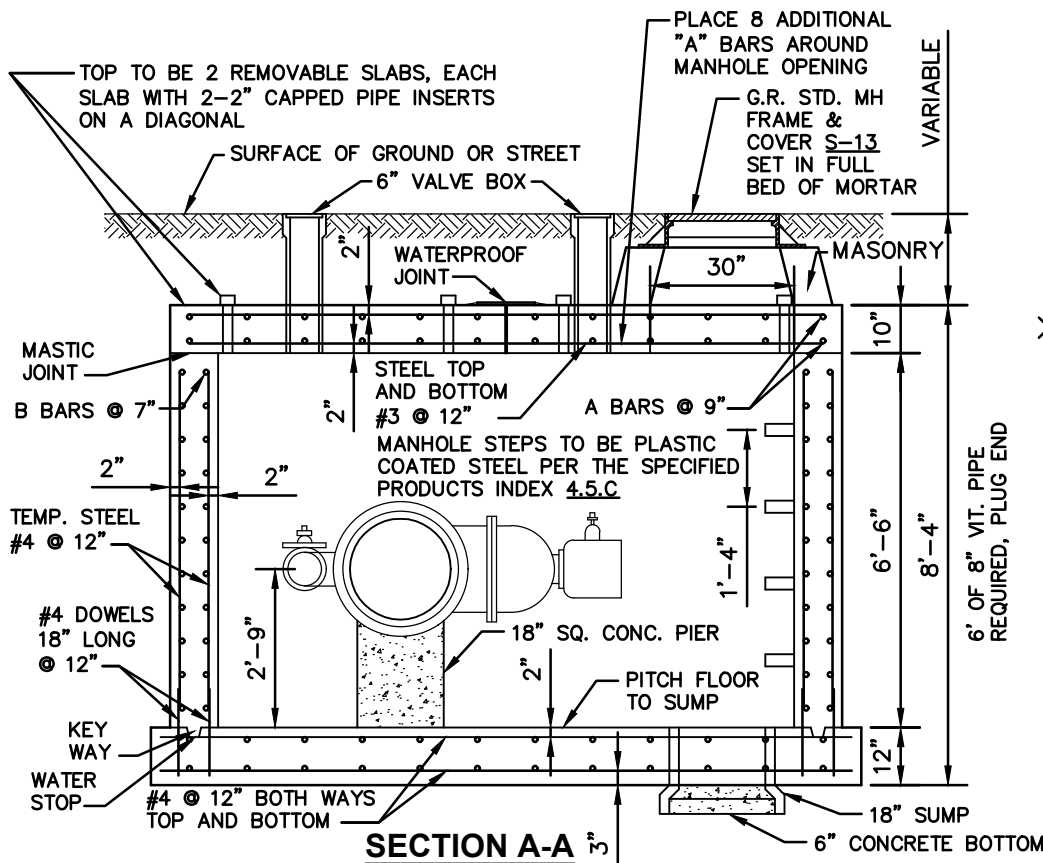


**PIPE SLEEVE
DETAIL**

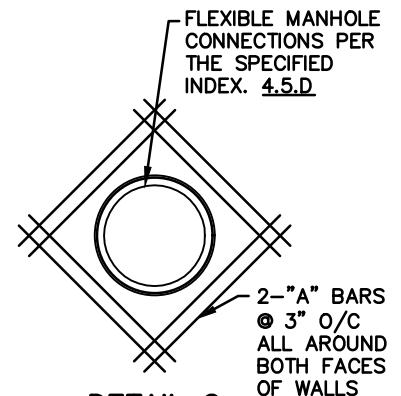
15# FELT COVERED
WITH HOT MOPPED
BITUMEN EXTENDING
16" DOWN THE SIDE



**WATERPROOF
JOINT DETAIL**



SECTION A-A



DETAIL C

NOTE:

CONCRETE PER SECTION 6.1
TO BE USED IN CHAMBER

NOTE:

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FOR CONSTRUCTION UNLESS
SPECIFICALLY CALLED FOR ON
DRAWINGS OR SPECIFICATIONS.

DIMENSIONS

VALVE SIZE	16"	20"	24"	30"	36"
L	8'-0"	9'-0"	10'-0"	12'-0"	13'-0"
W	5'-6"	5'-6"	6'-0"	7'-0"	8'-0"

STEEL REQUIREMENTS

#A BAR SIZE	#5	#6	#6	#7	#8
#B BAR SIZE	#4	#4	#5	#6	#6
CORNER BAR SIZE	#4	#4	#5	#6	#6
SHORT LEG LENGTH	1'-6"	1'-6"	1'-9"	2'-0"	2'-0"
LONG LEG LENGTH	2'-0"	2'-6"	2'-9"	3'-0"	3'-6"

**VALVE CHAMBER FOR
16" TO 36" GATE VALVES**

N.T.S.

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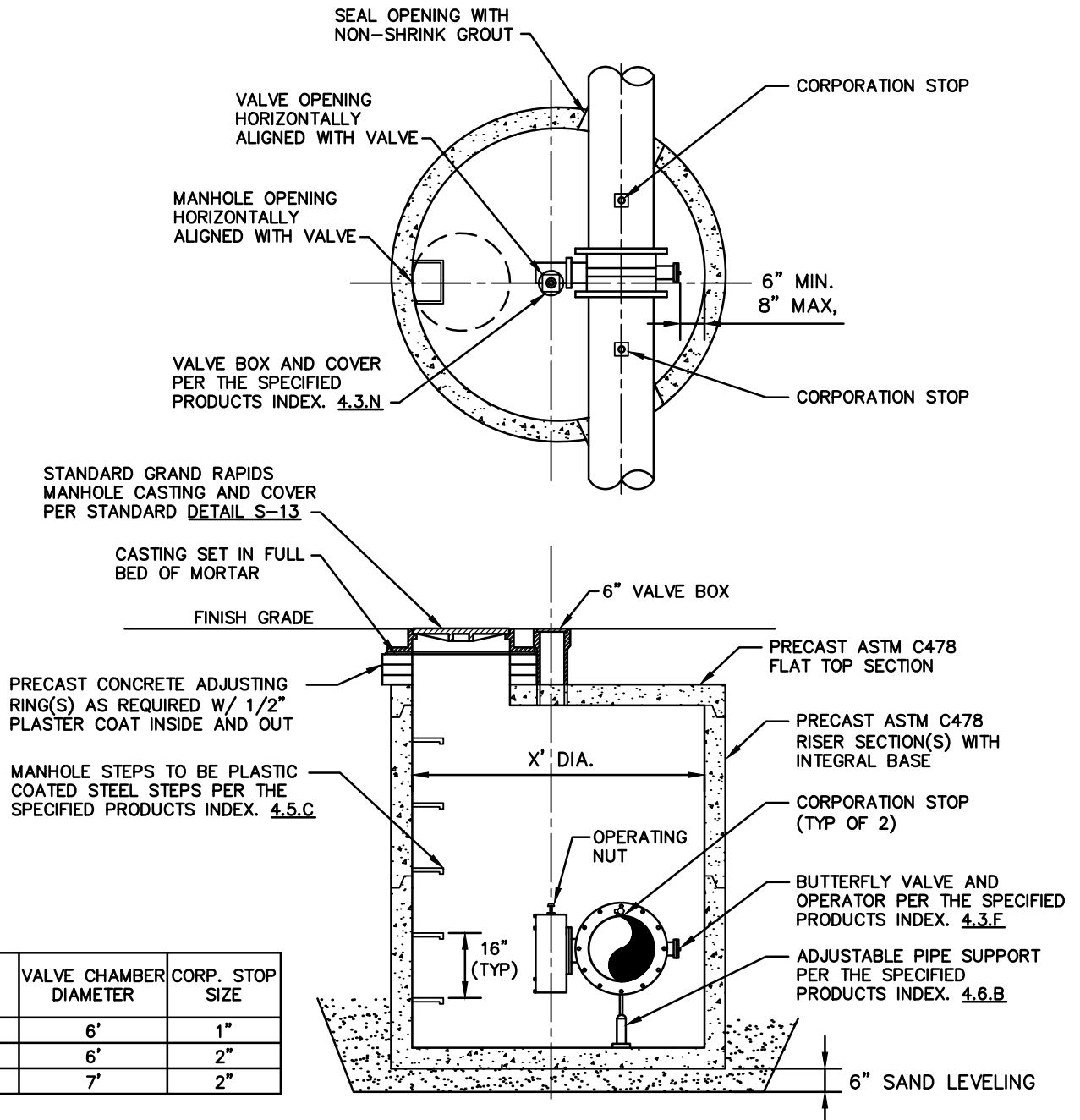
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WATER MAIN SIZE	VALVE CHAMBER DIAMETER	CORP. STOP SIZE
16"	6'	1"
20"	6'	2"
24"	7'	2"

VALVE CHAMBER FOR 16", 20" AND 24" BUTTERFLY VALVES

N.T.S.

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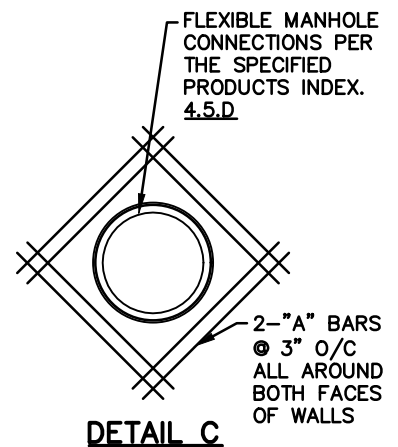
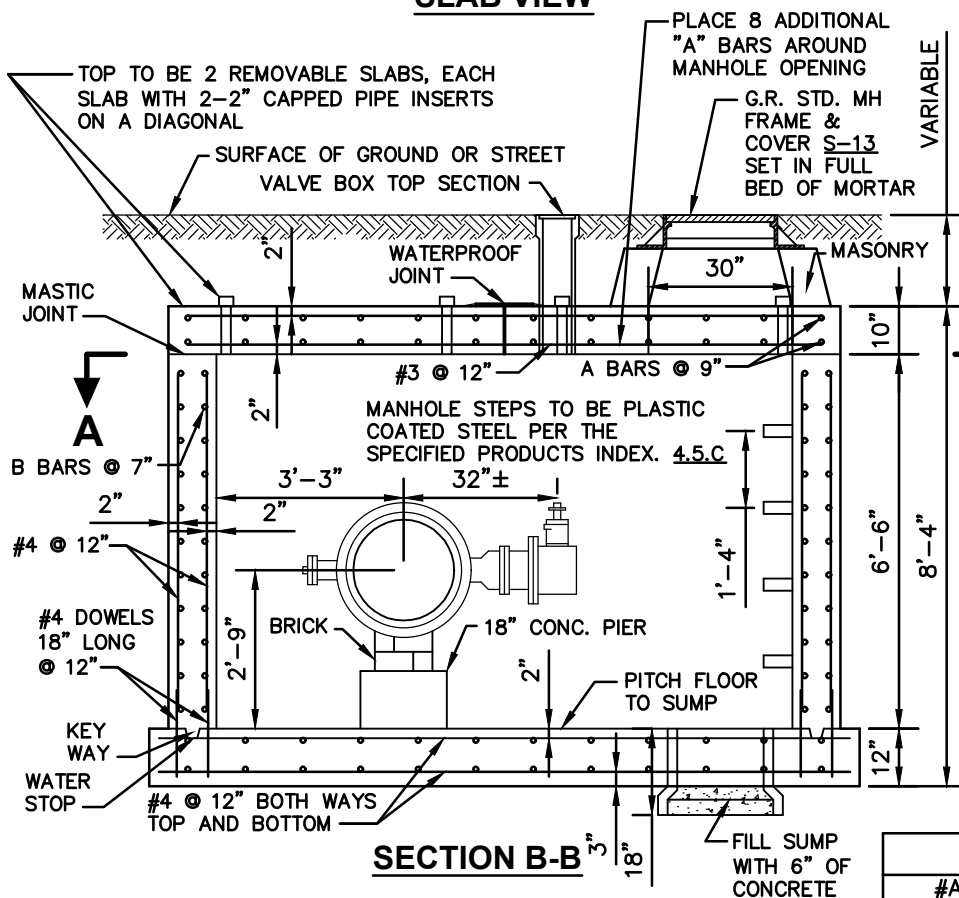
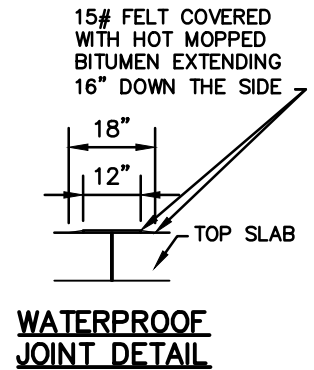
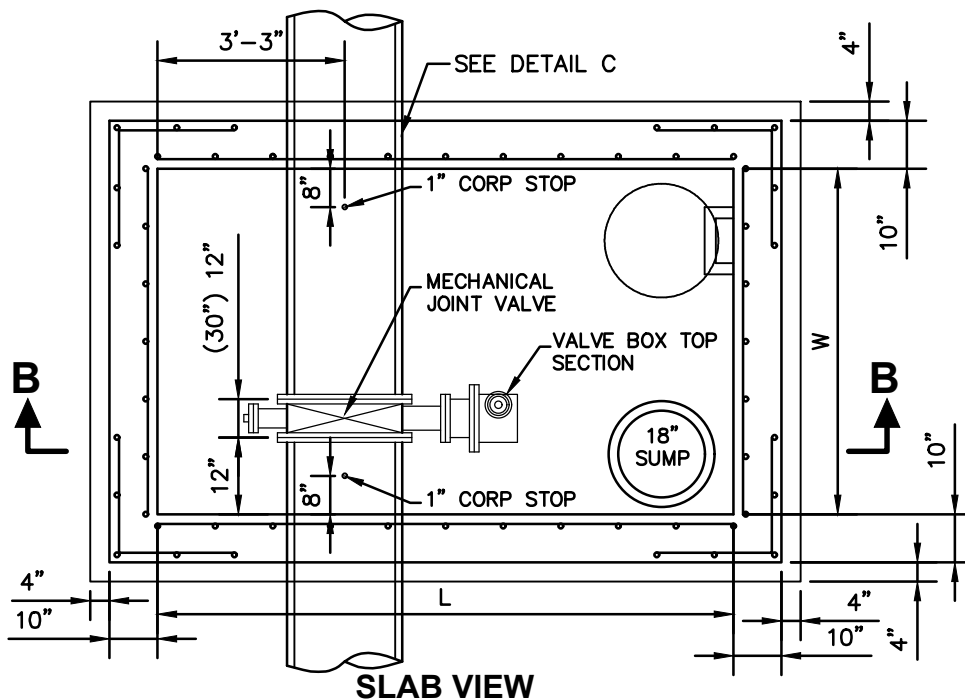
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W-2



NOTE:
CONCRETE PER SECTION 6.1
TO BE USED IN CHAMBER

NOTE:
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DRAWINGS OR SPECIFICATIONS.

DIMENSIONS		
VALVE SIZE	30"	36"
L	12'-0"	13'-0"
W	7'-0"	8'-0"

STEEL REQUIREMENTS			
#A BAR SIZE	#6	#7	#8
#B BAR SIZE	#5	#6	#6
CORNER BAR SIZE	#5	#6	#6
SHORT LEG LENGTH	1'-9"	2'-0"	2'-0"
LONG LEG LENGTH	2'-9"	3'-0"	3'-6"

VALVE CHAMBER FOR 30" AND 36" BUTTERFLY VALVES

N.T.S.

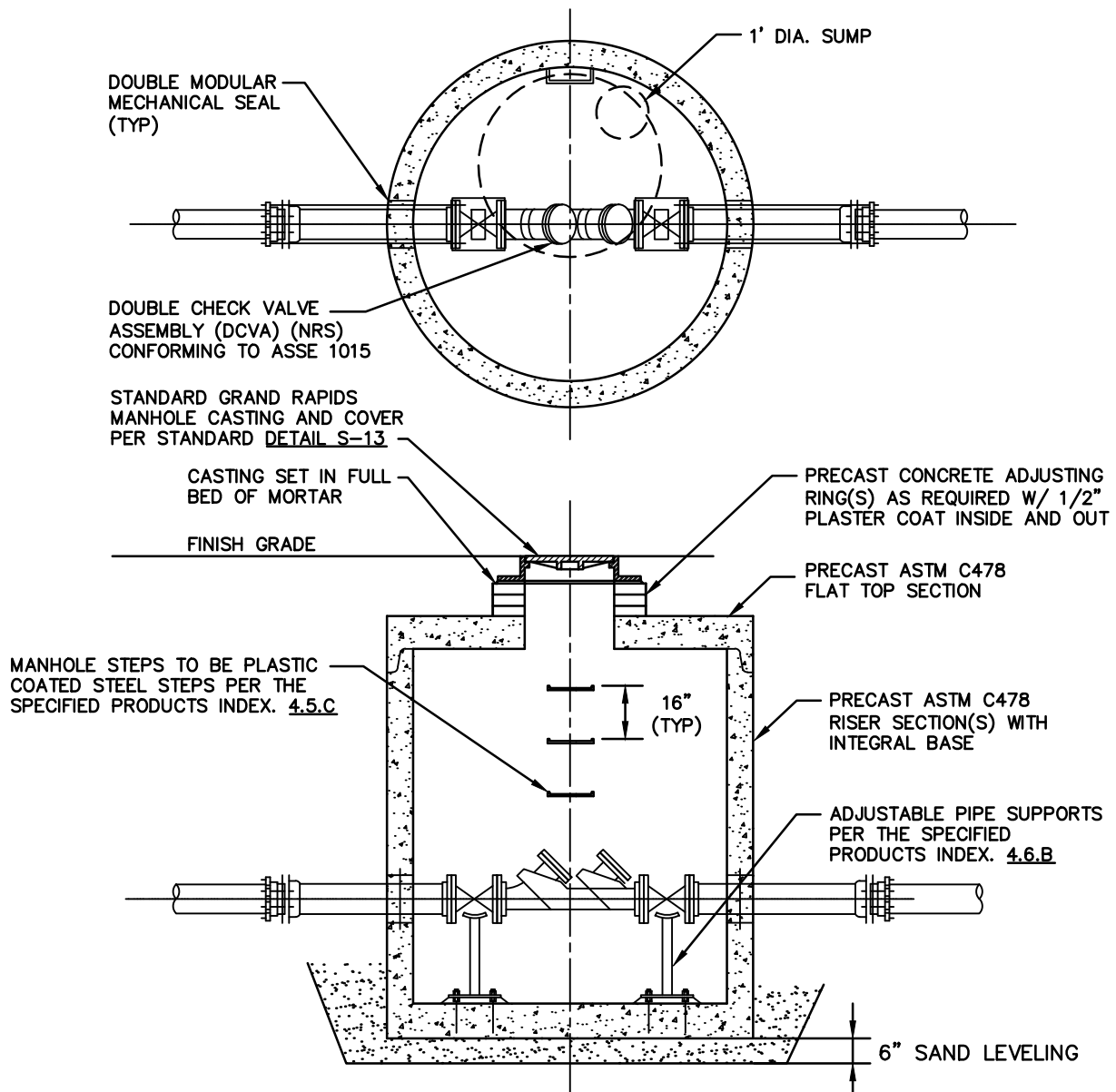
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W-2A



NOTES:

1. DCVA IS RECOMMENDED TO BE LOCATED INSIDE THE BUILDING WHEN THE PIPING BETWEEN THE DCVA AND THE STREET RIGHT OF WAY OR EASEMENT LINE IS LESS THAN 100 LINEAL FEET. WHEN THE DISTANCE EXCEEDS 100 LINEAL FEET, THEN A CHAMBER IS REQUIRED WITHIN 100 LINEAL FEET OF THE RIGHT OF WAY OR EASEMENT.
2. DCVA SHALL BE LOCATED UPSTREAM OF PRIVATE FIRE HYDRANTS AND FIRE DEPARTMENT CONNECTIONS.
3. SIZE CHAMBER APPROPRIATELY FOR MAINTENANCE/TESTING.
4. DESIGN STRUCTURE & LID FOR APPROPRIATE LOADS.

CHAMBER FOR 6" AND 8" DOUBLE CHECK VALVE ASSEMBLY

N.T.S.

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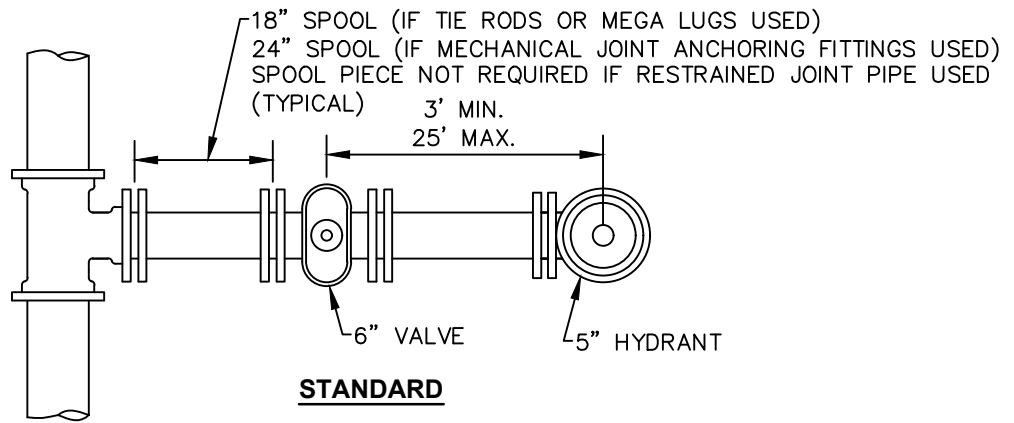
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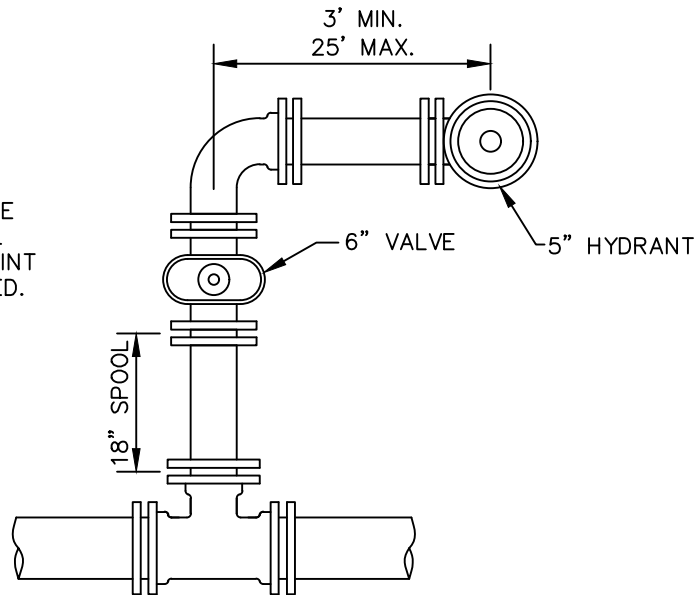
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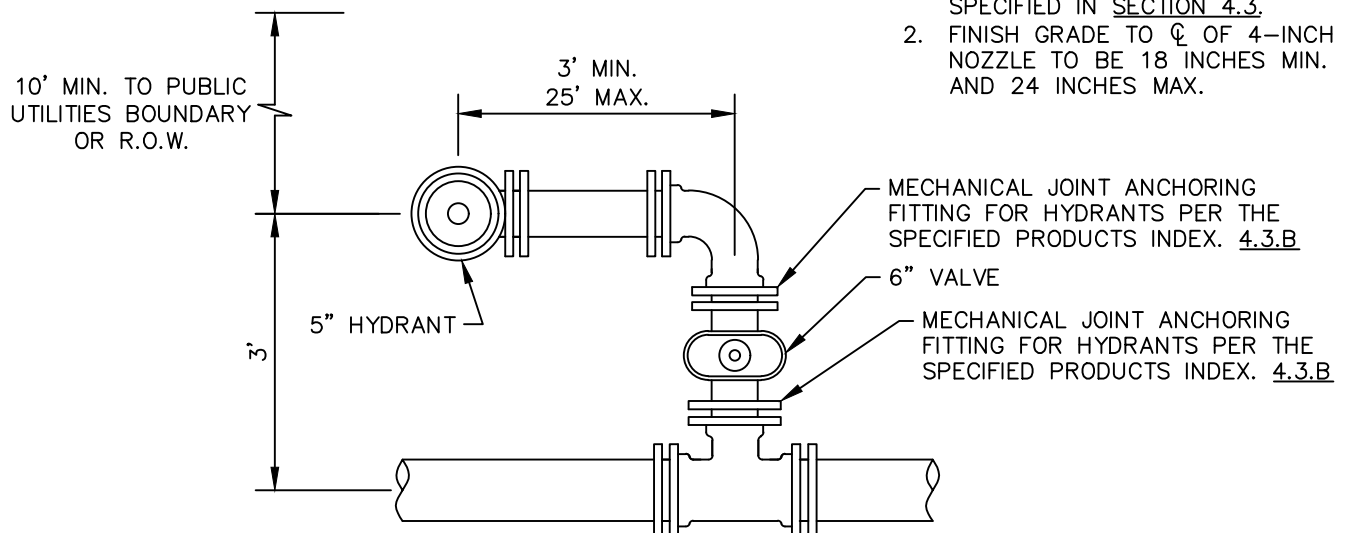
NOTE:

1. THE DISTANCE FROM THE TEE TO THE VALVE WILL VARY WITH THE RESTRAINT ALTERNATIVE BEING USED.



NOTES:

1. JOINT RESTRAINT SHALL BE AS SPECIFIED IN SECTION 4.3.
2. FINISH GRADE TO ϕ OF 4-INCH NOZZLE TO BE 18 INCHES MIN. AND 24 INCHES MAX.



HYDRANT ASSEMBLY INSTALLATION

N.T.S.

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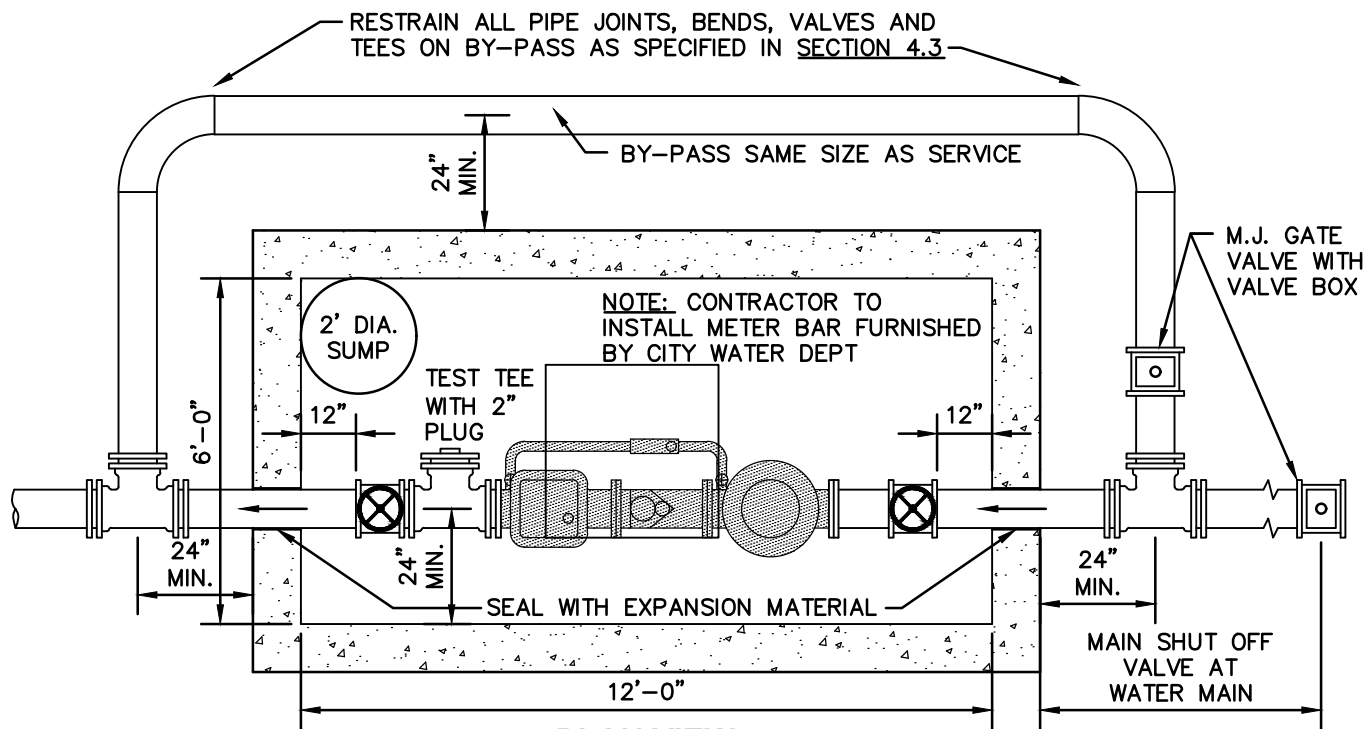
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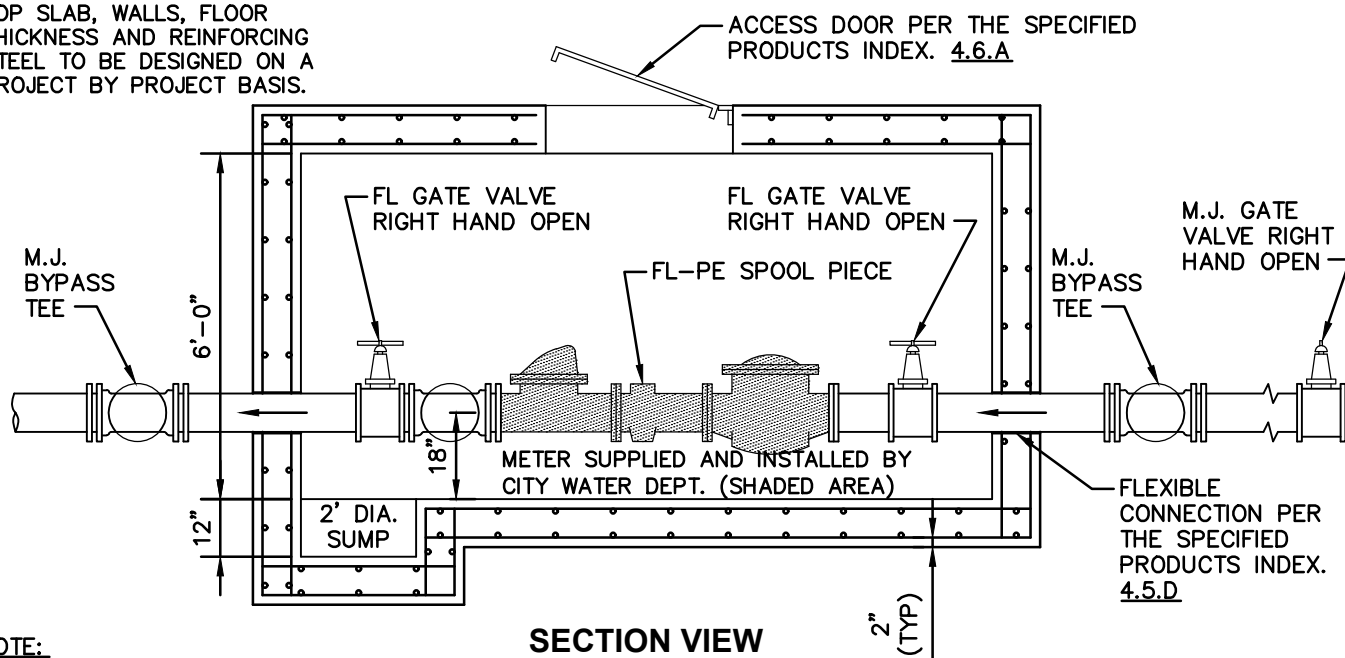
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W-4



PLAN VIEW

SCHEMATIC STRUCTURE SHOWN.
TOP SLAB, WALLS, FLOOR
THICKNESS AND REINFORCING
STEEL TO BE DESIGNED ON A
PROJECT BY PROJECT BASIS.



SECTION VIEW

NOTE:

VALVES SHALL BE RESTRAINED IN ACCORDANCE WITH
THE REQUIREMENTS FOR PLUGS, BASED ON THE SIZE
OF THE WATERMAIN ENTERING THE CHAMBER AS
SPECIFIED IN SECTION 4.3.

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CHAMBER FOR COMPOUND AND TURBO METERS (3" AND LARGER METERS)

N.T.S.

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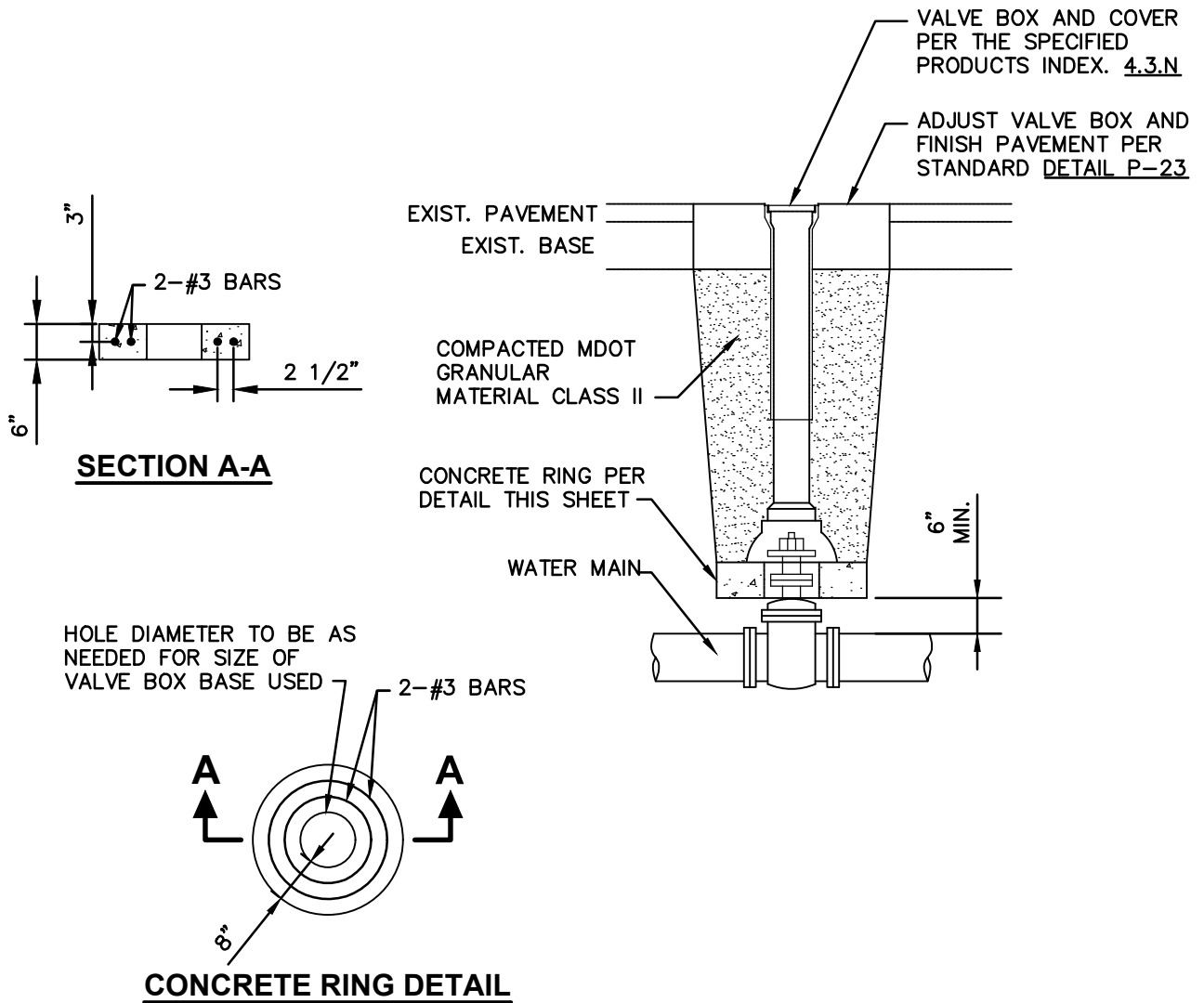
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W-5



VALVE BOX INSTALLATION FOR GATE VALVES

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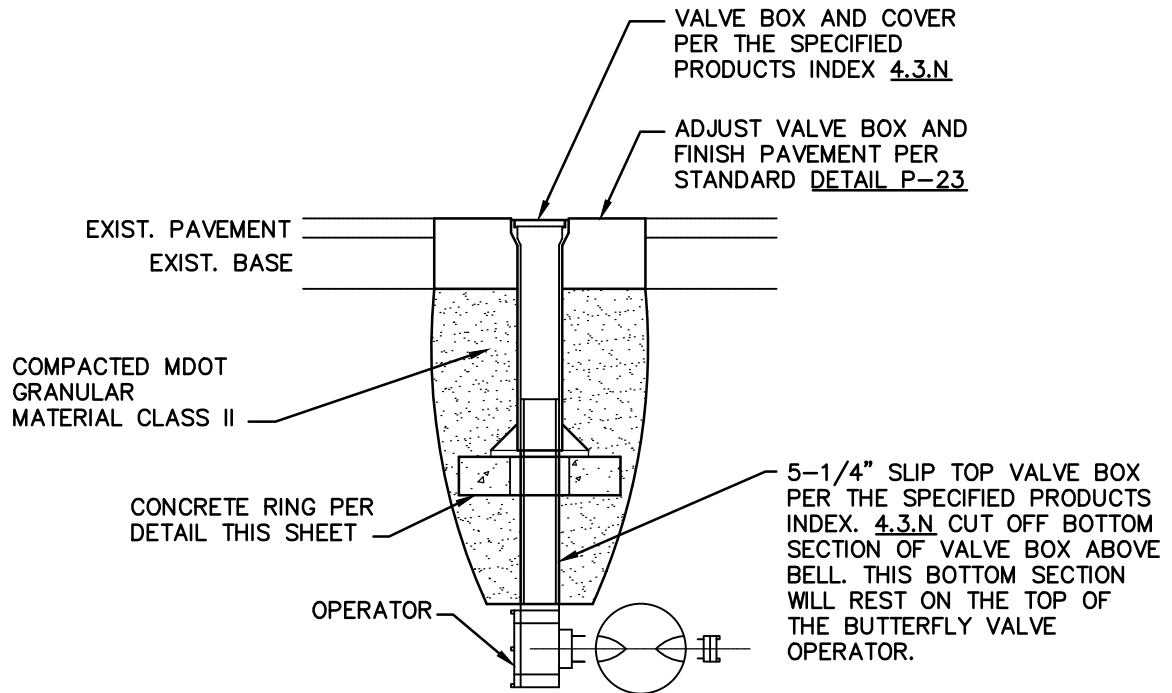
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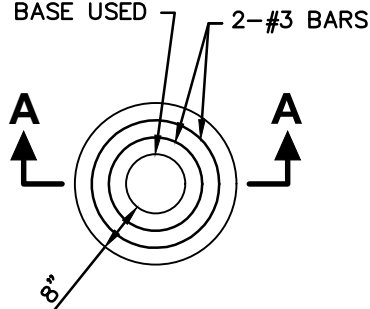
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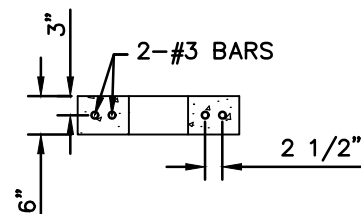
W-6



HOLE DIAMETER TO BE AS NEEDED FOR SIZE OF VALVE BOX BASE USED



CONCRETE RING DETAIL



SECTION A-A

VALVE BOX INSTALLATION **FOR BUTTERFLY VALVES**

N.T.S.

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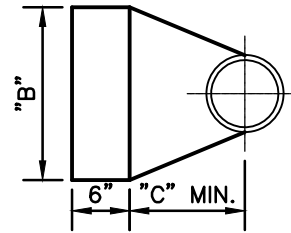
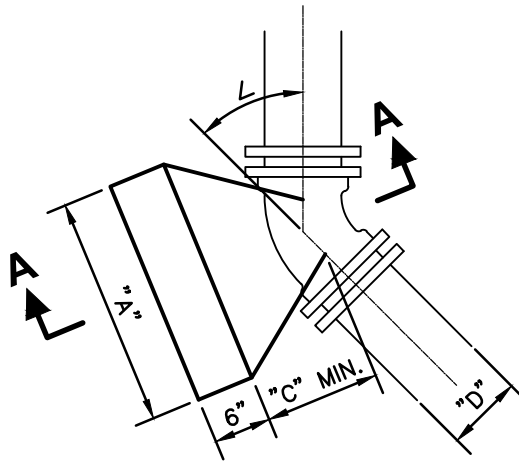
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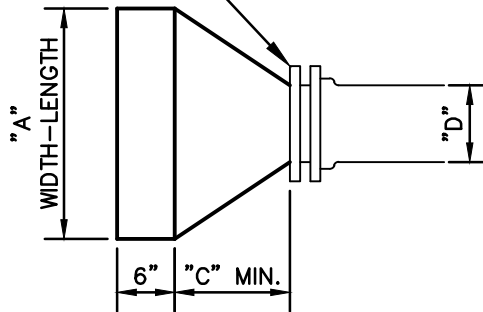
W-6A



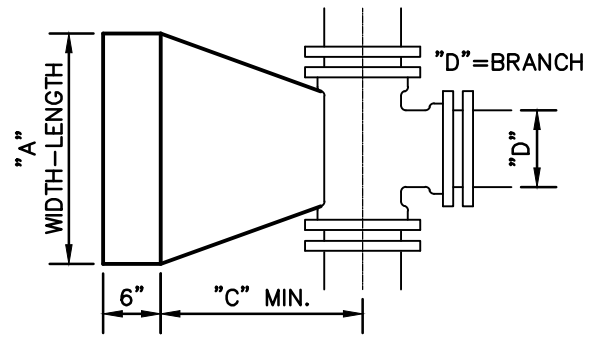
SECTION A-A

THRUST BLOCK FOR BENDS

BOND BREAKER
PER NOTE #3



THRUST BLOCK FOR PLUGS



THRUST BLOCK FOR TEES

NOTES:

1. ALL CONCRETE IN THRUST BLOCKS TO BE PER SECTION 6.1
2. IN AREAS WHERE ADEQUATE BACKING IS NOT AVAILABLE, THE WATER MAIN SHALL BE ANCHORED AS PER SECTION 4.3.c.16.
3. FORMING OF THRUST BLOCKS WILL BE AS PER THE TABLE TO THE RIGHT AND AS REQUIRED BY THE ENGINEER. PLACE ENGINEER APPROVED BOND BREAKER BETWEEN THRUST BLOCK AND WATER MAIN.

DIMENSIONS								
PIPE DIA.	FOR BENDS			FOR PLUGS		FOR TEES		
D	∠	A	B	C	A	C	A	C
16"	90°	5'-4"	4'-0"	1'-6"	4'-0"	1'-6"	4'-0"	2'-3"
	45°	3'-9"	3'-0"	1'-6"				
	22-1/2°	3'-9"	2'-0"	1'-6"				
12"	11-1/4°	2'-0"	1'-6"	1'-6"				
	90°	4'-0"	3'-0"	1'-3"	3'-0"	1'-3"	3'-0"	2'-0"
	45°	3'-3"	2'-0"	1'-3"				
8"	22-1/2°	2'-3"	1'-6"	1'-3"				
	90°	2'-9"	2'-0"	1'-0"	2'-0"	1'-0"	2'-0"	1'-9"
	45°	2'-0"	1'-6"	1'-0"				
6"	90°	2'-3"	1'-6"	0'-9"	1'-6"	0'-9"	1'-6"	1'-6"

**THRUST BLOCK DETAILS FOR
CAST AND DUCTILE IRON PIPE**

N.T.S.

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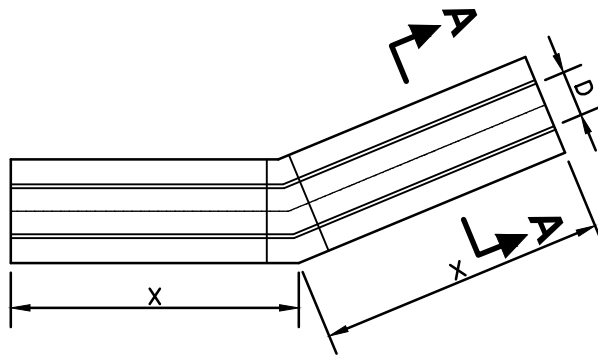
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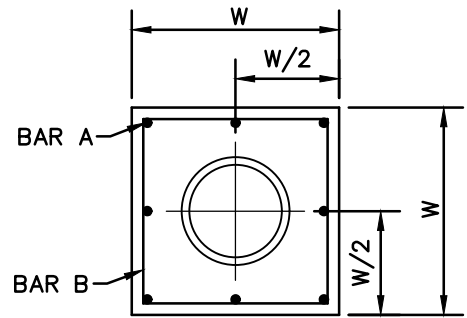
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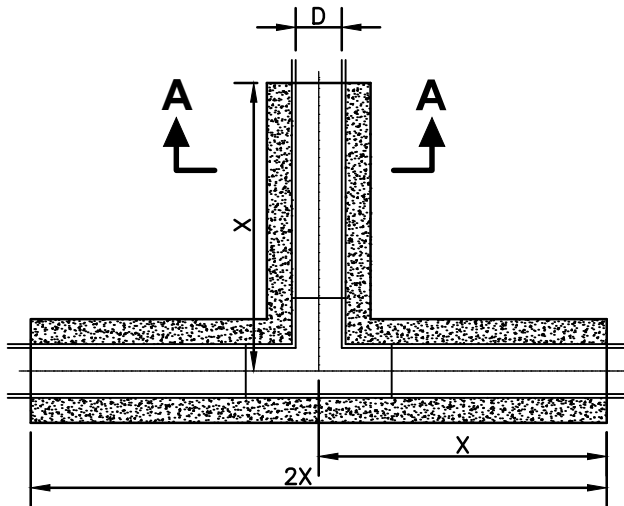
W-7



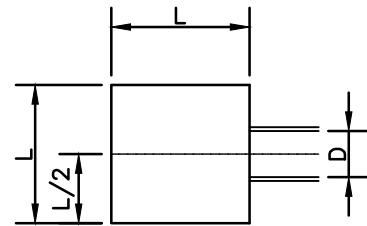
ENCASEMENTS FOR BENDS



SECTION A-A



ENCASEMENTS FOR TEES



PLUG ENCASEMENT DIMENSIONS

D	L
24"	6'-0"
30"	7'-6"
36"	8'-6"

ENCASEMENTS FOR PLUGS

BEND & TEE ENCASEMENT DIMENSIONS					
D	L	X (ft)	W (ft)	BAR A	BAR B
24"	11-1/4°	2.5	4.5	8 - #6	#4 @ 24"
24"	22-1/2°	5.0	4.5	8 - #6	#4 @ 24"
24"	30°	6.5	4.5	8 - #6	#4 @ 24"
24"	45°	10	4.5	8 - #6	#4 @ 24"
24"	60°	12.5	4.5	8 - #6	#4 @ 24"
24"	90°	18.0	4.5	8 - #6	#4 @ 24"
30"	11-1/4°	3.0	5.5	12 - #6	#4 @ 24"
30"	22-1/2°	6.0	5.5	12 - #6	#4 @ 24"
30"	30°	8.0	5.5	12 - #6	#4 @ 24"
30"	45°	12.0	5.5	12 - #6	#4 @ 24"
30"	60°	16.0	5.5	12 - #6	#4 @ 24"
30"	90°	22.0	5.5	12 - #6	#4 @ 24"
36"	11-1/4°	3.5	6.5	16 - #6	#4 @ 24"
36"	22-1/2°	7.0	6.5	16 - #6	#4 @ 24"
36"	30°	9.0	6.5	16 - #6	#4 @ 24"
36"	45°	13.0	6.5	16 - #6	#4 @ 24"
36"	60°	17.0	6.5	16 - #6	#4 @ 24"
36"	90°	24.0	6.5	16 - #6	#4 @ 24"

NOTES:

1. ALL CONCRETE IN ENCASEMENTS TO BE PER SECTION 6.1.
2. FOR DEFLECTION ANGLES NOT LISTED IN TABLE USE NEXT HIGHEST VALUES
3. ON ENCASEMENTS FOR TEES USE SAME DIMENSIONS AS FOR D ON 60° BENDS.
4. MIN. BAR LAP TO BE 30 DIAMETERS OF STEEL REINFORCEMENT BAR
5. BARS TO BE CONTINUOUS THROUGH ANGLE POINTS AND RUN TO OUTSIDE OF TEE AND CROSS ENCASEMENTS

ENCASEMENT DETAILS FOR CONCRETE PIPE

N.T.S.

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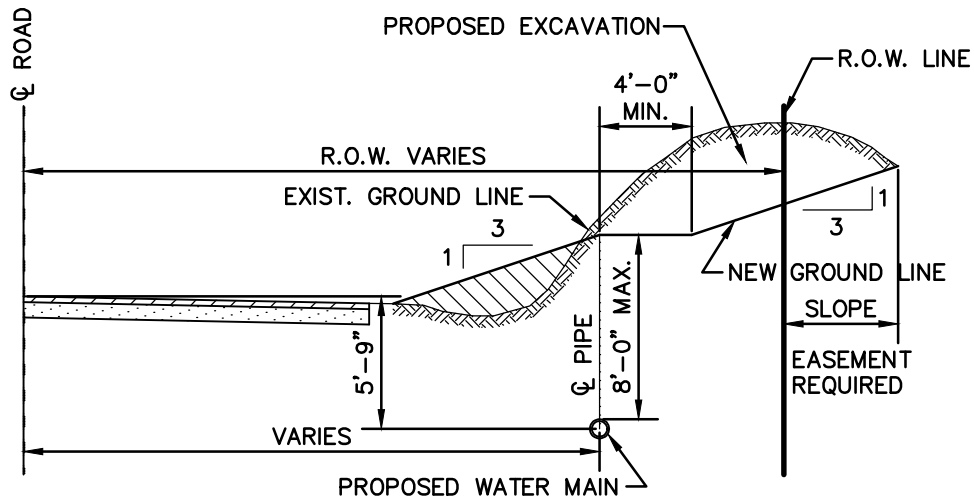
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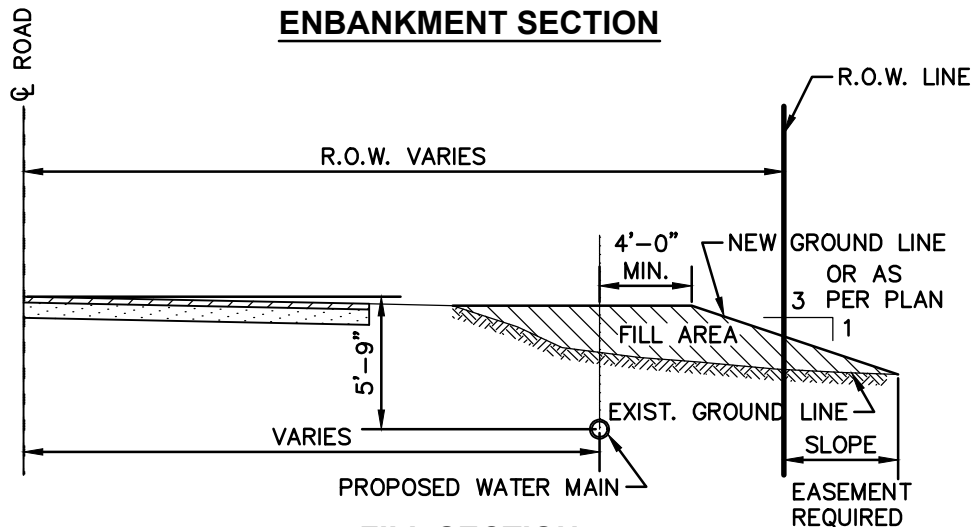
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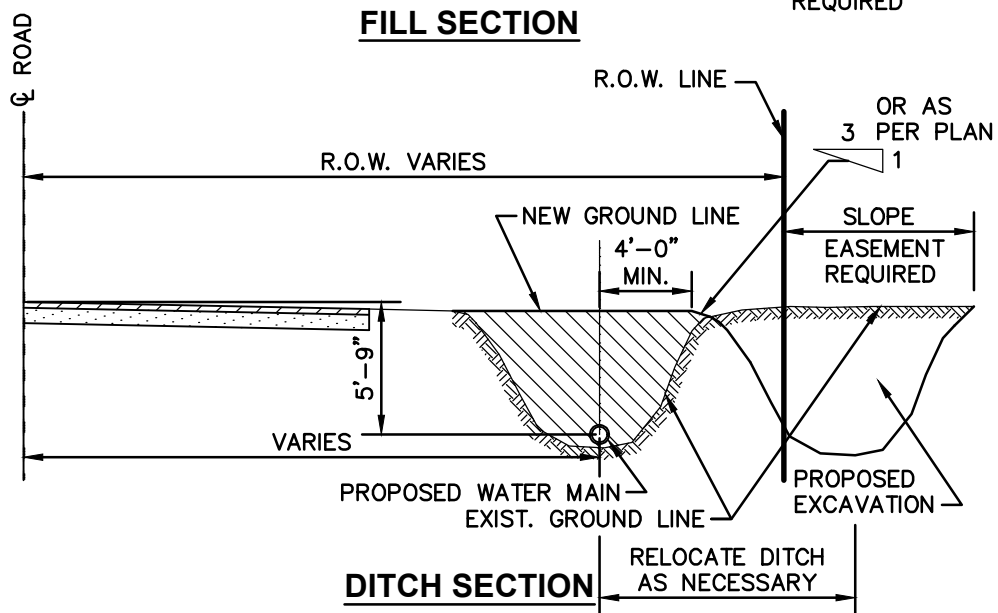
W-8



ENBANKMENT SECTION



FILL SECTION



WATER MAIN LOCATION OUTSIDE OF ROADWAY AREAS

N.T.S.

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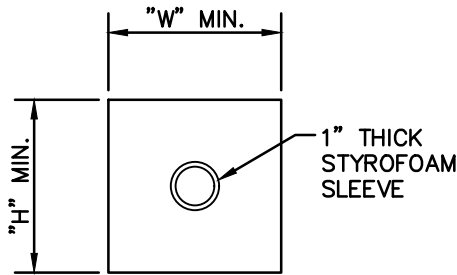
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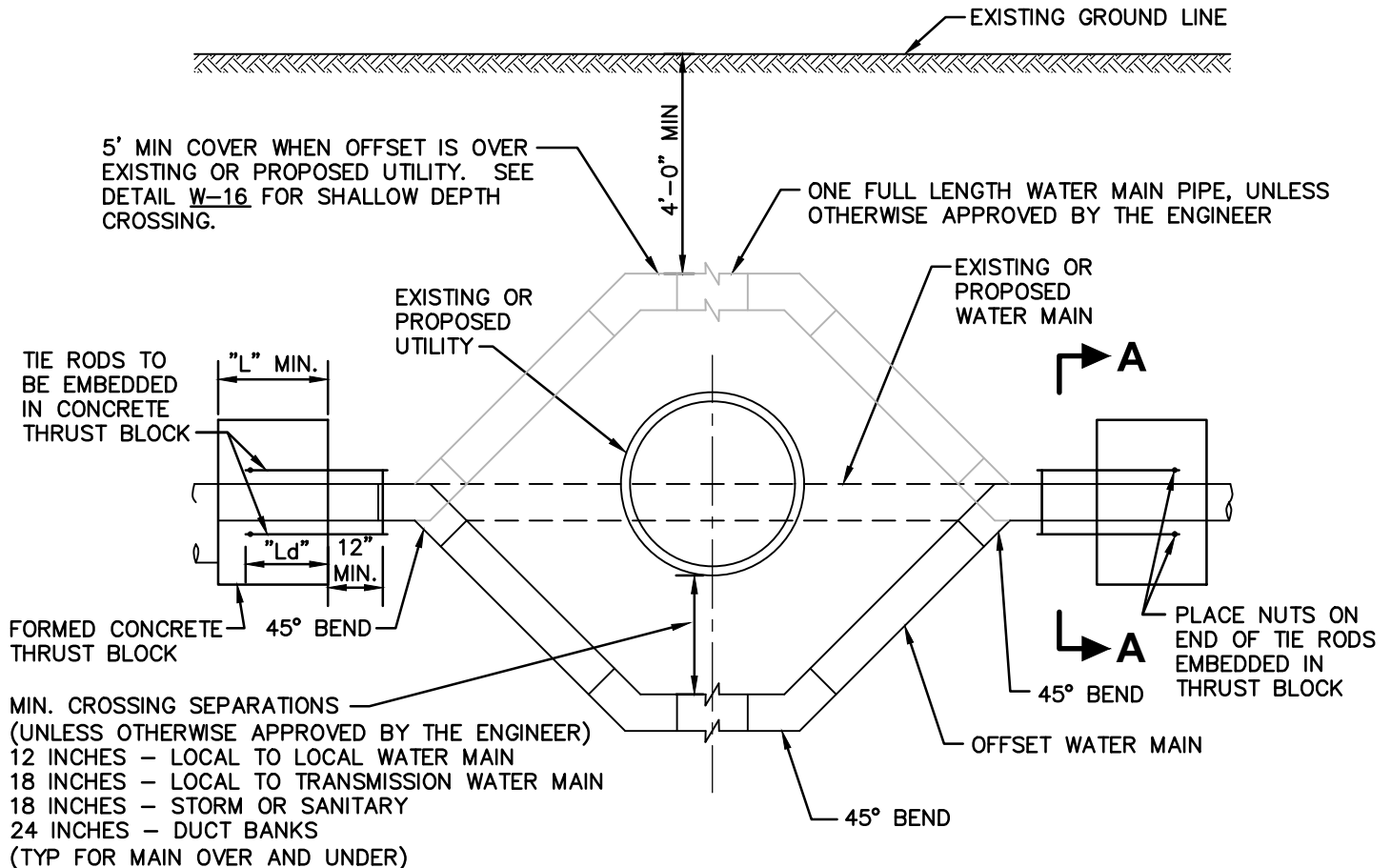
W-9

NO WATER MAIN JOINTS WILL BE ALLOWED INSIDE THE THRUST BLOCKS. IF A JOINT CONFLICTS WITH THE THRUST BLOCK PLACEMENT AS SHOWN, THEN THE JOINT WILL BE RESTRAINED AND THE THRUST BLOCK LOCATED THE MINIMUM DISTANCE BEYOND SAID JOINT.



SECTION A-A

DIMENSIONS				
PIPE DIA.	L	W	H	Ld
6"	1'-6"	3'-0"	3'-0"	1'-3"
8"	2'-0"	3'-0"	3'-0"	1'-6"
12"	4'-0"	4'-0"	3'-0"	3'-0"
16"	5'-0"	4'-6"	4'-0"	4'-0"



NOTES:

1. WHEN THE MINIMUM CLEARANCE AND COVER CANNOT BE OBTAINED IN ACCORDANCE WITH THIS DETAIL OR DETAIL W-16, THE WATER MAIN IS TO BE RELOCATED UNDER THE UTILITY.
2. ON EXISTING WATER MAIN, THE 45° BEND SHALL BE RESTRAINED AS SHOWN IN THIS DETAIL, INCLUDING THRUST BLOCKS AND AS SPECIFIED IN SECTION 4.3. ON NEW CONSTRUCTION, THRUST BLOCKS SHALL NOT BE USED AND THE WATER MAIN SHALL BE RESTRAINED WITH MECHANICAL JOINT RESTRAINT AND RESTRAIN GLANDS AS SPECIFIED IN SECTION 4.3.
3. IF TIE RODS ARE USED FOR JOINT RESTRAINT, SEE TABLE 4.3-6 IN SECTION 4.3 FOR NUMBER OF TIE RODS REQUIRED PER JOINT. ALSO, SEE TIE ROD DETAIL ON STANDARD DETAIL W-15.

WATER MAIN OFFSET

N.T.S.

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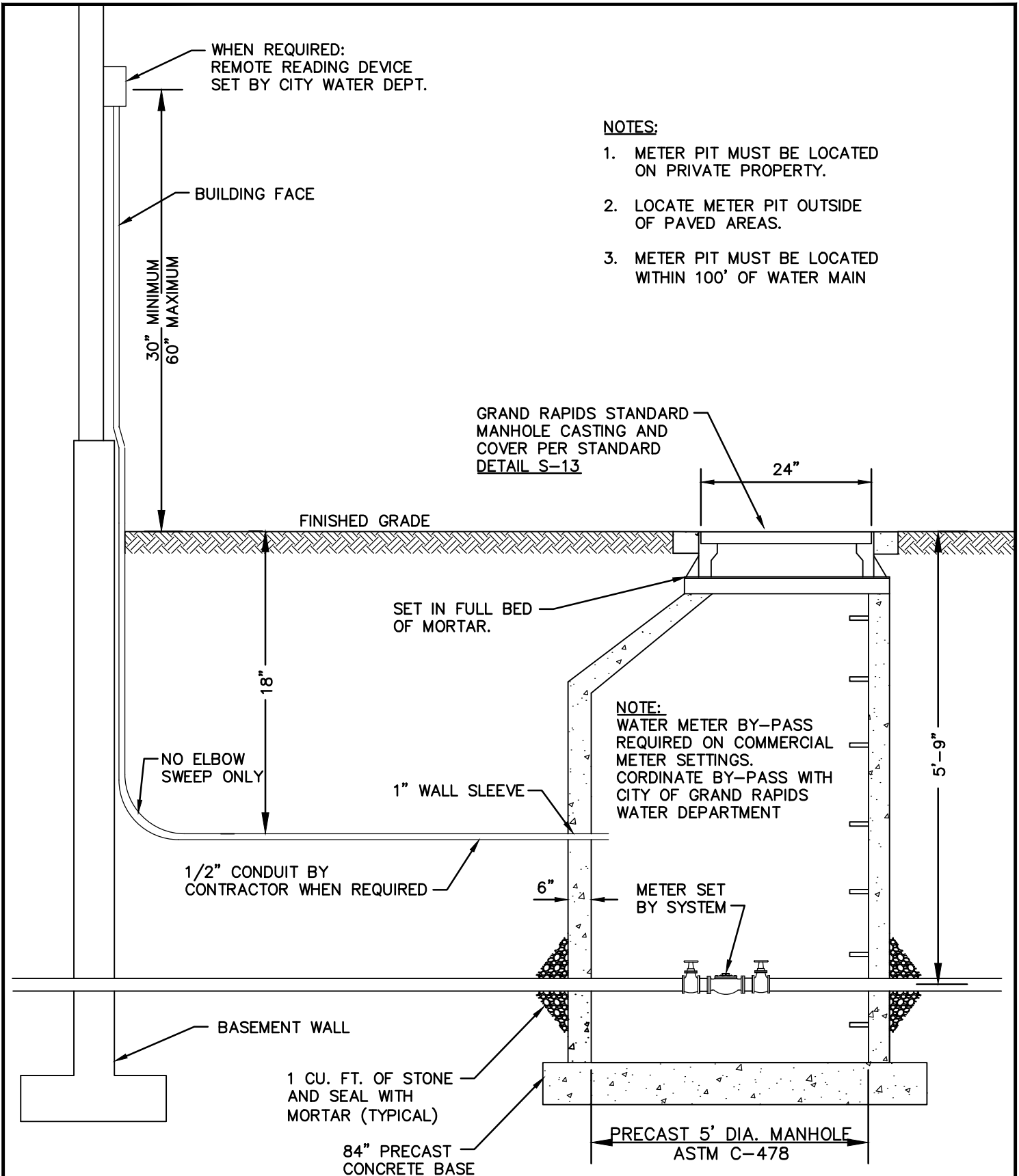
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W-10



NOTES:

1. METER PIT MUST BE LOCATED ON PRIVATE PROPERTY.
2. LOCATE METER PIT OUTSIDE OF PAVED AREAS.
3. METER PIT MUST BE LOCATED WITHIN 100' OF WATER MAIN

**PRECAST METER PIT FOR 2" OR
SMALLER METER (OUTSIDE OF ROADWAY)**

N.T.S.

APPROVED BY

T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

LAST REVISION DATE

City of Grand Rapids
Public Services
Engineering Department

W-11



- ## W-12 REGULATING VALVE AND CHAMBER

N.T.S.

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1/4/2021

LAST REVISION DATE

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Public Services
Engineering Department

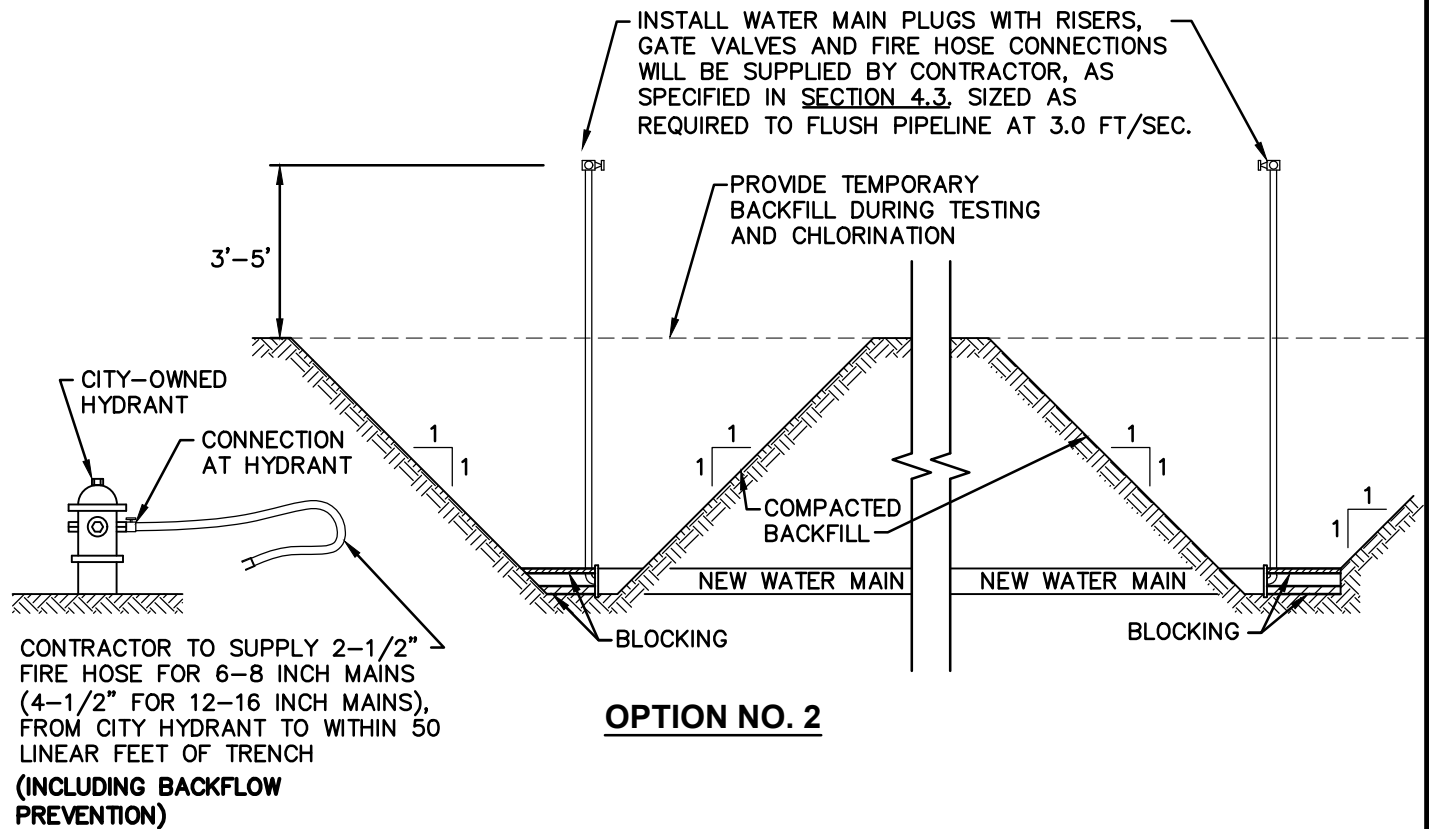
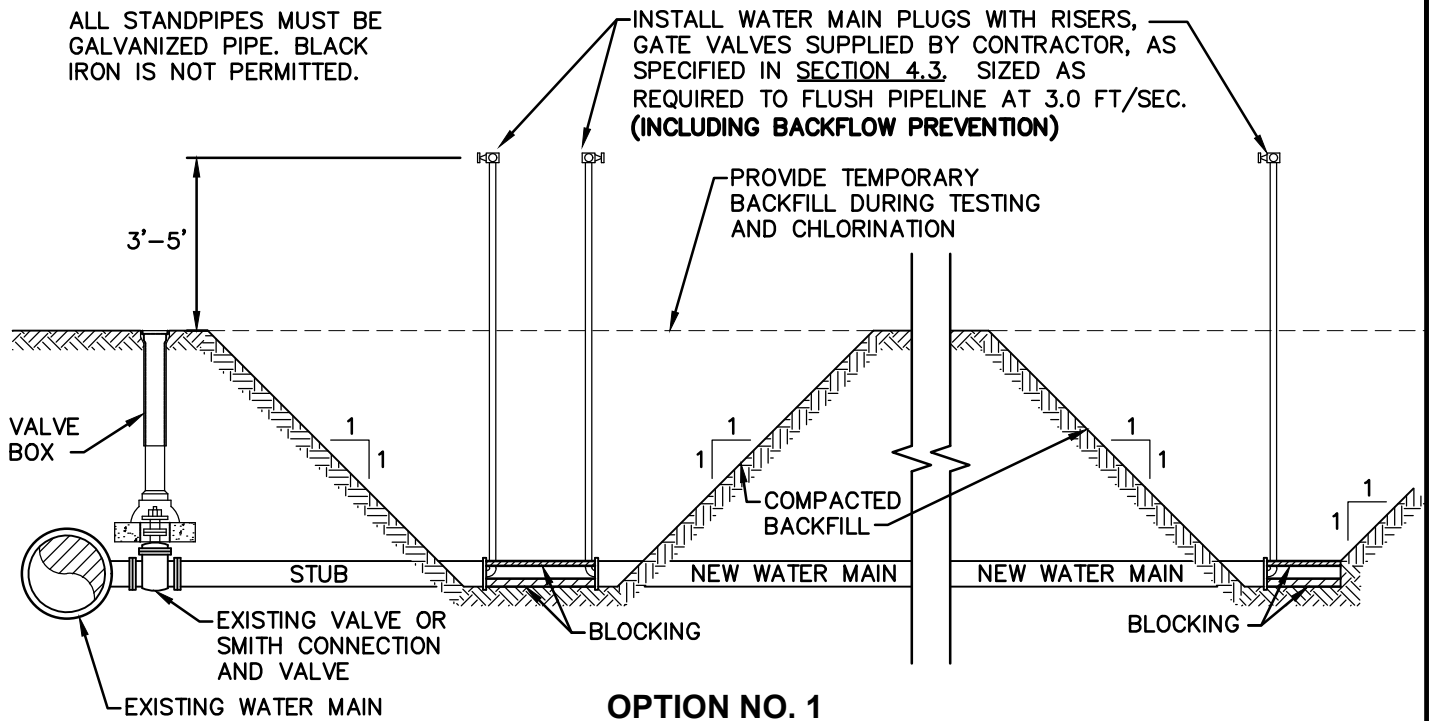
W-12



W-12A

NOTE:

ALL STANDPIPES MUST BE GALVANIZED PIPE. BLACK IRON IS NOT PERMITTED.



TESTING AND CHLORINATION

N.T.S.

APPROVED BY

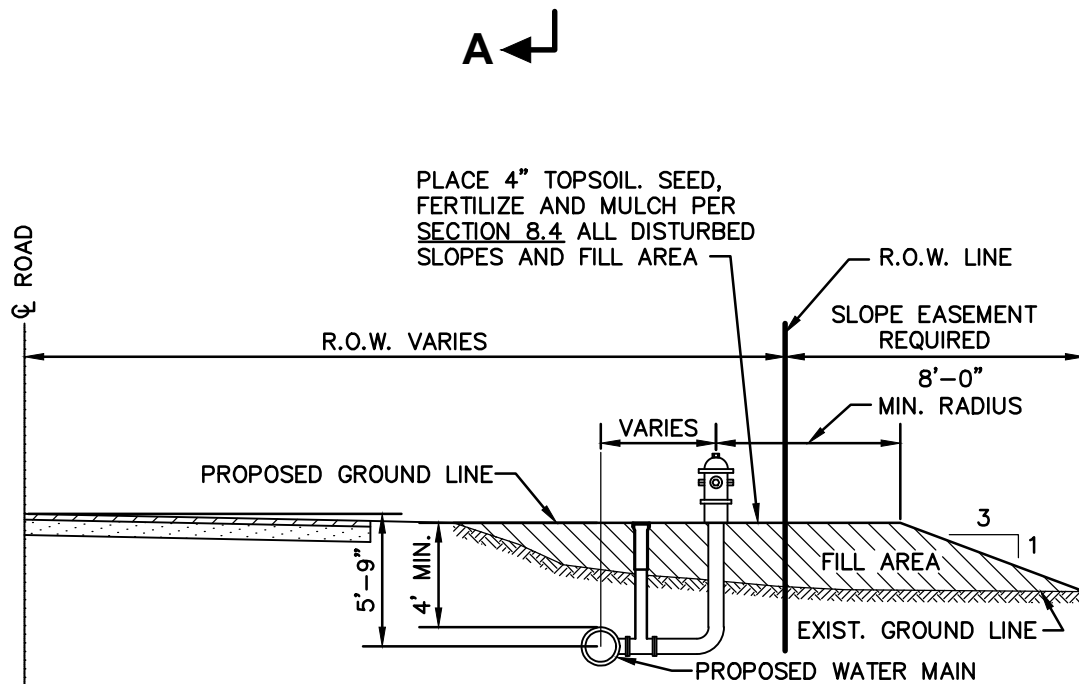
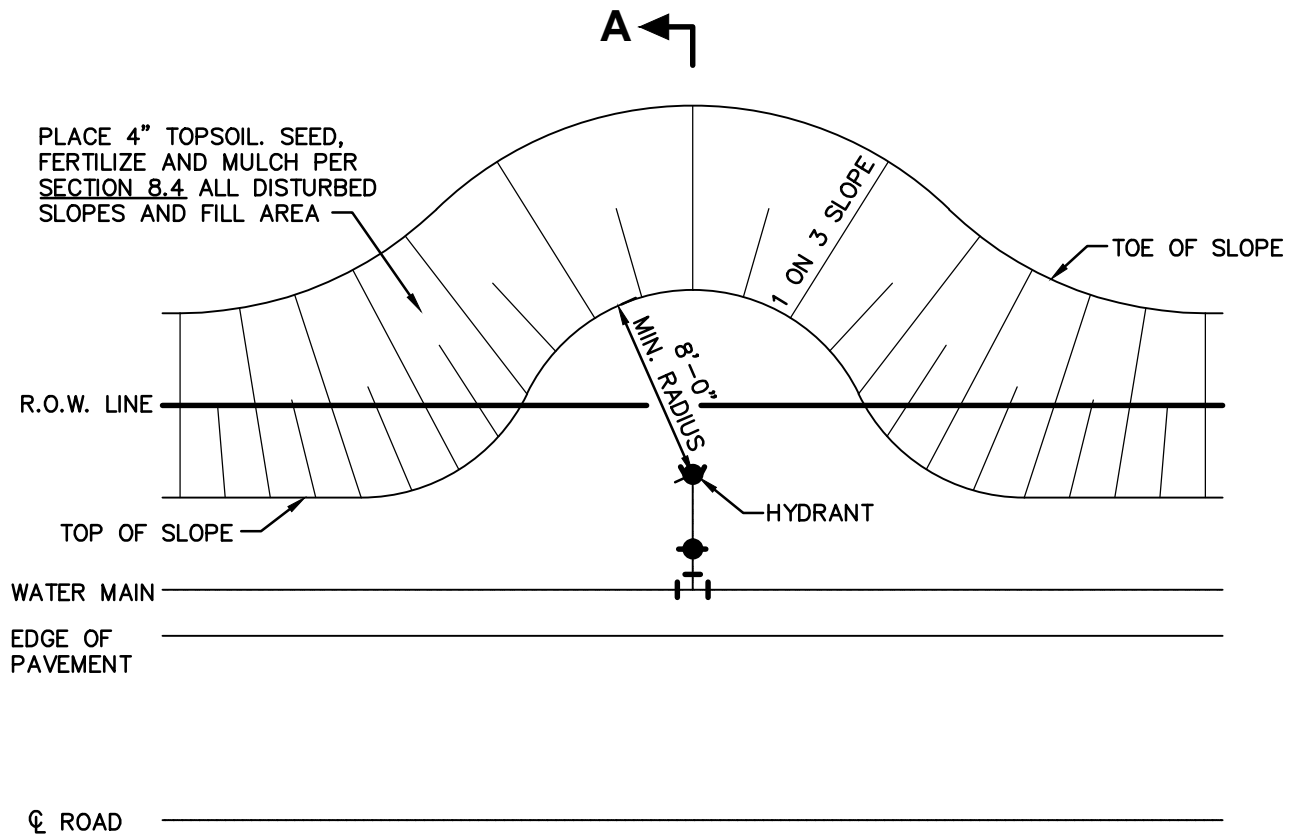
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Public Services
Engineering Department

W-13



SECTION A-A

HYDRANT LOCATION FOR ROADWAY SHOULDERS REQUIRING FILL

N.T.S.

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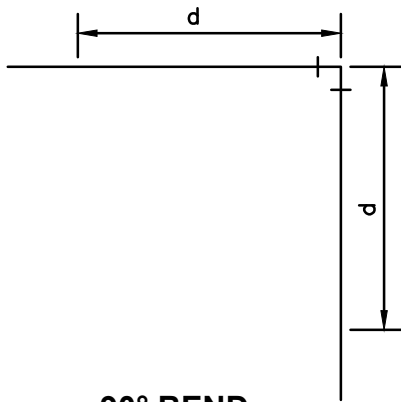
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1/4/2021

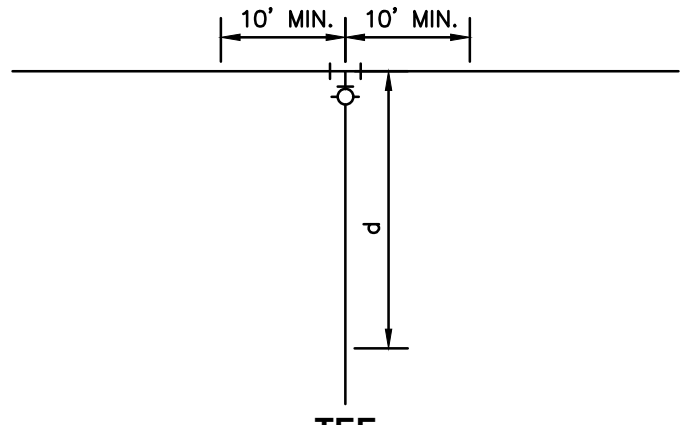
LAST REVISION DATE

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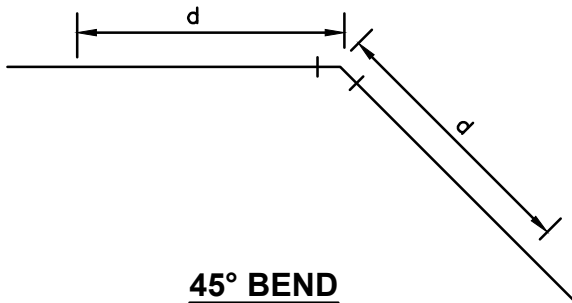
W-14



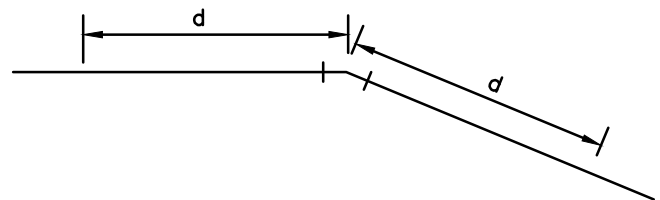
90° BEND



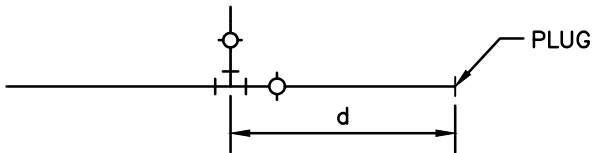
TEE



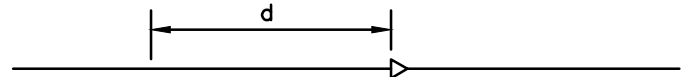
45° BEND



22-1/2° BEND OR LESS

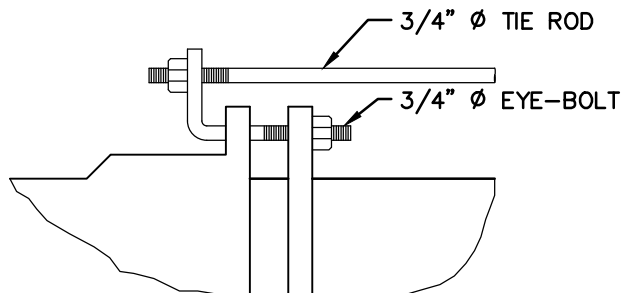


DEAD END



REDUCERS

DIMENSION "d" = SEE TABLE 4.3-7 SECTION 4.3.c.16



TIE ROD DETAIL

NOTE:

1. RESTRAIN FITTINGS AND PIPE WITH RESTRAINING GLANDS AND GASKETS IN ACCORDANCE WITH THE CITY STANDARD SPECIFICATIONS. TIE-RODS ARE ONLY TO BE USED WHEN DIRECTED BY THE ENGINEER.

**JOINT RESTRAINT REQUIREMENTS
AND TIE ROD DETAIL**

N.T.S.

APPROVED BY

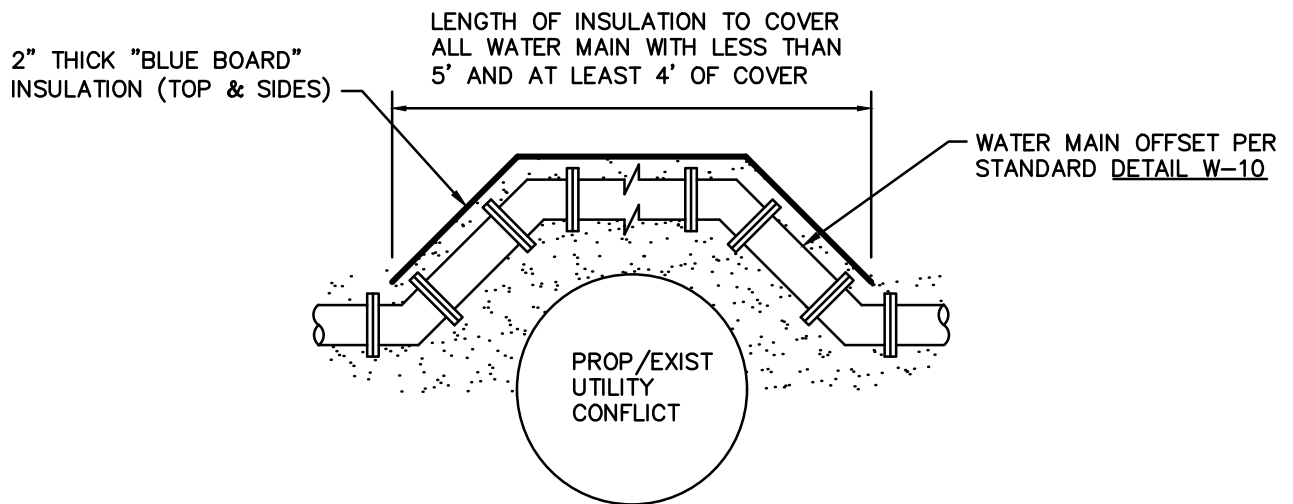
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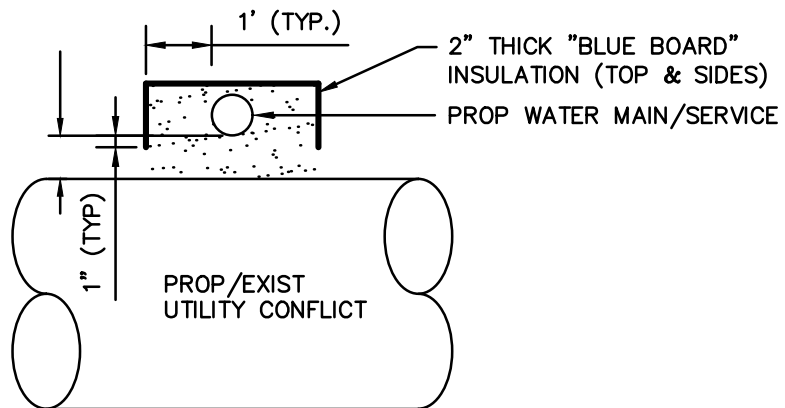
W-15



MIN. CROSSING SEPARATIONS

(UNLESS OTHERWISE APPROVED BY THE ENGINEER)

- 12 INCHES – LOCAL TO LOCA WATER MAIN
- 18 INCHES – LOCAL TO TRANSMISSION WATER MAIN
- 18 INCHES – STORM OR SANITARY
- 24 INCHES – DUCT BANKS



WATER MAIN INSULATION FOR SHALLOW DEPTH UTILITY CROSSINGS

N.T.S.

APPROVED BY

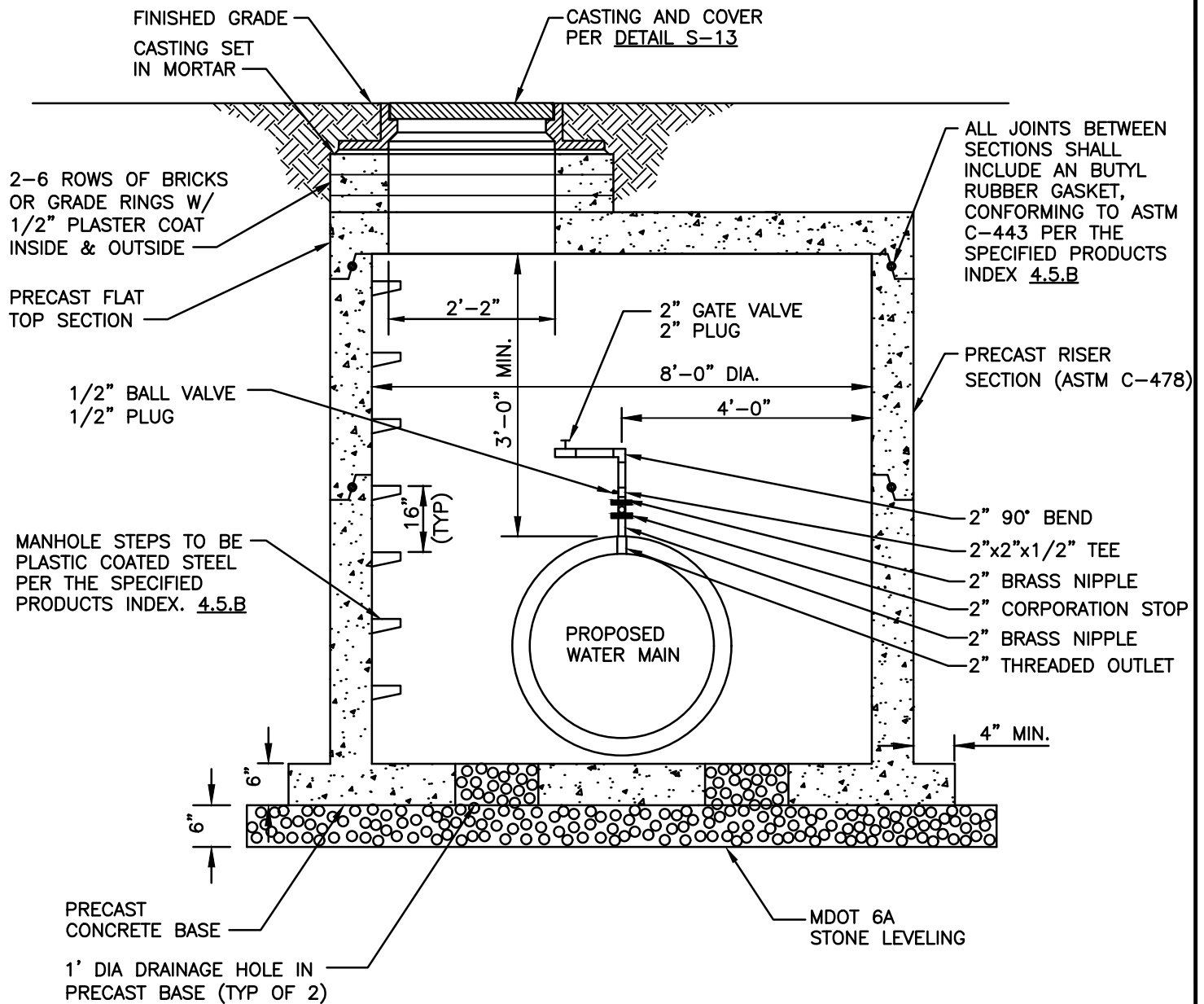
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1/4/2021

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City of Grand Rapids
Public Services
Engineering Department

W-16



NOTE:

CONTRACTOR SHALL INSTALL 2" TAP AND FITTINGS RATHER THAN WATER DEPARTMENT

AIR VENT MANHOLE

N.T.S.

APPROVED BY

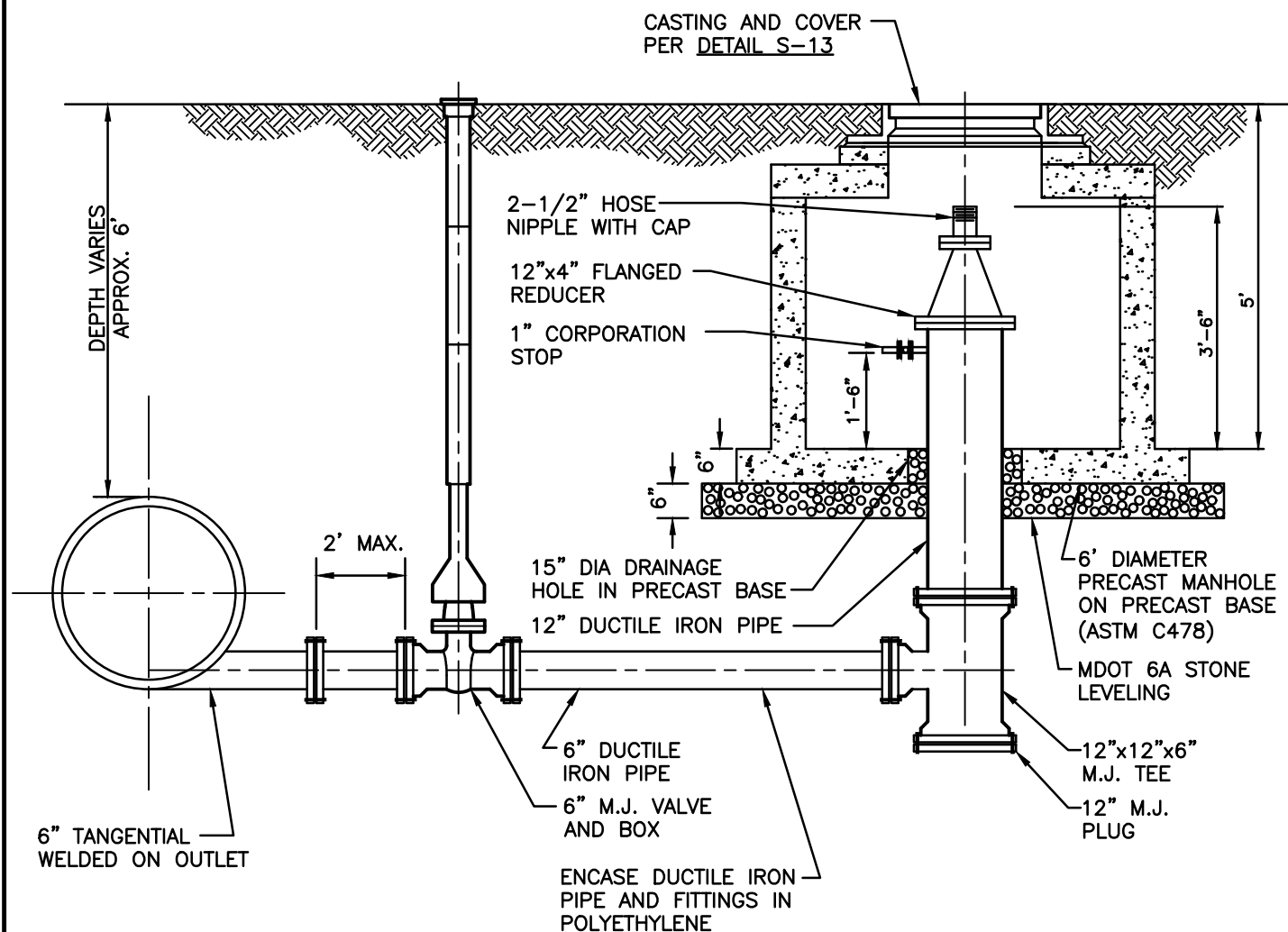
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Public Services
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W-17



NOTES:

1. BLOWOFF ASSEMBLY SHALL INCLUDE THE 6" TANGENTIAL WELDED ON OUTLET, INSULATED FLANGE AND POLYETHELENE ENCASEMENT, 6" VALVE AND BOX, 12"x12"x6" TEE, 12" PLUG, 12"x4" REDUCER, 2-1/2" HOSE NOZZLE, CORPORATION STOP, MANHOLE AND CASTING, AND ALL CONNECTING PIPING.
2. ALL NON-FLANGED JOINTS TO BE RESTRAINED USING MEGALUG JOINT RESTRAINT.

BLOWOFF ASSEMBLY CHAMBER

N.T.S.

APPROVED BY

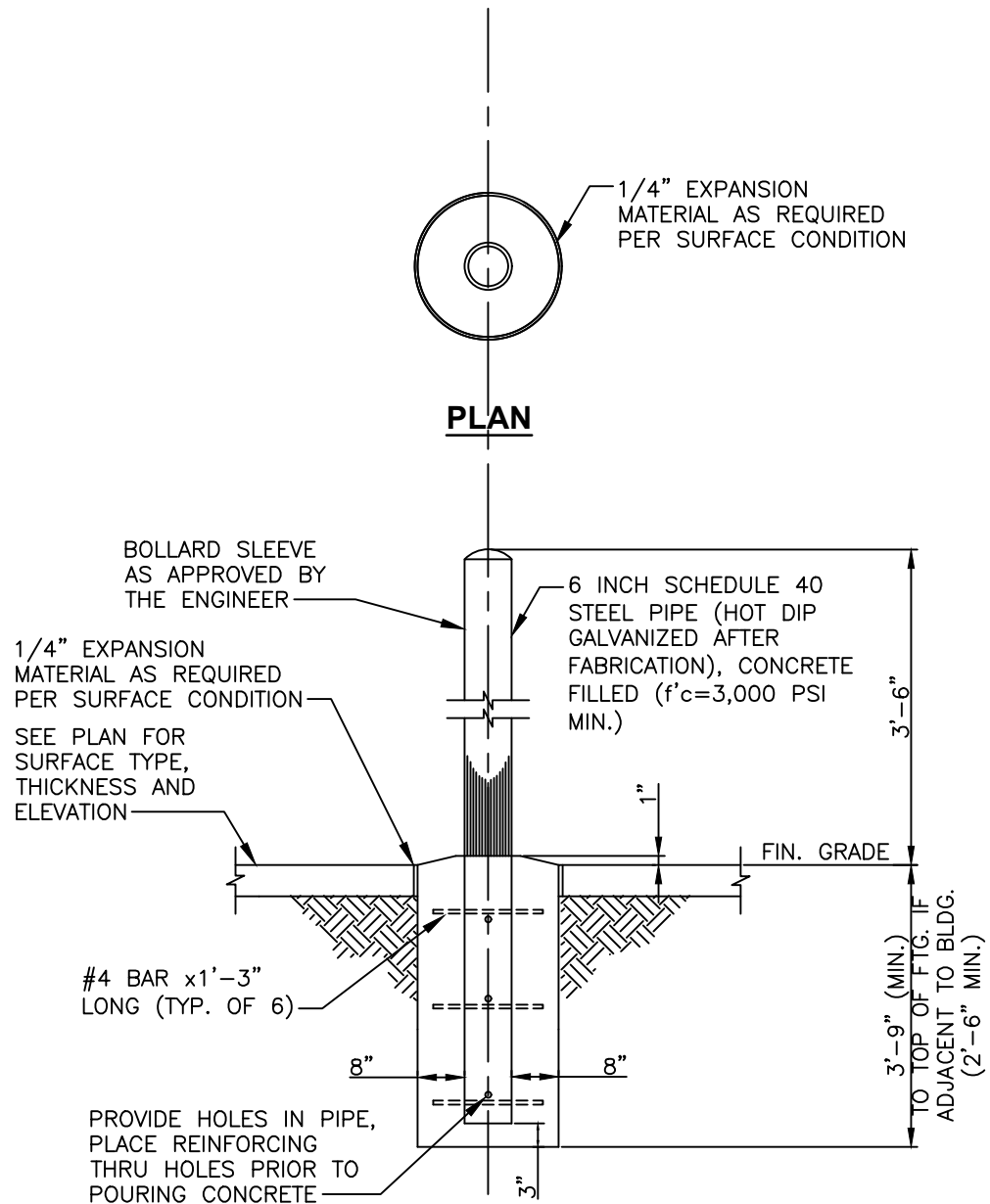
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1/4/2021

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Public Services
Engineering Department

W-18



STANDARD BOLLARD

N.T.S.

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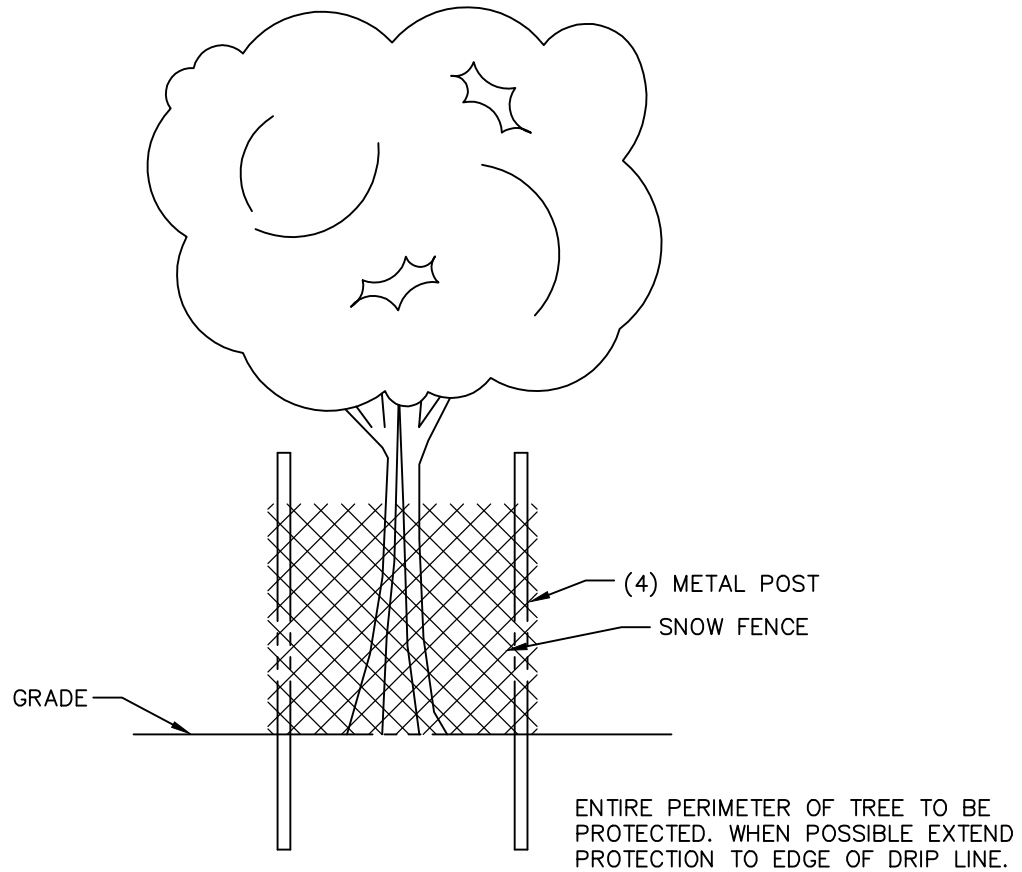
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1/4/2021

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Public Services
Engineering Department

M-1



TREE PROTECTION DETAIL

N.T.S.

APPROVED BY

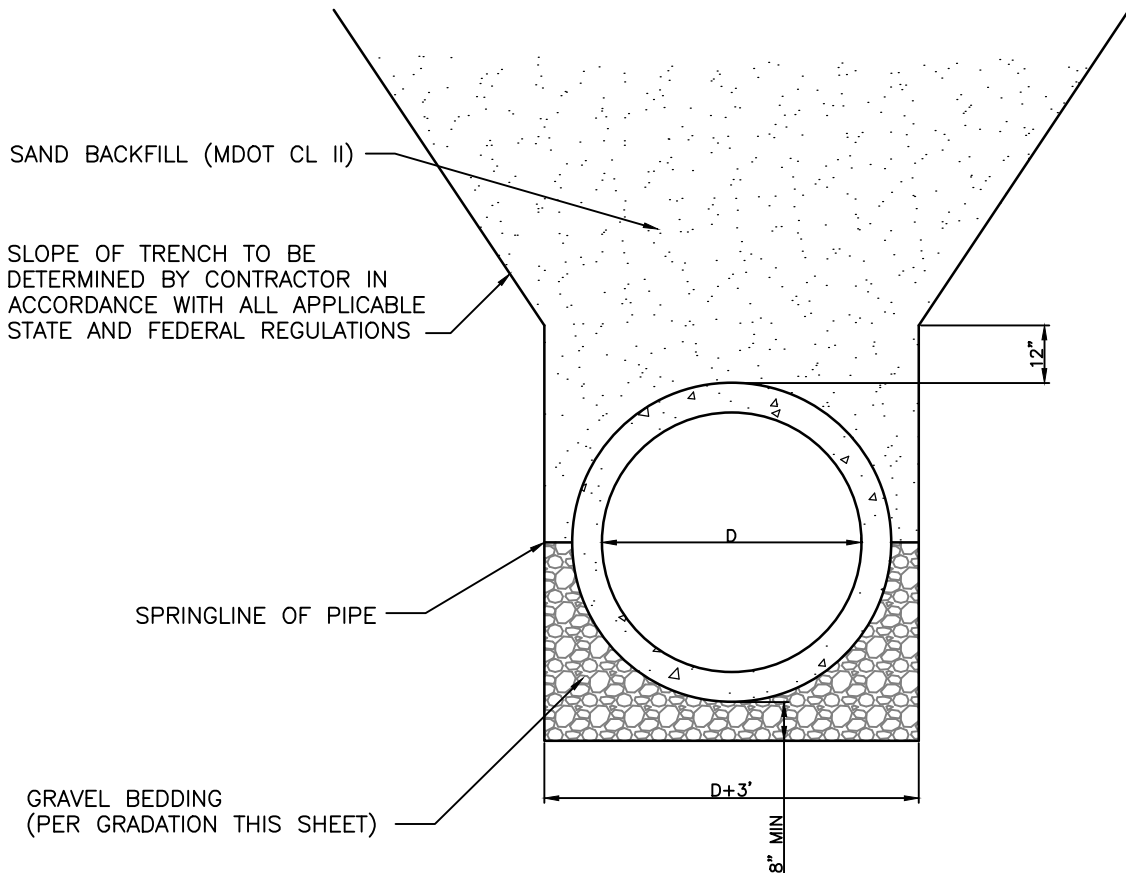
T. B. H.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

LAST REVISION DATE

City of Grand Rapids
Public Services
Engineering Department

M-2



GRAVEL BEDDING

SIEVE SIZE	PERCENT FINER BY WEIGHT
1-1/2 INCH	100
1 INCH	95-100
1/2 INCH	30-60
#4	15-30
#200	0-5

MIN PERCENT CRUSHED = 80

SPECIAL UTILITY BEDDING

N.T.S.

APPROVED BY

T. B. B.
CITY ENGINEER

ORIGINAL APPROVAL DATE
1/4/2021

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City of Grand Rapids
Public Services
Engineering Department

M-3

SPECIFIED PRODUCTS INDEX

1. **Description.** This index consists of specific products, materials, and information that the City has previously reviewed and approved as meeting the identified material specifications for the given Section. Provide products or materials for these Sections in accordance with the following. When a product or material is not specified in this Section, materials shall conform to the specifications, codes and standards specified in the Materials section of the individual Sections.

2. **Earthwork.**

2.6. Contaminated Soil and Groundwater Procedures.

A. Non-hazardous Solid Waste Landfills.

- (1) Autumn Hills Recycling & Disposal Facility
 - (a) Address: 700 56th Avenue Zeeland, MI 49464
 - (b) Phone Number: 616.688.5777
 - (c) Owner: Waste Management, Inc.
- (2) Ottawa County Farms Landfill.
 - (a) Address: 15550 68th Avenue Coopersville, MI 49404
 - (b) Phone Number: 616.837.8195
 - (c) Owner: Allied Waste Industries, Inc.
- (3) South Kent Landfill
 - (a) Address: 10300 South Kent Drive, SW Byron Center, MI 49315
 - (b) Phone Number: 616.877.4192
 - (c) Owner: Kent County Department of Public Works

B. Non-hazardous Liquid Waste.

- (1) Plummer's Environmental Services
 - (a) Address: 10075 Sedroc Industrial Drive SW Byron Center, MI 49315
 - (b) Phone Number: 616.877.3930
 - (c) Owner: Plummer's Environmental Services, Inc.
- (2) Ottawa County
 - (a) Address: 15550 68th Avenue Coopersville, MI 49404
 - (b) Phone Number: 616.837.8195
 - (c) Owner: Ottawa County Farms Landfill
- (3) SET Environmental, Inc.
 - (a) Address: 1040 Market Avenue, SW Grand Rapids, MI 49503
 - (b) Phone Number: 616.235.1500
 - (c) Owner: SET Environmental, Inc.

C. Fractionation Tank Vendors.

- (1) Fishburn Services
 - (a) P.O. Box: 5012 OH-299 Marengo, OH 43334
 - (b) Phone Number: 419.253.6031
 - (c) Owner: Fishburn Services, Inc.
- (2) Central Michigan Tank
 - (a) Address: 5963 Venture Way Mount Pleasant, MI 48858
 - (b) Phone Number: 517.772.2471
 - (c) Owner: Central Michigan Tank, Inc.

3. **Bases.** No products specified.

4. Utilities.

4.1. Sanitary Sewer.

- A. **Ceramic Epoxy Lining.**
 - (1) Protecto 401 by Induron Protective Coatings.
 - (2) Ceramapure by Induron Protective Coatings.
 - (3) or Engineer approved equal.
- B. **Flexible Connections.**
 - (1) Flexible manhole connections (also called rubber boots).
 - (a) KorNSeal by National Pollution Control Systems Inc.
 - (b) PSX by Press Seal Gasket Corporation.
 - (c) ZLok by Alok Products Inc
 - (d) or Engineer approved equal.
 - (2) Rubber sleeve lateral connections.
 - (a) Inserta Tee by ADS.
 - (b) or Engineer approved equal.

4.2. Storm Sewer. No products specified.

4.3. Water Mains.

- A. **Ductile Iron Pipe.**
 - (1) McWane.
 - (2) American Ductile Iron Pipe.
 - (3) US Pipe.
- Ductile Iron Pipe (Restrained Joint).**
 - (1) McWane (TR Flex).
 - (2) American Ductile Iron Pipe (Lok Ring Joint, Flex Ring Joint or Flex-Lok Ball Joint).
 - (3) US Pipe (TR Flex or Bolt-Lok)
- Ductile Iron Pipe Fittings.**
 - (1) McWane.
 - (2) American Ductile Iron Pipe.
 - (3) US Pipe.
 - (4) Tyler Union.
- B. **Mechanical Joint Anchoring Fittings for Hydrants.**
 - (1) Foster Adaptor by Infact Corp.
 - (2) or Engineer approved equal.
- C. **Joint Restraining Glands.**
 - (1) Joint restraining glands for sizes up to 16 inches shall be:
 - (a) Megalug Series 1100 by EBAA Iron, Inc.
 - (b) Uni-Flange Wedge Action MC Retainer Gland by Ford.
 - (c) or Engineer approved equal.
 - (2) Joint restraining glands for sized 18 to 24 inches shall be:
 - (a) Megalug Series 1100TDM by EBAA Iron, Inc.
 - (b) or Engineer approved equal.
- D. **Joint Restraining Gaskets.**
 - (1) Fast-Grip by American Pipe for Fastite Joint Pipe.
 - (2) Field Lok 350 by US Pipe for Tyton Joint Pipe.
 - (3) Barracuda RJ gaskets for Tyton Joint Pipe.
- E. **Gate Valves and Tapping Valves. (For valves 4 inches through 12 inches, unless otherwise approved by the City Engineer.)**
 - (1) FlowMaster Resilient Wedge Gate Valve by EJ.
 - (2) American Flow Control by American.
 - (3) Resilient Wedge Valve by Clow Valve Company.
 - (4) USP Series Resilient Wedge Gate Valve by US Pipe.
 - (5) Series 65 Ductile Iron Gate Valve by American AVK.

- (6) or Engineer approved equal.
- F. **Butterfly Valves. (For valves 16 inches through 24 inches, unless otherwise approved by the City Engineer.)**
 - (1) Groundhog by Pratt.
 - (2) Dezurik AWWA Butterfly Valves.
 - (3) or Engineer approved equal.
- G. **Compression Type Fire Hydrants.**
 - (1) 5BR250 WaterMaster Fire Hydrant by EJ.
 - (2) F-2641 Eddy Fire Hydrant by Clow Valve Co. (Transmission Mains only)
 - (3) or Engineer approved equal.
 - (a) Hydrant Paint.
 - (i) #944 by Rust-Oleum.
 - (ii) #448 by DEFI-Rust Enamel.
 - (iii) or Engineer approved equal.
- H. **Copper to Copper Connections.**
 - (1) H 15400n, H 15403n, H 15480n by Mueller Company
 - (2) 74756, 74758, 74758-22 by A.Y. McDonald Mfg. Co.
 - (3) C 22-xx-nl, CS 22-xx-nl, C 44-xx-nl by The Ford Meter Box Company, Inc.
 - (4) or Engineer approved equal.
- I. **Tapping Saddles.**
 - (1) 317 series by Smith-Blair.
 - (2) FC202 series by The Ford Meter Box Company, Inc
 - (3) 202N series by Romac Industries, Inc.
 - (4) 3417 series by PowerSeal Pipeline Products Corporation.
 - (5) or Engineer approved equal.
- J. **Smith-Type Tapping Sleeves.**
 - (1) 663 series by Smith-Blair.
 - (2) FAST series by The Ford Meter Box Company, Inc.
 - (3) SST series by Romac Industries, Inc.
 - (4) H304 series by Mueller Company.
 - (5) 3480 series by PowerSeal Pipeline Products Corporation.
 - (6) or Engineer approved equal.
- K. **Corporation Stops.**
 - (1) H 15000n, P 15008n, P 15013n by Mueller Company.
 - (2) 74701, 74701B, 74701-22, 74701B-22 by A.Y. McDonald Mfg. Co.
 - (3) F 600-x-nl, FB 600-x-nl, F 1000-x-nl, FB 1000-x-nl by The Ford Meter Box Company, Inc.
 - (4) or Engineer approved equal.
- L. **Curb Stops.**
 - (1) H-1502-2n, H-1504-2n, H-15200n or H-15204n, P-15209n by Mueller Company.
 - (2) 74713, 74713-22, 76100, 76100-22 by A.Y. McDonald Mfg. Co.
 - (3) B-22nl or B-44-xxx-nl by The Ford Meter Box Company, Inc.
 - (4) or Engineer approved equal.
- M. **Curb Boxes.**
 - (1) H-10350 (with H-10349 base for 2-inch) by by Mueller Company.
 - (2) No. 6500 D screw type by Tyler Union.
 - (3) or Engineer approved equal.
 - (4) **Curb Box Lock.**
 - (a) Vadle Curb Box Locks by JRC Supplies Inc.
- N. **Valve Boxes.**
 - (1) 6860 series by Tyler Union.
 - (2) 8560 series by EJ.
 - (3) or Engineer approved equal.

- O. **Basement Penetration Void Seal.**
 - (1) Thoroc Plug by ChemRex
 - (2) Octoplug Plus by IPA Systems, Inc.
 - (3) or Engineer approved equal.
- P. **Rust Preventive Coating.**
 - (1) Epoxyline Series 22 by Tnemec.
 - (2) Pota-Pox Plus Series N140 by Tnemec.
 - (3) or Engineer approved equal.

4.4. Forcemains.

- A. **Plug and Gate Valve.**
 - (1) Eccentric Plug Valves by Clow Valve Co.
 - (2) Eccentric Plug Valves by DeZURIK, Inc.
 - (3) Series 120 AWWA Eccentric Plug Valves by Homestead.
 - (4) Ballcentric Plug Valve by Pratt.
 - (5) or Engineer approved equal.
- B. **Air Relief Valves.**
 - (1) APCO Bulletin 400 by DeZURIK, Inc.
 - (2) Air Release Valves by Val-matic Valve & Mfg. Corporation
 - (3) or Engineer approved equal.

4.5. Manholes, Catch Basins and Similar Structures.

- A. **Gray Iron castings**
 - (1) Storm, Sanitary and Water manhole casting, [Detail S-13](#)
 - (a) #1045Z Frame with Specialized Lettered Cover, Type C by EJ
 - (b) #R-1642G by Neenah
 - (c) or Engineer approved equal.
 - (2) Storm, Sanitary and Water manhole casting, bolt down, [Detail S-14](#)
 - (a) #1040ZPT, #1040APT Assembly with Specialized Lettered Cover, Type C by EJ
 - (b) #R-1916-F by Neenah
 - (c) or Engineer approved equal.
 - (3) Storm, Sanitary and Water manhole castings, oversized
 - (a) #1588 by EJ with Specialized Letter Cover by EJ
 - (b) #3166 by EJ with Specialized Letter Cover by EJ
 - (c) #R-1578 by Neenah
 - (d) or Engineer approved equal.
 - (4) Catch basin casting, standard [Detail S-3](#), [Detail S-6](#), [Detail S-6A](#), [Detail P-8](#)
 - (a) #7020, Type #1 back, Type M2 grate by EJ
 - (b) R-3031A by Neenah
 - (c) or Engineer approved equal.
 - (5) Catch basin casting, double [Detail S-4](#)
 - (a) #7030, Type #1 back, Type M3 grate by EJ
 - (b) R-3067 by Neenah
 - (c) or Engineer approved equal.
 - (6) Catch basin casting, roll curb and gutter [Detail P-5B](#)
 - (a) #7490Z by EJ
 - (b) #R-3501-R by Neenah
 - (c) or Engineer approved equal.
 - (7) Catch basin casting, valley gutter [Detail P-5C](#)
 - (a) #7568 by EJ
 - (b) #R-3350 by Neenah
 - (c) or Engineer approved equal.

- (8) Outlet hood [Detail S-3](#), [Detail S-4](#), [Detail S-7](#)
 - (a) #5954 by EJ
 - (b) R-3701 by Neenah
 - (c) or Engineer approved equal.
- (9) Infiltration basin [Detail S-5](#)
 - (a) #6508 by EJ
 - (b) #1046Z with O2 Grate by EJ
 - (c) R-4340-A by Neenah
 - (d) R-2560-A by Neenah
 - (e) or Engineer approved equal
- (10) Alley basin [Detail S-7](#)
 - (a) #5105 by EJ
 - (b) R-3036-A by Neenah
 - (c) or Engineer approved equal.
- (11) Ditch basin [Detail S-8](#)
 - (a) #6508 by EJ
 - (b) R-4340-A by Neenah
 - (c) or Engineer approved equal.
- (12) Sewer Cleanout Casting [Detail S-9](#)
 - (a) R-4055 by Neenah
 - (b) or Engineer approve equal
- (13) Lamp Hole [Detail S-11](#)
 - (a) R-1973-1 by Neenah
- B. Precast Reinforced Concrete Manholes and Catch Basins Gaskets.**
 - (1) Premium rubber gaskets shall be:
 - (a) O-Ring by Press Seal Gasket Corporation.
 - (b) Tylox SOCL profile gaskets by Hamilton Kent.
 - (c) or Engineer approved equal.
 - (2) Butyl rubber gaskets shall be:
 - (a) EZ Stick by Press-Seal,
 - (b) Seal No. 2 by Hamilton Kent
 - (c) ConSeal CS-102
 - (d) or Engineer approved equal.
- C. Plastic Coated Steel Steps.**
 - (1) Plastic Coated Steel Steps shall be:
 - (a) ML-10-NCR by American Step Company
 - (b) PS1-PF by M.A. Industries.
 - (c) or Engineer approved equal.
- D. Flexible Connections.**
 - (1) Flexible manhole connections (also called rubber boots).
 - (a) KorNSeal by National Pollution Control Systems Inc.
 - (b) PSX by Press Seal Gasket Corporation.
 - (c) Z-Lok by A-lok Products Inc
 - (d) or Engineer approved equal.
 - (2) Rubber sleeve lateral connections.
 - (a) Inserta Tee by ADS.
 - (b) or Engineer approved equal.
- E. Watertight Manhole Insert.**
 - (1) Watertight Manhole Insert [Detail S-21](#) shall be:
 - (a) Mec-4 by Preco Industries
 - (b) or Engineer approved equal.

4.6. Valve Chambers, Meter Pits and Similar Structures.

- A. **Access Door.**
 - (1) Access Door shall be:
 - (a) Q-4 Type Q Single Leaf by Bilco
 - (b) APS 300 36 x 36 Alum by U.S.F. Fabrication Inc.
 - (c) or Engineer approved equal.
- B. **Adjustable Pipe Supports.**
 - (a) Adjustable Pipe Supports – Saddle Style by Trumbull
 - (b) Model S92 Adjustable Pipe Saddle Support by Standon Pipe Supports Inc.
 - (c) or Engineer approved equal.

4.7. Electrical Distribution.

- A. **Overhead Line Insulators.**
 - (1) Fiberglass guy strain. No products specified.
 - (2) Secondary cable Spreader.
 - (a) Hendrix #S-604
 - (b) Fargo G053
 - (c) or Engineer approved equal.
- B. **Overhead Line Conductors.** No products specified.
- C. **Lighting/Surge Arrestor.** No products specified.
- D. **Primary Cable.**
 - (1) Kerite
 - (2) Okonite
 - (3) or Engineer Approved equal.
- E. **Arrestor, Distribution, 10 KV.**
 - (1) Hubbel 2137097324 PDV 100 HD Optima
 - (2) Cooper UHS10050A1A1B1A.
 - (3) or Engineer approved equal.
- F. **Cut-out 200A with 125A T Fuse.**
 - (1) Chance C710-143PB
 - (2) or Engineer approved equal.

4.8. Street Lighting.

- A. **Light Poles, Fiberglass.** No products specified.
- B. **Bracket Arm.**
 - (1) 30-inch bracket arm. No products specified.
 - (2) 8-foot bracket arm.
 - (a) General Electric #C623-G005
 - (b) Fabricated Metals Corp. #P200S080
 - (c) or Engineer approved equal.
 - (3) 12-foot bracket arm.
 - (a) Fabricated Metals Corporation #D200S 120
 - (b) Utility Metals D200A120
 - (c) or Engineer approved equal.
 - (4) 20-foot bracket arm.
 - (a) Fabricated Metals Corporation #D200S200
 - (b) Utility Metals A200S200
 - (c) or Engineer approved equal.
- C. **LED Luminaires.** See Section.
- D. **Luminaires.** See Section.
- E. **Secondary Circuit Controls.** No products specified.

4.9. Ducts and Communications.

- A. **Concrete Encased Conduit.**
- B. **Manhole, Precast Concrete.**
 - (1) Pull-in irons with backing plates. No products specified.
 - (2) Grey Iron Casting.
 - (a) #1220C by EJ.
 - (3) Hex bolts with washer. No products specified.
 - (4) Cable Rack Stanchion
 - (a) Underground Devices #CR36
 - (5) Cable Rack Saddle
 - (a) Underground Devices #3HDS
- C. **Ducts and Conduits.** No products specified.
- D. **Direct Buried Conduit and Concrete Encased Conduit.** No products specified.

5. Hot Mix Asphalt Pavement.

5.1. Hot Mix Asphalt.

- A. **Marshall Mix Design.**
 - (1) In accordance with Michigan Department of Transportation Special Provision for Marshall Hot Mix Asphalt Mixture (20SP-501G-01).

6. Portland Cement Concrete and Brick Pavements.

6.1. Concrete, Grout, Mortar and Flowable Fill. No products specified.

6.2. Concrete Pavements. No products specified.

6.3. Concrete Curb and Gutter. No products specified.

6.4. Concrete Sidewalk, Sidewalk Ramps, Driveway and Approaches, and Alley Pavement and Approaches.

- A. **Detectable Warning Surface.**
 - (1) Duralast Detectable Warning Plate by East Jordan Iron Works.
 - (2) Detectable Warning Plate by Neenah Enterprises, Inc.
 - (3) or Engineer approved equal.

6.5. Quality Control and Assurance for Concrete. No products specified.

6.6. Brick Pavement.

- A. **Paving Brick (2-3/4 inch).**
 - (1) Belden.
 - (2) Watson town.
 - (3) Bowerstone.
 - (4) Pine Hall.
 - (5) McAvoy.

7. Structures. No products specified.

8. Miscellaneous.

8.1. Maintaining Traffic, Pavement Markings and Detector Loops.

A. Pavement Markings.

- (1) In accordance with MDOT Qualified Product List.

8.2. Preconstruction Documentation.

A. Crack Monitors.

- (1) Tell-Tale Crack Monitor by Avongard.
- (2) 4020A Heavy-Duty Building Foundation Crack Monitor by CrackMon.
- (3) Tell-Tale Crack Monitor by Mastrad
- (4) or Engineer approved equal.

8.3. Tree Protection. No products specified.

A. Sulfur.

- (1) Tiger 90cr Sulfur by Tiger-Sul.
- (2) Mega-S 90% Elemental Sulfur by RSS.
- (3) or Engineer approved equal.

8.4. Lawn Restoration.

A. Mulch Blankets.

- (1) Curlex NetFree 100% Biodegradable Erosion Control Blanket by American Excelsior Company.
- (2) or Engineer approved equal.

8.5. Tree and Landscaping.

A. Mycorrhizal Inoculant.

- (1) mycorrhizaROOTS by Rootsinc.
- (2) Rhizo Fuel by Rootgrow Inc.
- (3) PHC Biopak Plus by PHC Inc.
- (4) Doggett's Professional MYCO Bio Pack by Doggett.

8.6. Design and Inspection by Consulting Engineers. No products specified.

8.7. Trench Cuts and Restoration in Public Streets. No products specified.