

CROCKERY TOWNSHIP

**WATER SUPPLY SYSTEM
SANITARY SEWER SYSTEM**

DESIGN AND CONSTRUCTION STANDARDS

OCTOBER 2008

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INTRODUCTION

TO ALL DEVELOPERS, CONSULTING ENGINEERS AND CONTRACTORS:

The Crockery Township Design and Construction Requirements are intended to ensure the use of uniform, adequate, and acceptable construction methods and materials. The Township strives at all times to stay up to date regarding construction engineering developments.

This 2008 Edition is considered the standard requirements that are to apply to work and materials bid or contracted on or after January 1, 2009.

Crockery Township also has ordinances to administer, regulate, and provide additional requirements and regulations related to public and private improvements. Owners, consulting engineers, contractors, and plumbers are encouraged to review the document ordinances for requirements pertaining to private water services, fire lines, and sanitary sewers, private streets and ponds.

Leon Stille, Supervisor
Erika Harrison, Clerk
Judith VanBemmelen, Treasurer
Scott Constantine
Rich Sucheki

CROCKERY TOWNSHIP

**WATER SUPPLY SYSTEM
SANITARY SEWER SYSTEM**

DESIGN AND CONSTRUCTION STANDARDS

INTENT AND PURPOSE

The purpose of this document is to provide Developers, Consulting Engineers and Contractors working in Crockery Township, the general requirements and standard construction requirements required by the Township for water main and sanitary sewer which after acceptance by the Township, will become public facilities.

THESE STANDARD CONSTRUCTION REQUIREMENTS SHALL BE INCORPORATED AS PART OF THE CONTRACT DOCUMENTS BY REFERENCE, FOR THE ACQUISITION AND CONSTRUCTION OF THE WATER MAIN AND SANITARY SEWER.

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SECTION 1

GENERAL REQUIREMENTS

1.01 AGREEMENT

The Agreement shall incorporate by reference all of these Standard Construction Requirements and shall provide that the Township is a third party beneficiary of the Agreement and that all provisions of the Agreement in favor of the Owner and/or Township may be enforced by the Township. The Agreement shall be submitted to the Township for approval prior to its execution.

The Township shall require a Development Contract between the Developer and the Township. (See Appendix "C")

1.02 STANDARDS/ORDINANCES

All work shall conform to these Standard Construction Requirements and all applicable Township ordinances and rules and regulations.

To the extent applicable, the Township ordinances to administer, regulate, and provide for the connection to and use of the public water and sewer systems, and all rules and regulations adopted thereunder, are considered part of these Standard Construction Requirements.

The Owner, the Owner's Engineer, and the 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 Project.

THE PROCEDURE FOR GRANTING OF EXCEPTIONS TO THESE STANDARD CONSTRUCTION REQUIREMENTS IS:

- A. A written request for an exception shall be prepared and filed by the Owner with the Township. This written request for exception shall be prepared by the Owner's Engineer and shall be signed by both the Owner and the Owner's Engineer.
- B. The Township will consider the exception request and consult with the Township Engineer as necessary. The Township will then give a written notice to the Owner stating the Township's decision on the exception request. The Township decision shall be final and binding on the Owner.

1.03 PLAN REVIEW PROCESS

For Water Main and Sanitary Sewer

- A. The Owner's Engineer shall supply to the Township the Owner's name and address. Copies of all correspondence shall be sent to the Owner.

- B. Owner's Engineer shall submit a preliminary site plan for the Project to Crockery Township's Engineer and the Ottawa County Road Commission Public Utilities Department concurrent with submittal to the Township Planning Commission for review of any preliminary plat, preliminary planned unit development plan, rezoning request, preliminary site condominium approval request, site plan or any other planning approval document pertaining to the Project. No water or sanitary sewer Project shall be undertaken unless in conformance with the Township Wastewater Collection System and Township Water Supply System Master Plans.
- C. Owner's Engineer shall submit two sets of Construction Plans and Specifications to the Township's Engineer, and two sets of Construction Plans and Specifications to the Ottawa County Road Commission public utilities department.
- D. After review of the Plans and Specifications, Crockery Township's Engineer and the Ottawa County Road Commission will issue a joint review letter to the Owner's Engineer. The review will be valid for two (2) years from the date of its issuance.
- E. Upon receipt of these review comments, any changes required must be made prior to the Township Engineer submitting the Plans and Specifications to the Ottawa County Road Commission for construction permits. Total sets of Plans and Specifications required are: six (6) for water main *or* sanitary sewer, and; ten (10) for *both* water main and sanitary sewer. The Crockery Township Engineer will forward approved plans to the Ottawa County Road Commission, and the Ottawa County Road Commission will forward the plans and specifications to the Michigan Department of Environmental Quality for construction permits. Prior to commencing the Work, a copy of all permits must be submitted to the Township along with one copy of the final approved Plans and Specifications.

The following is a summary of the Crockery Township Plans and Specifications submittal process. All reference to Local Unit refers to Crockery Township. The Owner's Engineer should consult directly with the Township Engineer as to any questions and/or amendments to the submittal process and copies of all documentation pertinent thereto.

- i. Two sets of Plans and Specifications shall be submitted to the Township's Engineer and the Ottawa County Road Commission with a cover letter, which shall contain a brief description of the proposed extension or connection, including the name, location and the lengths and sizes of the water main and sewer lines per street to be constructed. The plans must indicate the project name, the location of the project and a location sketch.
- ii. The plans must be sealed by a licensed professional civil engineer, in the state of Michigan.

- iii. Easements for water and/or sewer lines must be detailed on the Plans. Platted easements must be so noted and all easement areas must be accompanied by the proposed easement document. (See Appendix "B")
- iv. A general note must be included on the Plans stating that the construction shall be done in accordance with the current "Crockery Township Standard Construction Requirements".
- v. The plans must define all areas of construction adjacent to lakes, streams, water courses, or other erosion sensitive locations and reference acceptable control techniques, which must be used to control soil erosion and sedimentation.
- vi. If this project is within 500 feet of a lake or stream, or if the construction activity is within a 100 year floodplain and/or wetlands (Wetlands as defined by 30301(d) of Part 303 of Act 451, PA 1994) copies of necessary permits or evidence of submittal or a request for determination from the Michigan Department of Environmental Quality - Land and Water Management Division regarding those activities must be submitted. The Plans must define all areas of construction adjacent to ponds, water courses, or other erosion-prone locations and reference acceptable control techniques, which must be used to control soil erosion and sedimentation.
- vii. For sanitary sewer projects, the permit application for wastewater systems as required under authority of Part 41, Act 451, PA 1994 as amended shall be completed and submitted.
- viii. For water main projects, the permit application for water supply systems as required under authority of Part 1976 PA 399 as amended shall be completed and submitted.

1.04 PERMITS AND APPROVALS

Prior to commencing construction of the Project, the following permits/approvals shall be obtained from the following entities (if applicable) by the Owner's Engineer:

- A. Township Engineer
- B. Ottawa County Road Commission Special Services and Public Utilities Departments - for all Water main and Sanitary Sewer construction and for all work within County Right-of-Ways.
- C. Ottawa County Drain Commissioner - For Soil Erosion Sedimentation Control (Part 91 of PA 451).Note: Storm water detention may be required.
- D. Michigan Department of Environmental Quality

- i. Water main construction permit (Act 399)
- ii. Sanitary sewer construction permit (Part 41 of Act 451)
- iii. Inland Lakes and Streams (Part 301 of Act 451)
- iv. Soil Erosion and Sedimentation Control (Part 91 of Act 451)
- v. Wetlands (Part 303 of Act 451)
- vi. Storm Water Discharge (Part 31 of Act 451)
- vii. Other

No construction work on the Project shall commence until all of the above referenced permits/approvals which are applicable have been obtained, the Development Agreement has been signed, any necessary agreements with the Township have been signed and delivered, all required easements have been signed and delivered to the Township, appropriate evidence that all required insurance is in force has been filed with the Township, the Township has reviewed and approved the Agreement, and the preconstruction conference has been held.

1.05 INDEMNITY/INSURANCE

A. Indemnity - General

The Contractor shall agree in the Agreement that as a condition of performing the Work, the Contractor agrees to assume all liability for and protect, indemnify and save the Township, Ottawa County Road Commission, the Ottawa County Drain Commissioner (including Road Commission's, Drain Commissioner's, Crockery Township's respective consulting engineers), their agents, consultants, officers, board members and employees, harmless from and against all actions, claims, demands, judgments, losses, expenses 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, and the Contractor's agents, contractors, subcontractors, officer and employees, arising in connection with or as a direct or indirect result of entering into and performance of the Work, whether or not due to or arising out of the acts of the Contractor 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 of obligation imposed directly or indirectly upon any of the above named indemnified parties 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. The Contractor shall pay, settle, compromise, and procure the discharge of any and all such claims and all such losses, damages, and expenses. The indemnified parties shall have the option to retain their own attorney

or attorneys and the reasonable expense thereof shall be paid by the Contractor.

B. Insurance Requirements

The Agreement shall provide that prior to commencing work, the Contractor shall file with Crockery Township and the Ottawa County Road Commission and the Ottawa County Drain Commissioner a certificate of insurance acceptable to the Township as proof that the Contractor has secured the types and amounts of insurance required by this subsection for the Project. Crockery Township shall have the right, in its sole discretion and at any time(s), to require the Contractor to file with the Township certified copies of any policies of insurance required by this subsection.

The Contractor shall provide Owners and Contractors protective insurance coverage for the project in the amount of \$2,000,000.00 (general aggregate and each occurrence) naming Crockery Township, and the Ottawa County Road Commission, the Ottawa County Drain Commissioner (including the Drain Commissioner's, the Road Commission's and Crockery Township's respective consulting engineers), of each of the above-named public entities. The named insureds shall include all officers, consultants, agents, employees, and board members.

The certificate or certified policies filed with the Township shall provide for giving the Township 30 days prior written notice of any cancellation, material change in coverage or non-renewal of the insurance.

The furnishing by the Contractor of any insurance policies and/or insurance certificates and their acceptance or approval by the Township shall not release the Contractor from the obligation to provide sufficient insurance coverage as set forth herein and shall not waive liability of the Contractor to provide indemnification as provided above.

1.06 PRE-CONSTRUCTION CONFERENCE

- A. A pre-construction conference shall be held with the Township, the Ottawa County Road Commission, the Ottawa County Drain Commissioner, the Township's Engineer, the utility companies and other agencies affected by the proposed construction. The Township's inspection procedures will be reviewed with regards to water main and sanitary sewer.
- B. At the pre-construction meeting, if the Project is for water main or sanitary sewer, Auto CAD drawing files on a compact disk shall be provided to the Township Engineer.

1.07 ASSESSMENTS/CHARGES/FEEES

Water and sewer assessments/charges/fees include, but are not limited to, connection, availability, frontage, trunkage, laterals, water services, meters and

Plan review and inspection fees (development fees). These assessments/charges/fees will be established by the Township Board by ordinance and resolution. It is the responsibility of the Owner to make inquiry as to the amount of assessments, charges and fees applicable to the Project. Payment terms, if any, shall be as agreed upon in writing with the Township.

See Appendix "A".

1.08 CONNECTIONS/FINAL ACCEPTANCE

Prior to service connections or final approval of the Project by the Township, the following items shall, if applicable to the Project, be submitted to the Township:

- A. Signed Certification and Approval for Water and/or Sanitary Sewer Construction (required form is included as page 1-25).
- B. Executed Bill of Sale (required form is included as page 1-26).
- C. Copies of Michigan Department of Environmental Quality permits.
- D. Final plat showing dedicated easements.
- E. Letter of credit for uncompleted work. See Development Contract (Appendix "C") between Owner and Township.
- F. All easements signed and provided to the Ottawa County Road Commission with copies to the Crockery Township Engineer (to be provided prior to the commencement of construction).

In addition, all testing shall have been completed and all complaints shall have been resolved. Auto Cad drawing files and three hard copies (1 mylar) of the project with record plan information shall be provided.

1.09 BUILDING CONNECTIONS

Separate permits will be required for any water services or sewer connections into buildings. See the Township's ordinance to administer, regulate, and provide for the connection to and use of the public water and sewer systems for requirements and regulations pertaining to private water systems, fire lines, and sanitary sewer, as well as these Standard Construction Requirements.

1.10 GUARANTEE

The Agreement shall provide that the Contractor shall guarantee the completed Work for one year and shall promptly repair, replace, restore, or rebuild, as the Township 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, except where other periods of maintenance and guarantee are provided. The one year period shall begin upon the date of the issuance of the certification and approval for water and sewer construction (see page 1-20).

All subcontractors, manufacturer, or supplier 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 Township, and all such warranties and guarantees shall inure to the benefit of the Township without the necessity of separate transfer or assignment thereof; provided that if required by the Township, the Owner and Contractor shall cause such subcontractors, manufacturers, or suppliers to execute such warranties and guarantees in writing to the Township and, further, that the Agreement shall provide that the Contractor will assign all such warranties and guaranties to the Township on request.

1.11 CONTRACTORS AND SUBCONTRACTORS

The Work shall be performed by responsible contractors and subcontractors known to be skilled and regularly engaged in work of similar character and magnitude.

1.12 CONTRACTOR RESPONSIBILITIES

A. General

All of the following Contractor responsibilities shall be incorporated as part of the Agreement.

B. 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:

- i. The public and all persons on the Work site or who may be affected by the Work; all the Work and materials and equipment to be incorporated therein, whether in storage on or off site; and
- ii. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, driveways, roadways, sidewalks/bike paths, 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 construction 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 Contractors' duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and accepted.

C. Safety Representative

The Contractor shall designate a qualified and experienced safety representative at the Work site, whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

D. 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 Owner or the Township, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Owner, Ottawa County Road Commission, and Crockery Township prompt written notice if the Contractor believes that any significant changes in the Work or variations from the Work have been caused thereby. If the Owner determines that a change in the Work is required because of the action taken by the Contractor in response to such an emergency, with prior written approval of the Township, the Owner may issue a change order or otherwise authorize a change in the Work to account for the consequences of the action taken with respect to the emergency.

E. 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. 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 Plans and Specifications.

The Contractor shall keep on the Work at all times during its progress a competent superintendent, who will cooperate fully with the Township at all times, and who shall not be replaced without written notice to the Township. 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.

F. Labor, Materials and Equipment

The Contractor shall provide competent, suitably qualified personnel to perform the Work. 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 Plans and Specifications. If required by the Crockery Township, or Ottawa County Road Commission, 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 Plans and Specifications.

G. Construction Records

The Contractor shall provide construction record information and utilize standard record forms as provided by the Township.

1.13 ASBESTOS, PCBs, PETROLEUM, HAZARDOUS WASTE OR RADIOACTIVE MATERIALS:

If, during the course of construction, any asbestos, PCBs, petroleum, hazardous waste or radioactive materials are uncovered or revealed at the Work site which were not shown or indicated on the Plans and Specifications, 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 Township and also the Owner in writing, who shall notify the necessary parties. No further disturbance of the materials shall ensue until the Contractor has been notified by the Owner, the Ottawa County Road Commission, and the Township that the Contractor may proceed.

1.14 PAYMENT

Payment shall be made by the Owner to the Contractor. The Township, unless it is the owner, shall not have any liability to the Contractor for amounts due the Contractor under the Agreement, or for any part of the cost of the Project. The method of payment (lump sum, unit prices, etc.) is between the Owner and the Contractor.

1.15 COST SHARING

All cost sharing agreements (if any) between the Township and Owner shall be in writing and shall be signed and delivered prior to the start of construction.

1.16 WORK SITE

The Contractor shall confine its work to the public rights-of-way, easements and Owner's property. Any other area required for equipment or material storage or for construction operation shall be the Contractor's responsibility.

1.17 ACCESS

The Ottawa County Road Commission and the Township and its 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.

1.18 CONSTRUCTION OBSERVERS

Authority and Duties of Construction Observers:

- A. Construction observers 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. Construction observers are not authorized to revoke, alter, enlarge or relax any of the Specifications nor to change the Plans in any particular. Construction observers are not authorized to increase or decrease any Agreement item nor to add new items to the Agreement. Construction observers will inform the Township as to the progress of the Work and the quality of the completed Work, and the quality of the materials being used. 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 Agreement.

- B. Crockery Township or their representatives, or the Ottawa County Road Commission shall make an 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 Crockery Township or the Ottawa County Road Commission, the Township or the Ottawa County Road

Commission shall inform the Owner and the Contractor orally or in writing as to the particular defects to be remedied.

- C. Inspection may be done by the Ottawa County Road Commission, its representative, or the Township's Engineer. Inspection will consist of daily inspection of water main and sanitary sewer installation, testing of water main and sanitary sewer and gathering of construction record information of all items related to water main and sanitary sewer construction, including laterals and water services.
- D. All construction staking, compaction testing, major field changes and pay estimates will be the responsibility of Owner's Engineer.
- E. The Owner's Engineer shall periodically review the work for conformance to the Plans and Specifications and these Standard Construction Requirements. The Owner's Engineer shall complete, sign and submit to the Township the Certification and Approval for Water and/or Sanitary Sewer Construction contained on page 1-20.
- F. The Township must accept the Work prior to placing water main and sanitary sewer in service.

1.19 DEFECTIVE MATERIALS AND WORK

- A. 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 Crockery Township in writing.
- B. All completed Work that is found to be defective before the final acceptance of the completed Work, shall be corrected and replaced immediately in conformance with the Specifications.

1.20 SCHEDULING

- A. The Contractor shall file a construction schedule with Crockery Township and the Ottawa County Road Commission and shall receive approval in writing prior to commencing construction.
- B. Certain projects may require street closings. The Contractor shall coordinate its work with the Ottawa County Road Commission and the Township and shall take all necessary precautions required by the Road Commission to minimize traffic interference.
- C. All traffic control that may be necessary for a project must be approved by the Ottawa County Road Commission.
- D. The Contractor's emergency telephone number shall be filed with Crockery Township, the Ottawa County Road Commission.

1.21 MAINTENANCE OF TRAFFIC

- A. When working within the limits of existing streets, the Contractor shall accommodate vehicular traffic in road rights-of-way as provided in the Specifications. Access to fire hydrants, water and gas valves shall be maintained at all times during construction.
- B. Where streets are partially obstructed, the Contractor shall place and maintain temporary driveways, ramps, etc., which, in the opinion of the Ottawa County Road Commission and/or the Township, are necessary to accommodate the public.
- C. The Contractor shall inform the local police, schools, ambulance services and fire department in advance of its program of street obstruction and detours. Detouring and construction signage shall be in accordance with MDOT Standards for Uniform Traffic Control and in accordance with the directions of the Ottawa County Road Commission.

1.22 LIMITATION ON OPERATIONS

When working within the limits of existing streets, the Contractor shall at all times conduct its work so that there is a minimum of inconvenience to the residents and traveling public within the Project area. Unless otherwise approved by Crockery Township, hours of operation are limited to 7:00 am to 7:00 pm on Mondays through Fridays, and 7:00 am to 1:00 pm on Saturdays. No work shall be performed on Sundays or legal holidays.

1.23 PROTECTION OF WORK

The Contractor shall protect the Work until it is accepted by the Township in writing. Any part of the completed Work that is damaged prior to acceptance by the Township shall be replaced at the Contractor's expense.

1.24 DUST CONTROL

All haul roads, detour roads and other public and private roads (including backfilled trenches), driveways and parking lots used by the Contractor must be maintained in a dust free condition. The control of the dust shall be accomplished by the application of dust control materials and methods of application as approved and/or sweeping shall be applied as often as is necessary to control the dust or if directed to do so by the Township (within 12 hours after notifications).

1.25 MATERIAL HAUL ROADS

- A. Any spillage on public roadways used as haul routes shall be cleaned daily.
- B. Gravel roads shall only be used by the Contractor when permission is given to the Contractor in writing by the Ottawa County Road Commission and only if the Contractor assumes responsibility of maintenance, dust

control and restoration of the gravel roads to the satisfaction of the Ottawa County Road Commission.

1.26 COLOR AUDIO-VIDEO TAPING

The entire Project area involving existing streets may be video taped by the Ottawa County Road Commission. Other Project areas may be video taped by the construction observers. These tapes will be available to the Contractor, Owner, and the Township during construction of the project.

1.27 MAIL BOXES

The Contractor shall temporarily relocate mail boxes interfering with construction so that mail service is not interrupted. Mail boxes shall be replaced in a condition and location equal to that prior to construction or as required by the U.S. Postal Service. All mail boxes shall be replaced with a turn out of six (6") inches of MDOT 23A gravel.

1.28 DEWATERING

Where dewatering is required, the Contractor shall limit the dewatering operation to the minimum time and depth required for construction. The Contractor will be required to furnish and maintain temporary water service to property owners whose wells may be affected by the dewatering operations. The Contractor shall also be responsible for any necessary repairs to existing wells required to place them back in operation after construction is completed. If the Contractor does not provide temporary water in a timely manner, the Township will cause temporary water to be provided and the Contractor shall promptly reimburse the Township for all of its expenses.

1.29 USE OF SLAG

No slag shall be permitted for use as backfill for any utility construction.

1.30 EXISTING UTILITIES

- A. Various utilities and underground structures are shown on the Plans. There is no guarantee that the location shown for existing utilities and underground structures on the Plans is accurate, nor that additional underground utilities or structures may not be encountered.
- B. The Contractor shall notify MISS DIG and the utility companies for utility locations before starting any open cut or tunnel construction or before drilling holes for construction purposes. The Contractor shall cooperate with the utility companies in any repair, relocation or other work to be performed on the utility caused by the construction of the Project.
- C. The Contractor shall be fully responsible for the location, protection, relocation, replacement, etc. for all existing underground utilities, which may reasonably be expected in any area, regardless of whether or not such utilities are shown on the Plans. Items in this category shall include, but not necessarily be limited to: water mains and services, gas mains

and services, storm sewer and catch basin leads, telephone, electric, and cable TV wire, etc. Such work shall be considered incidental to the major items of construction unless otherwise noted on the Plans.

i. Water Mains

It shall be the responsibility of the Contractor to uncover such mains for a reasonable distance ahead of his construction operation to permit field adjustments where such might be made in grade, location or alignment of the proposed sewer and water main and/or appurtenances.

An existing water main, including water services, shall be raised to pass over the sewer (where the elevation of the water main conflicts with the elevation of the sewer), provided a minimum cover of five feet is maintained on the water main. The existing water mains may be lowered where the elevation of the water main conflicts with the elevation of the sewer. The raising or lowering of existing water mains shall be accomplished by using vertical bends properly anchored. A sand cushion shall be provided between the water main and the sewer. The Contractor shall notify the Ottawa County Road Commission and the Township engineer before any work on existing water mains is begun. The Ottawa County Road Commission shall approve the configuration of the bends and thickness of the sand cushion. (A minimum of 18" is recommended.)

ii. Sewers (Sanitary, Storm, Culverts, and Underdrains)

All existing sewers crossing or parallel to proposed sewers and water mains (even if not shown on the Plans) shall be saved or relayed by the Contractor if damaged during construction, unless otherwise indicated on the Plans.

Existing manholes, catch basins and inlets shall be saved and protected unless otherwise indicated on the plans to be removed. Catch basins and inlets shall be reconstructed if damaged during construction. Costs for rebuilding, removing and/or repairing existing sewer, manholes, catch basins, inlets, house leads, headwalls, etc. shall be considered incidental unless otherwise noted on the construction Plans or in the Specifications.

D. MISS DIG

The Contractor shall contract "MISS DIG" not less than 72 hours before starting construction for assistance in locating utilities or for any work to be done on utilities. The toll free phone number is (800) 482-7171.

E. Utilities

- i. The Contractor shall notify other units of government and the utility companies of the Contractor's schedule and obtain any necessary permits from them.

- ii. The Contractor shall pay for any charges by the units of government and utility companies for permits, inspections, or similar charges required to construct the Project as shown on the Plans.

F. Water and Sewer

The Ottawa County Road Commission operates and maintain the water and sewer systems in the Township.

1.31 UTILITY POLES

When necessary, the Contractor shall shore and brace utility poles that interfere with construction. Shoring and bracing shall be such that sinking or excessive tilting does not take place. All relocation or removing and replacing of power poles, light poles and telephone poles shall be done in accordance with the pole owner's standards and all expenses shall be paid for by the Contractor. All arrangements for pole relocations shall be completed by the Contractor with the pole owner at least 72 hours prior to need for relocations.

1.32 TELEPHONE

An emergency telephone system (listing of number) shall be set up and given to Crockery Township the Ottawa County Road Commission, so that the Contractor may be immediately notified of any unsafe conditions or emergencies encountered during times that the Contractor is not working on the Project.

The Contractor shall provide a local number and a local employee so that the Contractor may be contacted at any time (including weekends and holidays) 24 hours a day.

1.33 EXISTING PRIVATE FACILITIES

Existing wells, septic tank, tile field, lawn sprinklers or other facilities which are not on the Owner's property which are disturbed or damaged by the Contractor, shall be repaired and restored to working condition before the end of that working day. Under no circumstances will such interruptions be extended overnight. The Contractor shall take necessary precautions not to allow any discharge from the above to enter any lake, stream or canal along the line of work. Costs for repairs or temporary service caused by the Contractor shall be at the Contractor's expense.

All precautions necessary shall be taken to insure no damage occurs to homes, including basements.

1.34 CASTING ADJUSTMENTS

Casting adjustments (manholes, water main valves, gas valves, etc.) required in order to meet the new/restored grade shall be made by the Contractor.

1.35 MATERIAL TESTING

- A. Crockery Township and Ottawa County Road Commission reserve the right to sample and test any of the materials required for the proposed

construction, either before or after delivery to the Project and to reject any material represented by any sample which fails to comply with the minimum requirements specified. Specifications and testing of public roadway materials shall conform to the Ottawa County Road Commission standards and specifications.

- B. The Contractor shall furnish all materials reasonably required by Crockery Township, and the Ottawa County Road Commission, for sample testing and analysis necessary for the testing of materials as required by the Specifications.
- C. If any pipe fails to meet the specified requirements, all pipe represented by the sample shall be rejected unless the Contractor can demonstrate through additional tests, at the Contractor's expense, that the remainder of the pipe is satisfactory.
- D. As a minimum requirement, the following shall be submitted to the Ottawa County Road Commission by the Contractor (at no extra cost to the Owner).
 - i. Pipe: Certified test reports for strength from the manufacturer.
 - ii. Material list: Valves, pipe, hydrants, etc. by type and manufacturer.

1.36 BONDS

The Township may require performance bonds for all of the Work or, as a minimum, for that portion of the Work within existing right-of-way. (Bonds will be required when the Township is the Owner.)

1.37 FUNDING

Prior to the Contractor starting work, the Owner shall submit in writing to the Township documentation that the Owner has available sufficient funds to complete the Project.

1.38 AUTHORITY OF THE TOWNSHIP AND THEIR AUTHORIZED REPRESENTATIVES

Crockery Township and their authorized representatives have the authority to verify that the Project is being constructed in accordance with the Plans and Specifications, the Standard Construction Requirements, the Township's Rules and Regulations and the Development Agreement.

1.39 DISPUTES

All disputes between the Owner and Contractor shall be reviewed and resolved in a timely manner.

1.40 SUSPENSION OF WORK AND TERMINATION

The Township reserves the right to suspend the Work until all disputes between the Owner and Contractor are resolved.

1.41 CONTRACT AMENDMENTS/CHANGE ORDERS/NOTIFICATION/ CONCURRENCE

When necessary, the Owner or the Owner's Engineer will prepare for the Township's prior written approval Agreement amendments and change orders.

1.42 SITE CLEANLINESS

The Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land areas identified in and permitted by the Plans and Specifications and other land and areas permitted by law, rights-of-way, permits and easements, and shall not unreasonably encumber the Work premises with construction equipment or other materials or equipment. The Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work.

1.43 SUBSURFACE CONDITIONS

- A. Any utilities shown on the Plans are located according to the latest available information. The Contractor shall make a conscientious effort and shall provide reasonable assistance to Crockery Township, the Ottawa County Road Commission, and their representatives as may be required to verify the locations and/or elevations of all existing utilities, which may be affected by the proposed construction.
- B. At points where the Contractor's operations are near the properties of railroad, telephone and power companies, or are near existing underground utilities, damage to which might result in considerable expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.
- C. The Contractor shall protect, shore, brace, support and maintain all utilities affected by his operations. The Contractor shall be responsible for all damage to utility properties or facilities and shall make his own arrangements satisfactory to the Owner, with the agency or authority having jurisdiction thereover, concerning repair or replacement or payment of costs incurred with said damage.
- D. In the event of interruption to water or other utility services as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the Township or other utility owner and shall cooperate with the Township and/or such owner in the restoration of service. If water service or other essential service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the Township Fire Department.

1.44 VALVE TURNING/PLUGS

- A. Only the Ottawa County Road Commission or their designated representative will operate water supply system valves in Crockery Township. No such valves shall be operated by the Contractor.
- B. Where plugs are required in existing sanitary sewer manholes, they shall not be removed until authorization is received in writing from Crockery Township and the Ottawa County Road Commission. These plugs shall be provided and installed by the Contractor at the start of the project.

1.45 WASTEWATER PUMPING STATIONS

All wastewater pumping stations and forcemain to be operated by the Township or the Ottawa County Road Commission shall be reviewed and approved by the Ottawa County Road Commission and the Township's Engineer. Standard equipment shall be supplied to match existing stations within the system. The Owner's Engineer shall contact Mr. Pat Staskiewicz, P.E. of the Ottawa County Road Commission prior to beginning design of any pump station, gravity sewer, and force main to assure that it conforms with the Township standards and meets their master plan for the sanitary sewer system.

1.46 FIRE PROTECTION SYSTEMS/FIRE HYDRANTS

The Township shall review/approve all fire protection systems except where an exception is authorized as is provided in the Water Rules and Regulations. All fire hydrants shall be on a public water main operated by the Township or Ottawa County Road Commission. Easements will be required when the water main and/or fire hydrants are on private property.

1.47 MASTER PLANS

The Township's water main and wastewater collection system master plans shall be followed by the Owner's Engineer in the design of the Project. It is recommended that prior to any design being completed, that a meeting be scheduled with the Township to review these master plans.

1.48 ROOF DRAINS/FOOTING DRAINS/SUMP PUMP DISCHARGES

All buildings and other structures shall provide for positive points of discharge for roof drains, footing drains and sump pumps.

Sump pump discharges will not be permitted in the sanitary sewer.

1.49 EASEMENTS

All easements to be granted to Crockery Township will be on forms as provided by Crockery Township. All easements must be delivered to the Ottawa County Road Commission with copies to the Township Engineer prior to the commencement of construction.

See Appendix B for standard utility line easement forms.

1.50 RECORD PLANS

Record plans shall be prepared and distributed by the Owner's Engineer. The Owner is responsible for the cost of preparation and distribution of record plans.

1.51 EXCEPTIONS

Exceptions to these Standard Construction Requirements may be granted in writing by the Township. Exceptions shall only be granted when applied for in writing and in circumstances where compliance with the Standard Construction Requirements is impossible or would cause extreme hardship. All requests for exceptions shall be in writing and signed by the Owner. The exception request shall include all relevant supporting documentation and information, including information supplied by the Owner's Engineer. The burden of proof shall be on the Owner to provide convincing proof that the exception is necessary because it is impossible to comply with the Standard Construction requirements or compliance will cause extreme hardship. Additional cost alone is not justification for the granting of an exception. If granted, the exception shall be granted in writing by the Township. The decision of the Township shall be final.

**CERTIFICATION AND APPROVAL
FOR WATER AND/OR SANITARY SEWER CONSTRUCTION**

Project Name: _____

Section _____, Crockery Township, Ottawa County, Michigan

I hereby certify that _____ has administered and supervised the _____ (Engineering Firm) construction of the above named project on behalf of the Developer. The work has been installed and completed in accordance with the approved design plans and specifications, the Crockery Township Standard Construction Requirements, and the construction materials meet the approved Specifications.

Exception(s): _____

Signed: _____ Date: _____
(Project Engineer)

I hereby certify that the work has been installed and completed for the above named project, that all construction materials meet the approved specifications, and required testing was performed and passed, in accordance with the Crockery Township Standard Construction Requirements.

Exception(s): _____

Signed: _____ Date: _____
(Inspection Supervisor)

Inspection Firm: _____

Based on the signed certifications above, connection of services to the () Water main & Sanitary Sewer () Water main Only () Sanitary Sewer Only, is hereby authorized.

Signed: _____ Date: _____
Ottawa County Road Commission

(Completed certification shall be provided to the Township for issuance of connection permits.)

WARRANTY

BILL OF SALE

_____, whose address is _____
_____, (hereinafter referred to as "Seller") for and in
consideration of One (\$1.00) Dollar and other good and valuable consideration, does
hereby grant, dedicate, transfer, and deliver to CROCKERY TOWNSHIP, whose
address is 17431 112th Avenue, Nunica, MI 49448 (hereinafter referred to as the
"Township") _____

_____ (the "Improvement").

Seller hereby warrants and certifies to the Township that the Improvement has been
acquired, constructed and completed in accordance with the Plans and Specifications of
_____ (consulting firm / dated) for the Improvement previously
approved by the Township, with only those change orders approved in writing by the
Township, and that no claim, action, or liability exists with respect to the Improvement
and its construction and installation.

Seller further warrants and represents to the Township that it is the lawful owner of the
Improvement, and that the Improvement is free of all liens and encumbrances of any
kind. Seller further represents that it has the authority to transfer the Improvement and
that Seller will warrant and defend the Township against all claims asserted by any entity
or person arising out of the installation, construction and completion of the Improvement.
Seller also warrants that the Improvement is free from defects in materials and
workmanship. All warranties and guarantees pertaining to the Improvement are hereby
assigned and transferred to the Township.

Dated: _____, 200____.

Witnessed By:

_____ By: _____
_____ Its: _____

_____ By: _____
_____ Its: _____

SECTION 2 CONTENTS
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SECTION 2

SPECIFICATIONS FOR EXCAVATING, TRENCHING, AND BACKFILLING FOR UTILITIES

2.01 DESCRIPTION OF WORK

The work shall consist of furnishing all materials, equipment, and labor for excavating, trenching, and backfilling for utilities. The work also shall include the necessary clearing, sheeting and shoring, boring and jacking, dewatering, pipe embedment, and other appurtenant work.

2.02 CLEARING, BRUSHING AND TREE REMOVAL

A. General

The contractor shall perform all clearing, brushing, and tree removal required for the proposed construction. Where indicated on the plans for a specific area, that area shall be completely cleared in accordance with Section 201 of the current MDOT Standard Specifications. Clearing and brushing shall be confined to the limits of the right-of-way, easements, and project site unless otherwise directed and shall be kept to a practicable minimum.

Existing stumps and stumps of trees which are removed shall not be ground down but shall be completely removed.

Trees shall be pruned neatly, and the scars from pruning or other damage by the contractor's equipment shall be covered with a preservative.

B. Preservation of Trees

Trees may not be removed from Ottawa County street right-of-way without permission from the property owner adjacent to the right-of-way.

Trees marked "REMOVE" on the Plans shall be taken down and removed from the right-of-way or easement in a manner that does not endanger the adjoining property or persons, or traffic using the right-of-way. The wood shall become the property of the adjoining property owner when in an existing right-of-way, or the property owner who granted the easement. If the adjoining property owner or property owner does not want the wood, it shall become the property of the Contractor. Burning or burying will not be permitted unless first approved in writing by the Township.

Because of the special concern for preservation of trees in the Township, only those trees, which have been indicated for removal on the Plans, may be removed. All other trees are to be preserved unless written permission for removal is obtained from the Township and the property owner. Selective pruning of trees will be permitted to allow operation of

the Contractor's equipment. Trees shall be pruned neatly, and the scars from pruning or other damage by the contractor's equipment shall be covered with a preservative.

Where tunneling is necessary to preserve a tree, it shall be incidental to the construction. Trees that may have to be tunneled may or may not be specified on the plans. Where tunneling is necessary, excavation may have to be done by hand to prevent damage to the tree or to its roots. When tunneling or excavating close to a tree to be preserved, every effort shall be made to preserve the main roots.

C. Disposal of Debris

All trees, brush, and stumps from clearing and brushing operations shall be disposed of by the Contractor by hauling from the site, or other suitable means approved by the Township.

2.03 REMOVAL OF SURFACE IMPROVEMENTS

Removal of surface improvements within public street right-of-way shall be done in accordance with Ottawa County Road Commission specifications.

Surface improvements such as sidewalks, improved lawns, drives, curb and gutter, and all types of pavement shall be removed just prior to excavating or trenching operations. All improvements shall be cut at the expected trench width prior to excavating using suitable equipment, which does not damage the improvement outside of the trench area.

Concrete and bituminous pavement and drives shall be cut with a pavement cutting saw. The depth of the cut shall be the full depth of the pavement. Pavement crushers or breakers of any type are prohibited unless specifically authorized by the Township. Pavement, which is removed, shall not become mixed with backfill material. Power equipment may be used for pavement removal, provided that damage is not caused to improvements which are to remain.

2.04 EXISTING UNDERGROUND UTILITIES AND STRUCTURES

A. Location

The Contractor shall notify the owners of all underground utilities before starting any work. House sewer connections, water and gas services, and other utility lines may not be indicated on the plans. However, the Contractor shall make every effort to locate all underground utilities from information obtained from the utility owner or by prospecting in advance of trench excavation.

B. Replacement

Certain underground utilities, such as sewers, may require removal and subsequent replacement in lieu of supporting or bracing during the proposed construction, or the Contractor may elect this option when temporary provisions to maintain essential services have been previously approved by the Township.

Unless otherwise specified, any utilities removed during the proposed construction shall be replaced by the Contractor. Materials and installation shall be equal to or better than original construction in every way. Salvaged materials may be reused when they are in good condition, and a satisfactory installation can be accomplished in the judgment of the Township.

C. Relocation

Should any pipe or other existing utility require raising or lowering or moving to another location because of interference with the pipe or structure being constructed under these specifications, such changes, which in the opinion of the Township are necessary, shall be made by the Contractor unless otherwise specified.

D. Reconnection

Where lateral services, house connections, or other pipe lines require reconnection to the proposed utility, as is the case when an existing utility is being reconstructed, the Contractor shall make these connections as specified or as shown on the plans.

E. Utilities to be Abandoned

When pipes, conduits, sewers, or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and mortar by the Contractor. Abandoned structures such as manholes or chambers shall be entirely removed unless otherwise specified or shown on the plans.

All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation by the Contractor. All salvageable materials remain the property of the Owner.

2.05 EXCAVATING AND TRENCHING

A. General

Excavating and trenching operations shall at all times be conducted in a safe, orderly manner using methods and equipment designed and suited to the intended use by personnel experienced in the work being performed.

None of the requirements or provisions specified herein or shown on the plans shall nullify or restrict any safety provisions required by any regulation or law governing the protection and/or safety of persons or property.

B. Width of Trench

The width of the trench shall be ample to permit the pipe to be laid and joined properly and the pipe embedment material and backfill to be placed and compacted as specified. Trenches shall be of sufficient extra width when required as will permit the convenient placing of trench supports, sheeting, and bracing.

C. Width of Trench for Rigid Pipe

In order to limit excessive loads on rigid pipe, the maximum width of trench for pipe 36 inches and larger in diameter shall not be more than twice the nominal diameter; for smaller sizes of pipe, the maximum width of trench shall be not more than three (3) feet greater than the nominal diameter of the pipe, except as otherwise specified or directed. The above limiting restrictions on trench width apply from outside bottom of pipe to outside top of pipe.

Where the width of trench within these limits exceeds the maximum limit specified, the Contractor shall install a heavier class of pipe or use other means to provide additional load-carrying capacity. Any changes in class of pipe or other variation shall be approved in writing by the Township before the work progresses.

D. Width of Trench for Flexible Pipe

Unless otherwise specified or approved by the Township, a minimum trench width of at least 18 inches on each side of the pipe for placement of select embedment material will be required.

E. Excavating to Grade

The trench shall be excavated to a depth required for the proper installation of the pipe and placing of the pipe embedment material as specified.

Any part of the bottom of the trench excavated below the specified subgrade shall be refilled with approved materials compacted to 95% of maximum unit weight in accordance with MDOT procedures. If additional excavation is required to correct unstable foundation conditions, the Contractor shall notify the Owner and agree on the cost prior to commencing work.

F. Sheeting, Shoring, Bracing, 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 compliance to such regulations and for the design, installation, and maintenance of all excavation safety measures.

G. Rock Excavation

i. General

Wherever the word rock is used in these specifications, it shall mean boulders, solid ledge rock, and other minerals geologically placed and of a hardness when first exposed of three (3) or greater in scales of mineral hardness, which in the opinion of the Engineer requires continuous use of drilling and blasting or special power equipment for its removal.

Soft disintegrated rock which can be removed with a power-operated excavator or with hand tools and loose, shaken, or previously blasted rock and broken stone in rock fillings shall not be classified as rock.

ii. Blasting

Where blasting is necessary, the Contractor shall obtain the required permits and licenses at his own expense. This work shall be done with due regard to the safety of workmen, other people, and public and private property. The method of covering blasts, amounts of charges used, and the general procedure for doing this work shall conform to the standard practice and shall meet all requirements of local ordinances and other regulations and shall be subject to the approval of the Township.

iii. Clearance

Rock shall be removed to provide a clearance for all pipes, appurtenances, or structures of at least six (6) inches below, and a minimum of six (6) inches on each side of the pipe, appurtenance, or structure.

The specified minimum clearances are the minimum clear distance which will be permitted between any part of the pipe or appurtenances being laid and any part, point, or projection of the rock.

H. Dewatering

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water, including water or sewage from exposed sewers or water mains, from all excavations and trenches, or other parts of the work. Each excavation shall be kept dry during the preparation of the subgrade and continually thereafter until the structure to be built or the installation of the pipe line is

completed to such extent that no damage from hydrostatic pressure, flotation, or other cause will result.

Where work is in soil containing an excessive amount of water, the Contractor shall provide, install, and maintain suitable well points or wells connected to manifolds or reliable pumping equipment, or other suitable dewatering methods, and shall so operate the dewatering system to insure proper construction of the work. If the Contractor elects to use a trench underdrain or similar dewatering system, he shall receive prior approval of the Township as to location and installation methods for this type of system. The Contractor shall make every effort to prevent sand, sediment, or debris from entering any existing pipe line or conduit which he may use for drainage purposes. The repair or cleaning of drainage structures made necessary by the Contractor's operations shall be performed by and at the expense of the Contractor.

Arrangements for discharge of ground water into any public storm sewer shall be previously approved by the Township and/or Ottawa County Drain Commission and/or Ottawa County Road Commission.

2.06 BORING AND JACKING

A. General

Where so specified on the drawings, railroad tracks, streets, or other obstructions to be crossed by utilities shall be bored and/or jacked as hereinafter specified. These specifications describe the general method of conducting the boring and jacking operations and set forth minimum conditions. The location and details of the proposed installation will be shown on the Plans.

Unless otherwise specified, the Contractor shall be responsible for obtaining any permits required for the work under the right-of-way, or other facility to be crossed, and shall carry out the details of his work in a manner that will fully meet the requirements of the authority having jurisdiction over the facility affected. No interruption of traffic will be permitted, and the Contractor shall take all precautions to that effect.

B. Casing Method

When the casing method is specified, a casing pipe shall be jacked into place and a carrier pipe shall then be installed in the casing pipe. The casing pipe shall be jacked into place by approved methods that will provide accurate alignment and grade and that will allow the carrier pipe to be installed within the casing at the specified alignment and grade.

The carrier pipe shall be joined together to form a continuous run through the casing. It shall be supported on wooden or plastic shoes or blocks which shall be securely fastened to each piece of pipe. The carrier pipe shall then be drawn or shoved through the casing. Junction with pipes of other materials at each end shall be made as shown on the Plans. After

the pipe has been inspected and accepted, the annular space between the pipe and the casing shall be filled with materials approved by the Township, such as peastone, or flowable fill. After the casing has been filled, the ends of the casing shall be sealed as shown on the plans or in the specifications.

C. Jacking Pipe Method/Directional Bore

When specified or indicated on the Plans, the pipe to be jacked shall also be utilized as the carrier pipe. The pipe shall be jacked into place by approved methods that will provide accurate alignment and grade. Excavation shall be performed ahead of the pipe by working inside the pipe or shall be performed by boring with approved equipment suitable for the intended use.

2.07 SUBGRADE

The subgrade for pipe and/or structures shall be firm, dense, and thoroughly compacted and consolidated, free from mud and muck, and sufficiently stable to remain firm and intact under the feet of the workmen.

A. Unstable Foundation

When the soil beneath the normal pipe embedment area is soft or unstable, even with adequate dewatering, or in the opinion of the Township cannot support the pipe or utility, further depth shall be excavated and refilled to the proposed grade with approved materials compacted in twelve (12) inch layers as specified in Section 2.08.05, or other approved means shall be employed to assure a firm foundation for the utility. 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 plan or in the proposal. 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 the Standard Detail for Unstable Soil Removal for Utility.

B. Special Foundations

Where the subgrade at the bottom of the excavation consists of soil which is unstable or yielding to such a degree that, in the opinion of the Township, it cannot properly support the pipe or structure, the Contractor shall construct such additional foundation or reinforcement of the subgrade as may be specified, such as timber piling, geotextiles, or other means as approved by the Township to provide a proper foundation.

2.08 PIPE EMBEDMENT

A. General

Pipe embedment shall include the furnishing and placing of approved materials as specified or as directed from four (4) inches under the outside bottom of the pipe to twelve (12) inches over the outside top of the pipe. Various classes of pipe embedment may be specified or shown on the Plans or Standard details in which case the limits of the various types will also be specified.

B. Flexible Pipe Embedment

Flexible pipe is any pipe having a pipe stiffness of less than 200 psi. as defined under the requirements of ASTM Designation D-2412 (this includes all plastic pipe except Composite (Truss) pipe, and may include corrugated metal pipe, ductile iron pipe, and steel pipe, depending on pipe diameter and wall thickness).

Pipe embedment for flexible pipe shall be Class B. For pipes less than fifteen (15) inches in diameter, bedding material meeting the requirements of the current MDOT Standard Specifications for granular materials Class II, modified to 100% passing a 1" sieve shall be used. If stone is used for bedding, it shall be placed at least up to the spring line of the pipe and shall not exceed 1 ½" diameter. For pipes fifteen (15) inches in diameter and larger, bedding material meeting the requirements of the current MDOT Standard Specifications for granular materials Class I, modified to 100% passing a 1" sieve shall be used.

C. Class B Pipe Embedment

Unless otherwise specified or shown on the Plans, all pipe embedment shall be Class B pipe embedment as shown on the Standard details. When the soil in the bottom of the trench at pipe subgrade meets all the requirements for Granular Material Class II as specified in the current MDOT Standard Specifications Section 902.12 and in the opinion of the Township will provide suitable bedding for the pipe, such soil may be utilized as bedding material and prepared to receive the pipe as specified without undercutting and subsequent replacement.

D. Special Pipe Embedment

Various types of special pipe embedment may be specified or shown on the Plans in locations where special conditions require their use.

The Contractor shall perform all the work of constructing special pipe embedment where specified.

E. Placing Pipe Embedment Material

Pipe embedment material shall be placed in the bottom of the trench and shaped by hand to provide a firm and uniform bearing for the barrel of the pipe with additional shaping to accommodate the bells on bell and spigot pipe.

After each pipe has been graded, aligned, and placed in final position on the bedding material and jointing is complete, additional embedment material shall be carefully placed and compacted under and around each side of the pipe and over the pipe until it is completely covered by 12 inches of embedment material. Said material shall be distributed along both sides of the pipe uniformly and simultaneously to prevent lateral displacement of the pipe. All granular embedment material shall be compacted to 95% of maximum unit weight in accordance with MDOT procedures.

All of the work of placing pipe embedment shall be considered an integral part of installing the pipe and shall be completed immediately after the pipe is laid to the correct alignment and grade.

2.09 BACKFILLING ABOVE PIPE EMBEDMENT

A. General

All backfill material shall be free from cinders, pavement, ashes, refuse, sod, organic material, boulders, or rocks larger than six (6) inches in diameter, frozen material or other material which in the opinion of the Township is unsuitable. The soil excavated from the trenches shall be used for backfilling when it is classified as suitable by the Township and the Ottawa County Road Commission. If all or a portion of the excavated material is classified unsuitable for backfilling, the Contractor shall remove and dispose of the unsuitable material and shall furnish and place granular material meeting the requirements of Section 902.12 of the current MDOT Specifications for Granular Material Class II.

All backfilling and compaction shall be performed by the Contractor using methods and equipment approved by the Township.

B. Trenches Requiring Compacted Granular Backfill

Trenches and excavations in the following locations shall be backfilled with approved granular material meeting the requirements of the current MDOT Standard Specifications for Granular Material Class II:

- i. Improved areas, including drives, sidewalks, parking areas, around structures, etc.
- ii. Within the limits of the roadway (within a 1 on 1 slope beginning two (2) feet from the edge of pavement or back of curb towards the right-of-way line).
- iii. Within the limits of future improvements (shown on Plans).
- iv. Within limits specified on Plans.

All backfill within these areas shall be placed in layers not exceeding twelve (12) inches thick, and shall be compacted to 95% of maximum unit

weight in accordance with MDOT procedures. Tests for compaction will be made by the Owner or other representative designated by the Owner at no cost to the Township. When tests indicate a density which is less than that required, the methods or equipment being used shall be modified to obtain the density specified, and the section in question shall be recompacted until the required density is obtained. The cost of retesting shall be borne by the Contractor. Density testing shall be in accordance with Ottawa County Road Commission requirements.

C. Trenches Not Requiring Compacted Granular Backfill

Where not otherwise specified or directed, backfilling above the pipe embedment shall be made with material which is originally excavated, which is suitable. Backfill materials shall be consolidated by mechanical equipment working longitudinally in the trench, or by other approved methods, so as to be free of large voids with any excess material mounded over the trench or removed as directed by the Township. The trench shall be graded to a reasonable uniformity and left in a neat condition.

2.10 DISPOSAL OF EXCESS EXCAVATION

All excavated material in excess of that needed for backfill or that material classified as unsuitable by the Township, shall be disposed of by the Contractor and shall be incidental to the major items of work. However, the Township reserves the right to direct the Contractor to haul all or a portion of the material not required for backfilling to an area designated by the Township which is not more than 1,000 feet outside the project and which is reasonably accessible.

2.11 LIMITATIONS ON OPERATIONS

The Contractor shall at all times conduct his work in compliance with Ottawa County Permit requirements and so that there is a minimum of inconvenience to the residents and businesses in the vicinity of the project. To this end, he shall complete his backfill and remove all debris and unsuitable backfill to a point as close to the actual pipe installation as is practical and keep the area where the pipe construction and backfill has been completed in a neat condition. Open excavations shall be protected by signs, lights, barricades, and/or fences at all times when work is not actually taking place at that excavation. The placement of 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.

Not more than 300 consecutive feet of street shall be closed at one time, and vehicular traffic through any street shall not be stopped for a period longer than two weeks without the written permission of the Township. Not more than one cross street shall be closed to vehicular traffic at the same time except by permission of the Township.

2.12 SOIL EROSION AND SEDIMENTATION CONTROL

The Contractor shall conduct his operations in such a manner that all soil is confined within the project limits and prevented from entering storm sewers, water courses, rivers, lakes, reservoirs, or wetlands.

The Contractor shall place a filter or barrier composed of straw, stone or other approved material around all catch basins or other inlets to the storm sewer or drainage courses to prevent sedimentation in these structures. After the construction operations are completed, the Contractor shall remove these filters and clean all the sediment and debris from the catch basins, ditches, or other storm sewer structures.

Soil erosion and sedimentation control measures if indicated on the plans are considered as minimum requirements and are not to be considered as complete and all-inclusive. Additional control measures as may be required due to circumstances or conditions at the time of construction or as directed by the Ottawa County Road Commission, or the designated Soil Erosion Control agency, shall be placed as required to insure conformance with the Part 91 of PA 451 of 1994. Deviations from or additions to the erosion control measures shown on the plan shall be subject to the approval of the Township or enforcing agency.

The cost of this work and other control measures which may be required or directed by the Township shall be incidental to the cost of the project unless specific items have been provided in the proposal.

2.13 STREAM CROSSINGS

The rules and regulations concerning Inland Lakes and Streams Part 301 of Act 451, shall govern all stream and river crossings. A minimum of three (3) feet of cover to top of pipe (depth below firm bottom) shall be required.

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SECTION 3

SPECIFICATIONS FOR SURFACE RESTORATION

3.01 GENERAL

All areas within existing rights-of-way and adjacent areas disturbed by construction operations shall be restored to the original condition thereof as determined by the Township and/or the Ottawa County Road Commission using information from plans, surveys, and photographs or video tapes when available.

3.02 GRADING

All existing streets, walks, and other improved surfaces disturbed by construction operations shall be replaced to uniform lines and grades established by the Owners Engineer. The finish grade line will be established within three (3) inches of the existing ground profile shown on the plans unless a proposed grade is shown which indicates otherwise.

The Contractor shall perform all grading, compacting, shaping, and related work required to prepare the subgrade to the satisfaction of the Township. The cost for preparing the subgrade as specified herein shall be incidental to the cost of the project, and no specific payment will be made therefor.

3.03 ROADWAY EARTHWORK AND SUBBASE

A. Roadway Earthwork

Unless otherwise specified or shown on the Plans, roadway earthwork shall conform to the Section 205 of the current MDOT Standard Specifications. Roadway Embankment unless otherwise specified, shall be suitable granular material salvaged from the project or contractor furnished borrow. The material shall be granular material Class II or III as specified in the current MDOT Standard Specifications.

B. Subbase

Unless otherwise specified or shown on the Plans, subbase shall conform to Section 301 of the current MDOT Standard Specifications. A minimum of Class II 12" sand subbase is required on all roads unless additional thickness is required by the Ottawa County Road Commission.

3.04 ROADWAY REPLACEMENT SPECIFICATIONS

A. Replacement for Crossing Existing Streets

The replacement roadway cross-sections shall be determined by the Ottawa County Road Commission.

B. Requirements for Open Cut Streets

- i. Absolutely no open cut of pavement will be allowed without proper notification and required permits. The approval and permits shall be obtained from the Ottawa County Road Commission.
- ii. Pavement shall be cut back so that patch is six (6) inches wider than trench opening.
- iii. Edges of existing blacktop will be saw cut perpendicular to centerline.
- iv. Local and subdivision streets will be blacktop based within 24 hours.
 - a. 22A gravel base four (4) feet wider than the bituminous pavement.
 - b. Construction signs must remain until the top course is placed.
- v. Primary and arterial streets will be blacktop based the same day of construction.
 - a. 22A gravel base, ten (10) feet wider than bituminous pavement.
 - b. Construction signs will be erected and will remain until cleanup is completed.

All work within existing rights-of-way require that the Contractor obtain a permit from the Ottawa County Road Commission.

Deviations from this policy will only be considered when it can be demonstrated there would be no adverse effect on the traveling public. In this case the Contractor will provide maintenance at adequate intervals guaranteeing a smooth crossing. Should this become deficient in any way the bituminous patch will be ordered in immediately.

3.05 CONSTRUCTION OF BITUMINOUS STREETS

Bituminous streets shall be constructed in accordance with the typical section shown on the plans. All work shall be in accordance with the Ottawa County Road Commission Standards.

A. Materials

Aggregate base for bituminous streets shall meet the requirements of 22A in Section 902 of the current MDOT Standard Specifications. Bituminous mixtures for base, leveling, and surface courses shall be as specified, and shall conform to the requirements of Section 501 of the current MDOT Standard Specifications. Materials for prime coat and bond coat shall be as specified in Section 502 of the current MDOT Standard Specifications.

B. Construction Methods

Aggregate base for bituminous streets shall be placed in accordance with Section 302 of the current MDOT Standard Specifications.

Bituminous mixtures shall be placed in accordance with the applicable portions of Section 501 of the current MDOT Standard Specifications. For placement of valley gutters, pavers shall be equipped with an extension to the vibrating screed adjustable to fit the typical section shown on the plans.

The Contractor shall not place the aggregate base course until the subgrade has been approved by the Ottawa County Road Commission. The Contractor shall not place the first bituminous course and each successive bituminous course until the underlying aggregate or bituminous course has been approved by the Ottawa County Road Commission.

3. 06 REPLACEMENT OF CONCRETE AND BITUMINOUS IMPROVEMENTS (other than roadways)

The Contractor shall replace all concrete sidewalk, drives, curb and gutter, and pavement removed during the installation of the utility or damaged by the Contractor.

A. Materials

Concrete sidewalks and driveways shall conform to 2003 MDOT Specifications Section 803. Concrete is to be six sack limestone mix and shall be air entrained.

B. Construction Methods

The thickness of the concrete shall be the same as the concrete adjacent to the trench but shall not be less than four (4) inches. The alignment and grade and the contour and finish of the surface shall be the same as the concrete adjacent to the trench unless otherwise directed by the Township.

Pavements, walks, and drives shall be sawed at the edges of the trench or removed to existing joints. The depth of the saw cut shall not be less than the full depth of the concrete.

The forms and joints and the methods of placing, curing, and protection shall be consistent with standard practice and shall meet all the requirements of the current MDOT Standard Specifications for the various items.

C. Bituminous Driveway and Sidewalk Replacement

Bituminous driveway and sidewalk replacement shall be replaced at a thickness equal to the existing at the trench but not less than one and one-half (1 ½) inches of MDOT 13A bituminous base and one (1) inch of MDOT 36A bituminous top over six (6) inches of MDOT 22A gravel compacted in place.

D. Gravel Driveway Replacement

Gravel driveways disturbed during construction shall be replaced with six (6) inches of MDOT 22A compacted in place.

3.07 TURF RESTORATION

All areas of established turf shall be replaced as nearly as possible to their original condition.

A. Topsoil

Topsoil shall be placed four (4) inches in depth over all areas disturbed by the Contractor's operations. The subgrade shall be graded to conform to the adjacent contours prior to placement of the topsoil and shall be approved by the Township prior to placing topsoil. The topsoil shall then be placed in accordance with Section 816 of the current MDOT Standard Specifications.

Existing topsoil, where available and suitable, shall be stripped, salvaged, and used for replacement. The soil shall consist of natural loam topsoil and shall be of uniform quality, free from hard clods, stones, and all other undesirable material. The soil shall contain not less than three (3%) percent organic matter. The acidity range shall be between PH 5.0 and PH 8.0. New topsoil will be required where the existing topsoil does not meet the above specifications.

B. Fertilizer

After the topsoil has been placed, it shall be fertilized with a good grade of chemical fertilizer at the rate of two (2) pounds of available nitrogen per 1,000 square feet. Fertilizer shall be applied just before the placing of the seed to retain its full benefit before unfavorable weather can cause deterioration.

C. Seeding

All lawn areas to be seeded shall be seeded with Class A seed. Other areas disturbed by the Contractor's operations shall be seeded with Roadside seed. Seed mixtures, application rates, and methods shall be in accordance with Section 816 of the current MDOT Specifications.

Seasonal limitations on seeding in Section 816 of the MDOT Standard Specifications are waived. The Contractor shall repeat the seeding procedure as often as necessary to produce a close stand of weed-free grass.

D. Mulching

All seeded areas shall be mulched immediately following the seeding. Mulching shall be applied to all newly seeded areas at a rate of two (2) tons per acre in accordance with the requirements of Section 816 of the current MDOT Standard Specifications.

E. Hydro Application

All fertilizing, seeding and mulching shall be applied by an approved Hydro seeding and mulching process unless separate applications as heretofore described are approved by the Township. Separate loose straw mulch is prohibited on residential lawn areas.

F. Sod

Sod shall be placed only where required by the Township or as noted on the plans or specifications.

All sod shall be nursery grown, conforming to MDOT requirements for Class A. Sod shall be approved by the Township prior to placing and shall be placed in accordance with the requirements of Section 816 of the current MDOT Specifications. The base on which the sod is to be laid shall consist of a minimum of four (4) inches of topsoil placed and fertilized in the same manner required for seeding.

3.08 TREE/BUSH REPLACEMENT

Replacement trees and bushes shall be the size and type specified in the Proposal. Transplanting replacement trees/bushes shall be in accordance with Michigan Department of Transportation Specifications 815 "Landscaping". The Contractor shall replace transplanted trees/bushes that are not in a vigorous growing condition one year after transplanting. Unless otherwise noted, tree/bush replacement is a pay item unless unnecessarily removed by the Contractor through carelessness.

3.09 SEWER LATERALS/WATER SERVICE TRENCH RESTORATION

Sewer lateral and water service trench restoration shall be repaired and replaced as often as necessary until settlement has stopped.

3.10 SCHEDULING OF RESTORATION WORK

Initial restoration (rough grading, temporary aggregate if necessary, removal of excess excavated material and debris) shall be done each day to the extent necessary to allow the movement of local traffic and permit access to all properties for emergency vehicles. Maintenance of streets, drives, sidewalks,

etc. shall be the responsibility of the Contractor (including dust control, grading, stabilization, etc.) until the restoration is complete and has been accepted by the Township.

Restoration of each street or section of utility line shall follow the construction in a timely fashion so as to minimize inconvenience to the adjacent property owners and the general public. The manner in which this restoration is done by the Contractor will be a determining factor in the approval by the Owners Engineer of staking requests and partial payment requests.

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SECTION 4

SPECIFICATIONS FOR WATER MAINS AND WATER SERVICES

4.01 DESCRIPTION OF WORK

The work shall consist of furnishing and installing water main of the specified size or sizes at the depths shown on the plans or specified herein, and furnishing all fittings and joint material, labor, materials, tools, and equipment for receiving, unloading, transporting, laying, testing, and disinfecting of water pipe and fittings. The Contractor shall furnish all hydrants, valves, valve boxes and other necessary accessories to complete the pipe work as shown on the plans and specified herein.

4.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are mentioned the current edition or latest issue shall be used.

A. Pipe

i. Ductile Iron Pipe

Ductile iron pipe shall conform to the requirements of AWWA C-151 (ANSI A21.51). Ductile iron pipe shall be Class 52 unless otherwise specified. Eight (8) inch is the minimum diameter for mainline pipe.

ii. Fittings

All fittings shall be ductile iron in accordance with AWWA C-153 (ANSI A21.53). Fittings twenty four (24) inches in diameter and smaller shall have a minimum pressure rating of 350 psi., fittings larger than twenty four (24) inches in diameter shall have a minimum pressure rating of 250 psi. Fittings shall have either cement mortar lining with seal coat in accordance with AWWA C-104 (ANSI A21.4) or fusion bonded epoxy coating in accordance with AWWA C-116 (ANSI A21.6). Lining shall have NSF61 approval for use with potable water.

iii. Joints

Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of AWWA C-111 (ANSI A21.11) for bolted mechanical joints or push-on joints. Joints on fittings shall be bolted mechanical joints.

iv. Cement Lining

All ductile iron pipe shall have a cement mortar lining with seal coat conforming to the requirements of AWWA C-104 (ANSI A21.4). Seal coat shall have NSF61 approval for use with potable water.

v. Polyethylene Wrap

When laying pipe in corrosive type soils as determined by the Ottawa County Road Commission, the pipe shall be encased in a seamless polyethylene tube, in accordance with AWWA C-105 (ANSI A21.5) 8 mills minimum thickness. The ends of adjacent sections of polyethylene tubing shall be overlapped a minimum of one (1) foot, and the joint taped or otherwise secured to prevent displacement during backfill operations.

B. Valves

i. Gate Valves

All valves 4" – 12" shall be resilient wedge gate valves or double disc gate valves.

Valves shall be Traverse City Iron Works, East Jordan Iron Works, Clow Corporation R/W Resilient Wedge, Waterous Resilient wedge, U.S. Pipe Metroseal 250, or equal (Resilient Wedge valves shall conform to AWWA C-509 or C515-99, Double Disc Gate Valves shall conform to AWWA C-500-71).

Valves will open right or clockwise.

Valve stem shall be made of high strength manganese bronze. Stem seals shall have two O-ring seals in the seal plate which shall be replaceable with the valve in the full open position at rated working pressure.

Valves shall have a 250 p.s.i. design pressure rating and a test pressure of 500 p.s.i. A certification of manufacturer and testing shall be provided on request.

Resilient Wedge Gate Valve bodies and bonnets shall be totally encapsulated with an epoxy coating. Resilient Wedge Gates shall be ductile iron and shall be totally encapsulated in rubber. This rubber coating shall be permanently bonded to the ductile iron wedge casting and shall meet A.S.T.M. D429 tests for rubber to metal bonding.

Double Disc Gate Valve discs shall be provided with a positive welding mechanism that will prevent disc distortion.

ii. Butterfly Valves

All valves 16" and larger shall be Butterfly Valves.

All butterfly valves shall conform to AWWA C-504, Standard for Rubber Seated Butterfly Valves. Valves shall be Class 150-B and shall have a "short body" form. Valves suitable for buried service will be acceptable without a manhole. Valves shall be constructed of material suitable for handling water. Shaft seals shall be replaceable without removing the valve shaft. Valves shall be equipped with totally enclosed worm gear operators conforming to AWWA C-504. All valves shall be Henry Pratt Company "Groundhog", or approved equal. Valves will open right or clockwise.

C. Tapping Sleeves

Tapping sleeves shall be stainless steel, Ford FAST, Smith-Blair 662, Romac Industries SST, with coated carbon steel or ductile iron flange, or approved equal.

D. Hydrants

Fire hydrants shall be furnished with a breakable stem and flange conforming to AWWA C-502 and shall be East Jordan Iron Works, Model BR-5. The hydrants shall have 2-2½" N.S. male hose connections with chains, 1-4½" N.S. male pumper connection with chain, a 5¼" main valve opening and a 6" mechanical joint inlet, the centerline of which shall be located 5'6" below ground. The hydrant's weep hole shall be left open and there shall be coarse gravel or crushed stone placed at the base to a distance of at least 6" above the weep hole and a distance of 1' around the elbow.

Access culverts (where required) shall be installed. Joint materials shall conform to those previously specified under ductile iron joints.

All Hydrants shall be factory painted yellow enamel.

Hydrants shall be located at all highpoints of the water main and so that all points of buildings served by the water main project are within 250 feet of a hydrant.

E. Valve Boxes

Valve boxes shall be cast iron screw type, three sectional, adjustable with round bases, with an overall length sufficient to permit the tops to be set flush with the established pavement or ground surface. The box shall be provided with a cast iron lid or cover and marked with the words "WATER". The valve boxes shall be designed to withstand heavy traffic. Valve Boxes shall be EJIW 8560-D4 or Tyler 6860 with 5" minimum inside diameter. Where the distance from the top of the valve nut to finish grade exceeds 7 feet, valve nut extension rods are to be installed.

F. Stainless Steel

Stainless steel components shall meet the specifications of A.S.T.M. type 304.

4.03 WATER SERVICES

Water services in the Township are to be installed in accordance with the following specifications:

A. Materials

i. Curb Boxes

Curb Boxes shall be McDonald 5614 for 1" service and 5615 for 1 ½" and 2" services or an approved equal and a brass penthead bolt to connect the lid. The lids of all boxes shall be marked with the word "Water" or the letter "W". The curb box shall be centered over the curb cock and must be plumb after backfilling. The tops of curb boxes are to be left 6" above finish grade. Stakes for finish grade at the curb stop must be provided if requested.

ii. Curb Stops

Curb stops shall be Ball Valves: McDonald Model No. 6104T with flared fittings, or approved equal. The curb stop shall normally be set on the property line. The curb stop shall be installed on an approved curb box foot piece, block, or brick support so that the valve can be operated normally after backfilling. The service shall be sealed shut using a brass union, w/ copper disc and plug.

iii. Corporation Stops

Corporation stops shall be McDonald Model 4701BT compression ball valve.

iv. Service Saddles

Service saddles shall be used on PVC mains and shall be Romac style 202S with double stainless straps.

v. Copper to Copper Connections

Copper to copper connections shall be Mueller No. 15404 and 15535, Ford C22 Series, McDonald Model No. 4758, or Hays No. 5615, with flared fittings, or approved equal.

vi. Copper Water Service Pipe

Copper water service pipe two inches and smaller in diameter shall be Type K, annealed, seamless copper tubing in accordance with the

current ASTM specification B88. (Pipe 4" and larger shall be Ductile Iron Class 52 or PVC and shall be reviewed and approved by the Ottawa County Road Commission). In areas of groundwater contamination polyethylene service lines are allowed, minimum 160 psi, copper pipe size.

B. Installation

i. Tapping

Tapping of the mains shall be made under pressure with a tapping machine similar to Hays No. B-1, or Mueller B-100. For services 2" diameter and larger, saddles are to be used for connecting the water service to the main. Drilling through service clamps, saddles or welded couplings shall be performed with a machine similar to Mueller D-5. The tap shall be installed 45 degrees above the horizontal axis of the pipe, and flow arrow shall point away from the main. The contractor shall keep an accurate record of measurements from the nearest valve or hydrant to each corporation or other connection to the main.

ii. Pavement Crossing

Service lines shall be jacked or bored across pavements at right angles to the right-of-way. No pavement shall be cut or removed without permission by the Township and the Road Commission in which the service is located.

iii. Cover

All services shall be installed with a minimum earth cover of five (5) feet. In no case shall the maximum earth cover exceed seven (7) feet.

iv. Curb Box Locations

Curb Boxes shall be located on the right-of-way line or on the utility easement limit.

v. Surface Restoration

Restoration required for the installation of the water service is the responsibility of the water service contractor.

vi. Dewatering

All taps must be made in a dry trench.

vii. Polywrap/Coating Repairs

All disturbed polywrap/coatings shall be repaired/replaced to provide the required protection to the mainline water main.

C. Water Services within the Public Right-of-Way/Easements-General

After the water main is tested and approved, water services shall be installed for all existing houses or buildings unless otherwise indicated.

Connection and use: Connection to the water supply system and use of the water supply system is governed by the Township ordinance to administer, regulate, and provide for the connection to and use of the water and sewer system. See this Ordinance for regulations governing use of the water supply system and penalties for violation of the Ordinance.

Services through 2.0" - within public right-of-way or utility easements

i. Installation:

Option 1. The water service will be installed by or on behalf of the Township and will be owned and maintained by the Township.

Option 2. The water service will be installed by a developer in conjunction with a water main extension and will be turned over to the Township for ownership and maintenance upon satisfactory completion and inspection.

ii. Inspection:

The Ottawa County Road Commission or an authorized representative must inspect all water services under pressure prior to backfill. All fittings and joints to be drip free at time of inspection.

iii. Tap Location:

Locations for taps will be determined by the Ottawa County Road Commission and/or the Township. For new developments this will be at the center of the lot. All water services will be installed perpendicular to the water main and outside of paved areas unless special circumstances warrant the Ottawa County Road Commission and /or the Township to authorize differently.

iv. Tapping Method:

The method of tapping will be determined by the Ottawa County Road Commission (direct, saddle, welded, etc.) and will be in accordance with sound engineering practices. All services must be inspected by the Ottawa County Road Commission or an authorized representative.

D. Water Services on Private Property-General (Also see the Township ordinance to administer, regulate, and provide for the connection to and use of the water and sewer system")

Application for connection: Application forms and permits for connection are available at the Township office. These forms will provide for payment of the connection fees at the time request is made for service.

i. Services through 2.0" - Private Portion:

a. Permits:

Permits for installation must be secured from the Township prior to the commencement of any installation.

b. Installation:

All water services must be buried between 5 and 7 feet deep. Water services will meet the same specifications as the public portion.

c. Inspection:

The Township and/or Ottawa County Road Commission must inspect all water services under pressure prior to backfill.

d. Acceptable Material Allowed:

Type K Copper, annealed, seamless, ASTM B-88, unless otherwise approved by the Township in writing.

ii. Services 4.0" and larger including fire protection lines:

a. Permits:

Permits for installation must be secured prior to the commencement of any installation. Forms for the permits will be provided by the Township and will detail procedures for obtaining the permit.

b. Installation:

The customer shall construct, own and maintain the water line at his expense in its entirety.

c. Inspections/Testing:

Inspections, pressure testing, and bacteria sampling must be done in accordance with the Crockery Township Water Supply System Standard Construction Requirements.

d. Acceptable Materials Allowed:

All services must be of Class 52 (or greater) cement-lined Ductile Iron Pipe. All construction materials must meet the specifications for water mains. All pipe joints within the building to the meter shall be screw on flanges.

e. Valves:

A valve shall be located on the right-of-way line or on the utility easement limit.

Note: The valve is where the change in ownership takes place.

f. Tapping Method:

Tapping sleeves shall be Ford stainless steel tapping sleeves style FTSC or approved equal.

E. Water Service Size, Tapping, Meters-General

i. Water Service Size:

- a. Single and two-family residences - minimum 1" service.
- b. Multi-family, commercial and industrial - minimum 1½" service.

ii. Taps:

If the service has not been pre-tapped, the contractor will bring the water service connection to the road right-of-way line. If the water service pipe has been installed out to the road prior to this, the contractor will connect the line to the tap provided sufficient pipe has been provided. If the tap is to be made before the line to the house is

installed, the homeowner or plumber must mark the tap location with a stake.

iii. Meters and remotes:

The homeowner or plumber is responsible for the installation of the water meter horn and/or meter bar available from the Township. Water meters shall be set in accessible location and in a manner approved by the Ottawa County Road Commission and/or the Township. Ottawa County Road Commission personnel will install the meter and remote reader to the outside of the structure with a wire running to the meter as necessary.

iv. Inspections:

All water service installations must be inspected by the Ottawa County Road Commission. Water inspections can be scheduled by calling the Ottawa County Road Commission by 3:00 pm on the day before an inspection is needed. A permit number is required to schedule an inspection.

v. Permits:

Installation permits must be secured prior to the commencement of any construction.

Water services larger than two (2) inches shall conform to the Water main Specifications.

vi. Installation Requirements:

All connections and services must meet the requirements of the Michigan State Plumbing Code and the State of Michigan Department of Environmental Quality (MDEQ) Administrative Rules.

vii. Meter/Service Sizes:

Meter and service sizes must be approved by the Township as suitable for the proposed application.

The following service sizes will be allowed: 1.0", 1.5", 2.0", 4.0", 6.0", 8.0", 12.0" and larger. Exceptions to these sizes can be made when the Township determines necessary.

The Township reserves the right to refuse or limit water service when service could overburden the system.

viii. Cross Connections:

All connections must meet the requirements of the Township Cross Connection Rules.

ix. Fire Hydrants:

Fire hydrants will not be installed on private fire lines. Exceptions may be authorized by the Township on certain high pressure systems when standard hydrants are not used.

x. Special Materials:

The Township reserves the right to require special materials, bedding, and/or construction methods when conditions warrant.

xi. All water services will serve one building only. Exceptions may be made if authorized by the Township for certain complexes and then only after the water is metered.

F. Meters

i. Installation:

All meters must be located at the point of the water service entrance into the building.

New Meters must be installed 18" above the finish floor and be placed horizontally and according to the manufacturer's specifications.

Valves must be installed immediately upstream and downstream of each meter.

Meters may not be installed in pits. On a case by case basis, the Township may allow the placement of meters in meter boxes.

Meter by-pass piping and valves are prohibited, except as provided for in this section. A commercial or industrial customer may submit a written request to install water meter by-pass piping and valves. The request shall explain why installation of water meter by-pass piping is necessary. The Township may approve water meter by-pass piping if it determines, in its discretion, that it is necessary for the protection of equipment and public health. In some cases a gap in the by-pass piping will be required.

ii. Accessibility:

All meters must be placed in a location readily accessible to Township and Ottawa County Road Commission personnel.

Crawl space installations must be approved by the Township prior to service installation.

When more than one meter is installed in a building for metering of tenant spaces, piping and meter configurations must be approved prior to installation and separate shut-offs, accessible to the Township, must be provided.

Customers must provide a chaseway (access way) for installation of the remote wire from the water meter to the outside of the building as necessary.

iii. Protection:

Meters and equipment must be protected from freezing and other damaging elements.

iv. Fittings:

All pipe and fittings prior to metering must be Class 52 cement-lined Ductile Iron, copper or brass.

The Water Department will furnish meter horns and/or meter bars and inside fittings, the cost of which will be included with the connection fees.

v. Ownership:

All meters shall remain the property of the Township.

All meters shall be furnished by the Township, the cost of which will be passed on to the customer and included in the connection fees.

4.04 INSPECTION

A. Shop Inspection

All materials furnished by the Contractor are subject, at the discretion of the Township to inspection and approval at the Manufacturer's plant. All inspection in the plant of the manufacturer of materials furnished by the Contractor shall be made at the expense of the Township. If the materials are defective, the Contractor shall pay for costs for replacing the defective materials and for inspection, both for installation and visit at the manufacturer's plant.

B. Field Inspection

All pipe and accessories shall be laid, joined, and tested under pressure for defects and leakage in the manner specified herein and in the presence of, and as approved by the Township.

C. Disposition of Defective Material

All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Township. All defective materials furnished by the Contractor shall be promptly removed by him from the site.

4.05 RESPONSIBILITY FOR MATERIAL

A. Responsibility for Material Furnished by Contractor

The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered prior to the final acceptance of the work.

B. Responsibility for Safe Storage

The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

C. Replacement of Damaged Material

Any material that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.

4.06 HANDLING OF MATERIAL

The Contractor shall use care and proper equipment during the unloading and distribution of water main materials on the job site to insure the materials are not damaged.

Pipe and/or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

4.07 ALIGNMENT AND GRADE

A. General

The water main shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations and all valve and hydrant stems plumb.

B. Deviations Occasioned by Other Structures

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the Township shall have the authority to change the plans and order a deviation from the line and grade or arrange with the Owners of the structures for the removal, relocation, or reconstruction of the obstructions. If the change in plans results in a change in the amount of work by the Contractor, such altered work shall be done by a written field order.

C. Depth of Pipe

All pipe shall be laid with the top of the pipe a minimum depth of five (5) feet below established street centerline grade, and with a minimum cover of five (5) feet below existing grade at the water main, unless specified otherwise. Water main eight (8) inches and larger shall be laid to a specified grade. Generally water main eight (8) inches and larger shall have a depth of 5 feet 9 inches below proposed centerline of the street or the existing ground to centerline pipe unless specified on the plans or approved by the Ottawa County Road Commission. Maximum depth of cover to be nine (9) feet. Grade stakes for the water main will be required where the depth of the water main deviates from the above standard depths.

4.08 LAYING

A. Lowering of Water main Material into Trench

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 suitable tools or equipment, in such a manner as to prevent damage to water main material and protective coatings and linings.

Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants, or water main accessories in handling, the damage shall be immediately brought to the Township's attention. The Township shall prescribe corrective repairs or rejection of the damaged items.

B. Inspection before Installation

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Township, who will prescribe corrective repairs or rejection.

C. Cleaning of Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

D. Laying of Pipe

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. No tools or other articles shall be stored in the pipe at any time.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Township. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

E. Cutting of Pipe and Connections to Existing Water mains

The Contractor shall cut the pipe in a straight and uniform manner, at right angles to the axis of the pipe, wherever necessary for placing valves, fittings, or closure pieces without damage to the pipe, and without extra cost to the Owner. The cut ends of the pipe shall be beveled before assembly of the joint.

Connection to existing mains shall be done at a time when it will least interfere with normal use of the main. The Contractor shall be responsible for draining water from the closed off section of the existing main so that the connection can be made.

The Contractor shall uncover existing mains at points of connection sufficiently in advance of making the connection to allow verification of the dimensions of the existing main and shall make any revisions required to the fitting, or obtain special adaptors required for the connection. Existing pipe lines shall be adequately supported during the connection operation and prior to placement of backfill.

The Contractor shall be responsible for preventing contamination of existing water mains while the connection is made. He shall be responsible for any damage caused by his operations to existing mains to which the connections are being made.

F. Bell Ends to Face Direction of Laying

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Township. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

G. Sleeves

In connecting pipe together with a sleeve, the space between adjoining pipes shall not exceed one (1) inch. Where the space between adjoining pipe exceeds one (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 pipe, and shall be cut straight and uniform and be free of defects and damage.

4.09 JOINING OF MECHANICAL - JOINT PIPE

A. General Requirements

The general requirements in Section 4.04 - 4.08 inclusive shall apply, except that where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of mechanical-joint pipe.

B. Cleaning and Assembly of Joint

The last eight (8) inches outside of the spigot and inside of the bell of mechanical- joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint and then coated with a lubricant. The gasket lubricant shall be non-toxic, tasteless, and odorless, and shall be as supplied or recommended by the pipe manufacturer and approved by the Township. The Mega-lug restraint

shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell, end. The rubber gasket shall be coated with lubricant and placed on the spigot end with the thick edge toward the Mega-lug.

C. Bolting of Joint

The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The Mega-lug restraint 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 suitable (preferably torque-limiting) wrench. The torque for various sizes of bolts shall be as follows:

<u>Size</u> Inches	<u>Range of Torque</u> Foot - Pounds
5/8	45 - 60
3/4	75 - 90
1	100 - 120
1-1/4	120 - 150

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 Mega-lug 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 or torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts to compensate for poor installation practice is not allowed.

D. Permissible Deflection in Mechanical-Joint Pipe

Whenever it is desirable to deflect mechanical-joint pipe in order to form a long-radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 1.

TABLE 1
PERMISSIBLE DEFLECTIONS IN MECHANICAL - JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches				Approx. Radius of Curve Produced By Succession of Joints – Feet			
	12'	16'	18'	20'	12'	16'	18'	20'
3	21	28	31	35	85	110	125	140
4	21	28	31	35	85	110	125	140
6	18	24	27	30	100	130	145	160
8	13	18	20	22	130	170	195	220
10	13	18	20	22	130	170	195	220
12	13	18	20	22	130	170	195	220
14	9	12	13.5	15	190	250	285	320
16	9	12	13.5	15	190	250	285	320
18	7.5	10	11	12	230	300	340	380
20	7.5	10	11	12	230	300	340	380
24	6	8	9	10	300	400	450	500
30	6	8	9	10	300	400	450	500
36	5	7	8	9	330	440	500	550
42	5	6	7.5	8	340	450	510	570
48	5	6	7.5	8	340	450	510	570

4.10 JOINING OF PUSH-ON JOINT PIPE

A. General Requirements

The general requirements in Section 4.04 - 4.08 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of push-on joint pipe.

B. Cleaning and Assembly of Joint

The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

The thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe or both.

Gasket lubricant shall be non-toxic, tasteless, and odorless and shall be as supplied or recommended by the pipe manufacturer and approved by the Township.

The spigot end of the pipe shall be centered in the bell and forced or pushed home. Smaller sizes of pipe can be pushed or forced into place by hand; larger sizes will require the use of mechanical assistance.

The condition of the trench bottom must be such that correct location and position of the pipe to be joined is in a straight line assuring a joint of maximum tightness and permanent seal.

C. Permissible Deflection in Push-On Joint Pipe

Whenever it is desirable to deflect push-on joint pipe, in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 2, unless recommended by the pipe manufacturer and approved by the Township.

TABLE 2
PERMISSIBLE DEFLECTIONS IN PUSH-ON JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches				Approx. Radius of Curve Produced By Succession of Joints - Feet			
	12'	16'	18'	20'	12'	16'	18'	20'
3	12	16.5	19	21	140	185	205	230
4	12	16.5	19	21	140	185	205	230
6	12	16.5	19	21	140	185	205	230
8	12	16.5	19	21	140	185	205	230
10	12	16.5	19	21	140	185	205	230
12	12	16.5	19	21	140	185	205	230
14	7.5	10	11	12	230	305	340	380
16	7.5	10	11	12	230	305	340	380
18	7.5	10	11	12	230	305	340	380
20	7.5	10	11	12	230	305	340	380
24	7.5	10	11	12	230	305	340	380
30	7.5	10	11	12	230	305	340	380
36	7.5	10	11	12	230	305	340	380
42	5	6.5	7.5	8	340	460	510	570
48	5	6.5	7.5	8	340	460	510	570

D. Brass Wedges and Tracer Wire

A minimum of two (2) Brass wedges are required for all push on joints on ductile iron pipe. Tracer wire shall be include with PVC water main.

4.11 SETTING OF VALVES AND FITTINGS

A. General Requirements

Valves, fittings, plugs, and caps shall be set and joined to pipe in the manner specified above for cleaning, laying and joining pipe. Valves are to be installed vertically.

B. Location of Valves

Valves in water mains shall, where possible, be located as shown on plans unless otherwise directed by the Township. At intersections of streets, valves shall be placed in line with extensions of the right-of-way lines.

C. Valve Boxes

A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished grade or such other level as may be directed. Valve boxes are to be left flush with grade.

D. Dead Ends

A hydrant or water main blowoff will be placed at all dead ends unless otherwise approved by the Township. Brass plugs will be required to plug tapped holes in ductile iron water main plugs or caps that have been tapped for temporary standpipes.

4.12 SETTING OF HYDRANTS

A. Location

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. Maximum spacing between hydrants shall be five hundred (500) feet. Hydrants shall be located at all highpoints of the water main and so that all points of buildings served by the water main project are within 250 feet of a hydrant.

When placed behind the curb, unless otherwise directed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than two (2) feet from the face of the curb.

When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within six (6) inches of the sidewalk.

B. Position

All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb. Hydrants shall be set to the established grade, with nozzles a minimum of twenty seven (27) inches above the street centerline grade and a minimum of twenty one (21) inches above the ground at the hydrant, unless otherwise directed by the Township and/or the Ottawa County Road Commission.

C. Connection to Main

Each hydrant shall be connected to the main with a six (6) inch ductile iron branch controlled by an independent 6 inch gate valve, unless otherwise specified. All hydrant gate valves shall be open at the time of testing and remain open thereafter. The cost of the branch pipe shall be incidental to cost of installing the hydrant.

D. Hydrant Drainage

All hydrant drains and weep holes shall be left unplugged unless otherwise directed on the plans due to a high water table, non-draining soils, or contaminated soils. One half cubic yards of pea gravel must be placed below the weep hole as shown on the hydrant detail.

E. Pumping of Hydrants

All hydrants shall be pumped completely dry as necessary when the water main is placed in service.

4.13 ANCHORAGE

A. Restrained Joint Pipe

All ductile iron restrained joint pipe shall be Clow Corporation "Super-Lock"; American Ductile Iron Pipe "Lok-Ring Joint" or Flex-Ring Joint; Griffen Pipe Products Co. "Snap-Lok"; U.S. Pipe "TR Flex" or approved equal. All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system actually installed.

B. Joint Restraining Glands

Joint restraining glands shall be Megalug as manufactured by EBAA Iron Sales, Inc. or approved equal.

C. Mechanical Joint Anchoring Fittings

Mechanical joint anchoring fittings shall be as manufactured by Clow Corporation, Tyler Corporation, or approved equal.

D. Joint Restraining Gaskets

Joint restraining gaskets shall be U.S. Pipe Field Lok Gaskets, American Ductile Iron Pipe Fast Grip Gasket, or approved equal. At all joints where joint restraining gaskets are used, the joint is to be wrapped with 2½" minimum width plastic tape with text "restrained joint".

E. Anchorage for Hydrants

All hydrants shall be restrained to the hydrant lateral valve, and the hydrant lateral valve shall be restrained to the main using an approved joint restraint system consisting of joint restraining glands (Megalug), mechanical joint anchoring fittings, or approved equal.

F. Anchorage for Plugs, Caps, Tees, Bends and Valves

Unless otherwise specified or approved by the Township, movement of all plugs, caps, tees, bends, and valves shall be prevented by use of restrained joint pipe, mechanical joint anchoring fittings, joint restraining gaskets, or Mega-lugs as manufactured by EBAA Iron Sales.

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 the following table. All joints of water main in casings are to be restrained.

Approval of restraining method and distances by the Engineer shall not relieve the contractor from their responsibility for the adequacy and limits of restraint.

PIPE RESTRAINT LENGTH REQUIRED, FEET

Pipe Diameter	Tees, 90° Bends	45° Bends	22-1/2° Bends	11-1/4° Bends	Dead Ends	Reducers (one size) **	
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

**If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

NOTE: The length of restrained joint pipe required as shown in the table above is based on trench backfill being compacted to 95% of maximum unit weight in accordance with MDOT procedures. If the pipe is wrapped in polyethylene, a greater length of restrained pipe will be required as specified, shown on the Plans, or directed by the Township. A multiplier of 1.43 shall be used if the pipe is installed with polyethylene wrap.

All joints lying within the above minimum distances from the fitting must be restrained as noted herein.

Tees: Tees shall be restrained in the branch direction as required in the table above. 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 ten (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 ten (10) feet.

Plugs/Caps: All dead ends on water mains shall be plugged or capped 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 the table above.

Bends: Bends shall be restrained in both directions as required in the table above.

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 shall be

restrained to the tee by use of restrained joint pipe or joint restraining glands as specified above. Hydrant valves may be restrained using mechanical joint anchoring fittings.

4.14 HYDROSTATIC TEST

A. Procedure

All tests will be made by the Contractor using his own equipment, operators, and supervision, in the presence of the Township or his duly authorized representative. The length of the section to be tested shall be as approved by the Ottawa County Road Commission and/or the Township. The test shall not be against an existing valve, unless written permission is obtained from the water system operator. In no case shall a test be made against an existing valve that is found to be leaking or otherwise defective.

B. Air Removal before Test

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

C. Leakage Test

A leakage test shall be conducted in the presence of the Township after the pressure test has been satisfactorily completed. The Contractor shall furnish the pump, pipe, connections, gages and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of the test shall be two (2) hours, and during the test the main shall be subjected to a pressure of 150 psi.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled, and the pipe has been filled with water. When several valved sections are tested as one test, the maximum allowable leakage will be equivalent to the calculated smallest value of the maximum allowable leakage for any valved section. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L = Allowable leakage in gallons per hour

S = Length of pipe tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch gage.

When testing lengths of water main greater than 1,000 feet, the maximum allowable leakage will be the amount calculated for 1,000 feet.

This formula is based on allowable leakage of 11.65 gallons per day, per mile of pipe, per inch of nominal diameter at 150 psi.

The Township shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. The report shall be signed by the Contractor and the Ottawa County Road Commission or the Township or their designated representatives.

D. Variation from Permissible Leakage

If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall at his own expense locate and repair the leaks until the leakage is within the specified allowance.

E. Time for Making Test

The pipe may be subject to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled.

4.15 CLEANING AND DISINFECTION

A. Flushing Water main

The water main and services three (3) inches in diameter and larger shall be flushed by providing taps in sufficient size or number to provide a velocity as required by AWWA Standard C651. For water mains twelve (12) inches in diameter and larger, minimum four (4) inch diameter standpipes are to be provided. Hydrants may be used providing the requirements listed below are met.

B. Procedure

The Contractor shall submit to the Ottawa County Road Commission or the Township or their designated representative, a procedure schedule outlining the method he proposes to use for flushing water mains. Mains shall be flushed at a maximum of 1/4-mile intervals.

C. Time for Flushing

Flushing may be done prior to pressure testing or following pressure testing but, in any case, prior to chlorination of the water main.

D. Chlorination

All newly-laid lines shall be chlorinated. The Contractor shall furnish all necessary equipment and materials and shall furnish all necessary assistance for effective disinfection of the water mains. Chlorination shall be accomplished by using the following general procedure.

E. Procedure

After the water main has been pressure tested and flushed, the Contractor shall pump a chlorine solution into the water main in such a manner and at such strength that the residual free chlorine shall be 50 to 100 ppm.

The amount of chlorine required for each 100 feet of pipe of various diameters to produce 50 ppm chlorine solution is as follows:

<u>Pipe Sizes (Inches)</u>	<u>100 Percent Chlorine (lb.)</u>	<u>16% Bleach (gal.)</u>
6	.061	.046
8	.108	.081
10	.170	.128
12	.240	.180
16	.436	.313
24	.980	.737
30	1.463	1.100

F. High Test Calcium Hypochlorite

("HTH", Perchloren", Pittchlor"). Prepare a ten-thousand-parts-per-million solution in water and pump at a constant rate into the water main while bleeding off the water at the extreme end. The bleed rate will determine the feed rate of the chlorine in order to arrive at a 50 to 100 ppm solution in the water main.

G. Liquid Chlorine

Liquid Chlorine may be applied to the water main much the same way as the hypochlorite solution listed above. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine.

H. Point of Application

The chlorinating agent shall be applied at the supply end of the line through a corporation cock. The water for injecting the chlorine into the

new main may be taken from the pressure side of the isolation valve or by utilizing a pressure pump.

Care shall be exercised to prevent any of the strong chlorine solution from entering existing water mains.

I. Retention Period

The chlorinated water shall be retained in the new water main for a period not to exceed 24 hours nor less than 16 hours in the event 50 parts per million is used. In cases where a shorter retention period is necessary, a stronger solution may be used and the retention period reduced accordingly. For these stronger solutions the approval of the Ottawa County Road Commission or the Township must be secured in writing as to the length of retention time in relationship to chlorine strength.

While the chlorine solution is in the line, the Contractor shall operate valves and hydrants in the chlorinated section to insure the complete disinfection thereof.

J. Flushing and Testing

The chlorinated water shall be flushed from the main at the end of the retention time so that the entire line is clear of any residual chlorine. A sample shall be taken from the line by the Township, the Ottawa County Road Commission, or their designated representative, (through a corporation stop) after the line is flushed, and delivered for bacteriological analysis. In the event that the water does not pass this bacteriological test, the chlorination procedure outlined above shall be repeated until the quality of water is substantially the same as that being delivered from the existing distribution system. The test procedure shall be repeated until two (2) consecutive safe results are obtained at each location as required by the Michigan Department Environmental Quality. The two samples shall be taken 24 hours apart. Flushing of the main shall not occur between the two samples.

4.16 DEAD ENDS/LOOPING

Generally the Township will not permit dead end water main and will require looping.

4.17 SHUT DOWNS OF EXISTING WATER MAIN FOR CONNECTION

- A. Shut downs of existing water mains can only be made when approved by and coordinated with the Township and the Ottawa County Road Commission.
- B. Notice to water customers affected by the shut down shall be given by the Ottawa County Road Commission unless otherwise directed.
- C. The duration of the shut down shall be minimized. All necessary labor, equipment and materials must be present before work proceeds.
- D. The Ottawa County Road Commission shall be present, perform the shut down and inspect the connection.

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SECTION 5

SPECIFICATIONS FOR SANITARY SEWER

5.01 DESCRIPTION OF WORK

The work shall consist of installing sanitary sewer pipe of the specified size or sizes in a trench and shall include the construction of manholes, lateral connections to the abutting property and other appurtenant work. Excavating, trenching and backfilling shall be as specified in Section 2.

5.02 MATERIALS

All materials furnished by the contractor shall conform to the specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition or latest issue. Certified test reports for strength from the manufacturer shall be submitted to the Township when the pipe is delivered to the site.

A. Sewer Pipe

All sewer pipe shall be of the materials and strengths shown on the Plans and as specified. Only one type of pipe material is to be placed from manhole to manhole.

i. Polyvinyl Chloride (PVC) Composite (Truss) Pipe

Polyvinyl Chloride (PVC) Composite (Truss) Pipe shall conform to the requirements of ASTM Designation D-2680 with elastomeric gasket seal as specified in current ASTM specification D-3212.

Couplings and fittings shall be as supplied or recommended by the pipe fitting manufacturer.

ii. Polyvinyl Chloride (PVC) Solid-Wall Pipe

Polyvinyl chloride (PVC) solid-wall pipe shall conform to the requirements of ASTM Designation D-3034, with a standard dimension ratio of 35 (SDR-35).

Extra strength pipe shall conform to the requirements of ASTM Designation D-2241, with a standard dimension ration of 26 (SDR-26) and shall be used for depths over sixteen (16) feet.

Joints for (PVC) solid wall pipe shall be elastomeric gasket seal as specified in current ASTM specification D-3212.

B. Sanitary Sewer Laterals

All sewer laterals shall be extra strength pipe, and unless otherwise specified, may be of any material specified in Paragraph 5.02. All fittings to be heavy wall solvent weld or glued fittings.

C. Wyes and Tees

Wyes and Tees may be cast fittings of the same material and joints as the main sewer and are to be heavy wall, or may be an approved fabricated special fitting which provides a suitable connection for the lateral to the main sewer.

Details of special fittings and/or adaptors for connection laterals of a material different than the main sewer shall be approved by the Township before they are manufactured.

Wye and Tees will be required as follows:

- 6" Wyes on main sewer of 8" through 15" diameter
- 6" Wyes or Tees on main sewer of 18" in diameter or larger.

D. Plugs and Stoppers

Plugs or stoppers for plugging the ends of laterals or risers which are not extended shall make a water tight seal and shall be solvent welded or glued.

E. Cement Mortar

Cement mortar shall be non-shrink grout mixed in accordance with manufacturer's recommendations.

The sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The retempering of mortar will not be permitted.

i. Cement

Air Entraining Portland Cement shall conform to the requirements for Type 1A of the current specifications for Air Entraining Portland Cement, ASTM Designation C-175.

ii. Masonry Sand

Masonry Sand shall conform to the requirements of "Natural Sand, 2 NS" of the current standard specifications of MDOT.

iii. Water

Water for mixing mortar shall be obtained from the public water supply unless otherwise approved by the Township.

F. Manhole Materials

A. Adjusting Rings

Adjusting rings are to be precast grade adjusting rings conforming to the requirements of ASTM Designation C-478, or where specified on the plans up to 3" of GNR Technologies "Infra Riser" rubber casting adjustment rings may be installed in accordance with manufacturer's recommendations.

B. Precast Units

Unless otherwise specified, all manholes shall be precast.

Precast reinforced concrete manhole risers and precast reinforced concrete manhole cone sections shall conform to the requirements for reinforced concrete manhole risers and tops, ASTM C-478.

Joints for precast sections shall be premium rubber O-ring seals. All exterior joints of manholes will be sealed with a flexible Butyl rubber based tape (12" wide) centered over the manhole joint. Joints must be clean before applying, and primer used according to manufactures recommendations. Exterior of the Manhole will be waterproofed with an asphalt or tar coating.

C. Castings

Castings shall meet the requirements specified in the current Michigan Department of Transportation Standard Specifications Section 908. Manhole covers and rings and similar combinations of castings shall be machined to provide an even bearing.

Unless otherwise specified, manhole castings shall be East Jordan No. 1040 with Type A solid cover, or approved equal. Where indicated on the plans, water-tight manhole covers shall be East Jordan No. 1040 WT (bolt down), with Type A solid cover, or approved equal. Grouting shall be as shown on the standard manhole details.

D. Steel Reinforcement

Steel Reinforcement shall conform to the requirements for steel reinforcement of the current MDOT Standard Specifications.

E. Flexible Manhole Connectors (Rubber Boots)

Flexible manhole connectors (also called rubber boots) shall be "Kor-N-Seal" by National Pollution Control Systems, Inc., "P.S.X." or "Press Wedge II" by Press Seal Gasket Corporation, "Lock Joint Flexible Manhole Sleeve" by Inter Place Corporation, "A-lok" by A-lok Products, Inc., or approved equal. Flexible manhole connectors shall conform to the requirements of ASTM Designation C-923, Resilient Connectors.

F. Manhole Steps

Unless otherwise specified, manhole steps shall be plastic coated steel steps conforming to the requirements of ASTM Designation C-478, or approved equal, spaced at 16" center to center.

G. Stainless Steel

Stainless steel components shall meet the specifications of A.S.T.M. type 304.

H. Manhole, Ring, and Casting Sealing System

Where a manhole, ring, and casting sealing system is specified on the plans, full GNR Technologies "Infra Riser" rubber ring casting adjustment, or CANUSA "Wrapid Seal" heat shrink casting and ring protection, or "Cretex" external casting and ring protection are to be installed in accordance with manufacturer specifications.

5.03 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws or other defects before they are incorporated into the work. Any materials found to be defective or damaged, shall be promptly removed from the job site.

5.04 LAYING PIPE

A. Alignment and Grade

The Contractor shall use the laser beam method of maintaining line and grade for sewer construction, unless otherwise approved by the Township. The Contractor shall submit evidence to the Township that a qualified operator will handle the laser beam equipment during the course of construction.

The Owners Engineer shall place line and grade stakes at each manhole, or more often, as determined by the Township. The Contractor shall check the line and grade at every point at which a stake has been placed.

B. Handling

Pipe shall be protected during unloading and handling against impacts, shocks and free fall. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

Pipe shall be carefully lowered into the trench in such a way as to avoid danger to the workers or damage to the pipe.

C. Direction of Laying

Excavation of trenches and laying of pipe shall begin at the outlet for the sewer and proceed upgrade with the individual pipe being laid with the spigot end downstream.

D. Placing

The pipe shall be placed on the prepared sub-grade and held firmly in place during subsequent pipe jointing and embedment operations. Successive pipes shall be carefully positioned so that when laid, they form a sewer with a uniform invert true to line and grade.

Sufficient pressure shall be applied by an approved method to each pipe as it is laid to insure that the spigot is completely home in the bell. Care shall be exercised to prevent joints from opening as successive lengths of pipe are place. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

E. Cleaning Sewer

In small sewers where cleaning after laying may be difficult, a swab or drag may be required in the pipe line to satisfactorily complete this work.

The Contractor shall place and maintain a plug in the downstream end of the newly constructed sewer to minimize dirt and debris from entering the existing system. The plug shall be maintained by the Contractor until the newly constructed sewer has been accepted by the Township.

Channel protection is required for any live manholes within which work will be performed. Channel protection is to consist of $\frac{3}{4}$ " plywood cut to match the inside diameter of the manhole. Two 2" x 4" boards are to be nailed across the plywood for support. Geotextile fabric is to be placed on top of the plywood to collect debris. The contractor is to remove the channel protection upon completion of work.

F. PIPE JOINTS

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets, and other materials required to make the joints shall be supplied or recommended by the pipe manufacturer and approved by the Township.

Pipe layers shall be fully qualified and experienced in the work being performed and shall check each joint after it is completed to see that no part of the joint material is left on the inside of the pipe and that the joint is properly made.

G. LOCATION OF WYES AND TEES

The approximate locations of wyes or tees are shown on the plans. These locations may be adjusted where necessary to best serve the various properties. Exact locations will be determined by the Township before the wyes or tees are installed.

The Contractor shall keep an accurate record of measurements from the nearest downstream manhole to each wye or tee which is installed. These measurements shall be recorded on the record plans to be furnished by the Contractor.

H. SANITARY SEWER LATERALS

i. General

Installation of sanitary sewer laterals shall meet all requirements specified for sanitary sewers. All laterals shall be inspected by the Township before the trench is backfilled. Laterals shall not be connected to manholes.

ii. Length

All sanitary sewer laterals shall be laid at right angles to the sanitary sewer mainline, and shall be extended as shown on the lateral and property line detail unless otherwise directed.

The Contractor shall measure and record the horizontal length of the lateral from the main line sewer to the end of the lateral and provide this information to the Township.

iii. Grade

It is intended that the ends of laterals at property lines will be deep enough to service the lowest floor of all existing buildings by gravity flow.

The minimum grade on the lateral shall be two (2%) percent (1/4 in/ft.). Where minimum depths as specified herein cannot be obtained, minimum grades may be reduced to one (1%) percent (1/8 in/ft.).

Where the elevation of the end of the lateral to serve an existing structure is not shown on the plans it shall be set at three (3) feet below basement grade for standard houses (eleven (11) feet below first floor) or four (4) feet below basement grade for houses with walkout basements (twelve (12) feet below first floor) where the set-back is fifty (50) feet or less.

In other cases the lateral may be set at two (2) feet below the basement elevation for standard houses (three (3) feet for walkouts) plus an additional depth of two (2%) percent multiplied by the set-back distance to the structure.

iv. Risers

Where the sanitary sewer is more than twelve (12) feet deep, a main line riser shall be constructed in accordance with the standard details or as shown on the plan. Backfill shall be carefully placed and compacted around the riser in an approved manner which will not damage the sewer or riser.

Property line risers shall be constructed on all laterals. Property line risers shall be constructed at the end of the lateral (at a point approximately five (5) feet from the right-of-way line unless otherwise specified). The property line riser shall consist of a six (6) inch sewer lateral pipe extended upward to a minimum of one (1) foot above the normal groundwater table, or to a depth of not less than four (4) feet below grade at the end, whichever is higher. (See detail)

v. Markers and Measurements

After installation of the service lateral, but prior to backfilling, the Contractor shall provide and install a 2" x 2" wood marker for each service. The wood markers shall be set vertically from the end of the lateral to twelve (12) inches above finish surface elevations. Also, a 1/2" diameter by 3' long metal stake shall be placed vertically and adjacent to the wood marker with six (6) inches of cover. The Contractor shall assist the Inspector in locating the end of each lateral, and in recording the location by measuring to the nearest downstream manhole. Also, the Contractor shall provide the

Inspector the depth of the lateral and property line riser relative to the street centerline elevation.

5.08 RULES FOR SEWER SERVICE ON PRIVATE PROPERTY

See the Township ordinance to administer, regulate, and provide for the connection to and use of the water and sewer system.

A. Connection and Use

Connection to the sewer system and use of the sewer system is governed by the Township ordinance to administer, regulate, and provide for the connection to and use of the water and sewer system.

B. Application for Connection

Application forms and permits for connection are available at the Township Office. These forms will provide for payment of an inspection fee, assessments, and charges at the time request is made for service.

C. Sewer Service Installation

i. Acceptable lateral materials are:

- a. Cast iron soil pipe and fittings, ASTM A74.
- b. PVC sewer pipe, ASTM D-2665, Schedule 40 with solvent welded joints.

ii. Size and grade:

Four (4) inch minimum size for single and two-family residential laid at a minimum grade of 1/8 inch per foot from the lateral (stub) at the property line to the building.

PLEASE NOTE: A grade of 1/4 inch per foot is recommended.

iii. Cleanouts:

- a. A four (4) inch cleanout shall be placed within five (5) feet of the building. (A four (4) inch cleanout located just within the basement wall shall be sufficient.)
- b. Four (4) inch cleanouts shall be placed at all bends totaling greater than 45 degrees and at every one hundred (100) feet.

iv. Adaptors for size changes and/or types of pipe shall be approved by the Township. (6" x 4" Fernco adaptor by Hamilton/Kent or equal)

- v. Inspection manholes may be required by the Township to monitor flows of industrial and/or commercial users before entering the public sewer system. (Manholes to be ASTM C-478 or equal)

5.09 MANHOLE CONSTRUCTION

Manholes shall be constructed in accordance with the standard details and as specified herein.

Unless specified otherwise, all manholes shall be precast.

Precast bases shall be installed on the subbase in such a way as to provide a uniform bearing under the manhole base.

Precast manholes with integral bottom and channel may be used, however, any changes to the structure due to minor field adjustments of alignment and grade required to meet construction conditions shall be made by the Contractor at no additional cost to the Owner.

Stubs shall be provided in manholes for future connections as shown on the plans or as directed by the Township. All such stubs shall be sealed with standard watertight, removable plugs.

All openings in manholes for the purpose of receiving pipes (including openings for future pipes) shall be fitted with a flexible type connector. Flexible connectors shall be factory installed. Openings for future connections shall be sealed by an approved prefabricated cap or plug. Bituminous waterproofing shall be applied to the outer surface of all manholes at the rate of one (1) gallon per 100 square feet.

Flow channels through Manholes are to be the same height and width as the pipe size.

5.10 CUT-INS

When cutting into an existing manhole, the opening shall be no larger than is necessary to admit the new sewer. The opening shall be made by a concrete drilling or coring machine, and shall have a mechanically compressed flexible joint connection installed. All broken or surplus material falling inside the structure shall be removed.

Flow channels and/or drop connections shall be constructed as specified or as directed to accommodate the sewer being cut-in. Pipe inverts higher than 6' from the primary flow channel will require a drop connection to within 6" from the primary flow channel.

5.11 ACCEPTANCE TESTS

A. Alignment and Grade

Each section of sewer may be checked by the Township for alignment and grade using lights and mirrors, television inspection, or other similar means. The Contractor shall assist the Township in the performance of these tests when necessary.

The Contractor shall be responsible to maintain plugs in existing manholes to prevent any water, debris, etc. from entering the existing sewer. These plugs shall remain in place until the new sewer system is accepted by the Township.

B. Leakage Tests

The completed sewer shall be free from leaks either by infiltration or exfiltration. Manholes and sewer lines will be visually inspected for leakage.

The Contractor shall provide all necessary labor, equipment and supervision to perform infiltration, exfiltration and air tests in accordance with the requirements of the Township. All sewer shall be subjected to an air test unless otherwise specified below.

Leakage testing of the sewer shall be performed after all water main, water services, and storm sewer proposed in the vicinity of the sanitary sewer has been installed. This requirement may be waived by the Township or Ottawa County Road Commission in cases where the natural ground water table is above the grade of the sanitary sewer and dewatering is in place.

All sewer which is submerged by ground water to an average depth of greater than seven (7) feet above the crown of the sewer at the time of the test shall be subjected to an infiltration test.

The air test shall be performed on each section of pipe between manholes after laterals are installed. The section of pipe being tested shall be sealed at each manhole using inflatable plugs or other approved devices. All plugs shall be adequately braced.

Pressure gauges are to have a range of 0-15 p.s.i.g. with increments of 0.10 p.s.i.g. and accuracy of +/- 0.04 p.s.i.g.

Where the expected water table level, as determined by the soil borings, is above the sewer elevation, the pressure testing limits for dry trench condition shall be as follows:

- i. Where the expected water table level is zero (0) feet to seven (7) feet above the pipe, the test pressure limits will be 3.5 to 2.5 psig.

- ii. Where the expected water table level is over seven (7) feet above the pipe, the test pressure limits will be 4.5 to 3.5 psig.

In a wet trench condition where the water table has risen above the pipe to a depth of less than seven (7) feet above the crown of the pipe prior to testing, the air testing limits shall be determined by adding to the original 3.5 psig. an additional 0.43 psig. for each foot the water table is above the crown of the pipe, or as determined in the dry trench condition, whichever is greater. Maximum test pressure shall be 6.0 psig.

The air pressure in the section under test shall be raised to an initial pressure of 0.5 psig. above the beginning test pressure and allowed to stabilize for a minimum of five (5) minutes. Air shall be added during this stabilization period as required to maintain the pressure at or above the beginning test pressure.

The rate of air loss shall be determined by measuring the time interval required for the internal pressure to decrease 1.0 psig. within the limits previously specified.

Minimum time interval for a satisfactory test shall be in accordance with the table following this section.

In the event the Township determines that the results of the air test are inconclusive because of visible infiltration, unsatisfactory or incomplete record, or improper application of testing methods or equipment, or other similar reasons, the Township may require either an exfiltration test or an infiltration test for the section or sections of sewer involved.

The allowable leakage as measured by either an infiltration test or an exfiltration test shall not exceed 50 gallons per day per inch of diameter per mile of sewer.

Sewers shall be tested for exfiltration by isolating a section or sections of the sewers between manholes by means of an approved temporary type of water-tight bulkhead. The isolated section of sewer shall then be filled with water to a level which is two and one-half (2-1/2) feet above the existing water-table but not less than two and one-half (2-1/2) feet above the crown of the sewer pipe at the high end of the isolated section under the test. The length of the section shall be such that, where possible, the water level at its lower end will not be more than five (5) feet above the crown of the pipe except as may be required by a high water table.

The length of time and the exfiltration test period shall be at the discretion of the Township. 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.

On any section of sewer that the Township shall deem impractical to test by means of the exfiltration test specified above, as may be the case

when local connections are involved, a suitable infiltration test will be required.

C. Pipe Deflection Tests (Flexible Pipe Only)

Flexible pipe is any pipe having a pipe stiffness of less than 200 psi. as defined under the requirements of ASTM Designation D-2412.

The completed installation of flexible pipe shall at no point have out-of-round deflections in the main sewer pipe greater than five (5%) percent of the pipe's actual original inside diameter (see chart for mandrel sizes below). Go/no go gauging tests, using an approved pointed mandrel with nine (9) points, shall be performed by the Contractor in the presence of the Township, or his authorized representative after the trench is backfilled, and before the surface restoration is begun. Pipe with deflections greater than five (5%) percent shall be relaid by the Contractor at no additional expense to the Owner. Vibratory rerounding of failed sections is prohibited. More than one person, mechanical means, or leverage will not be allowed to force the mandrel through test sections.

The pipe shall have been in place a minimum of 30 days prior to the mandrel test. When sanitary sewer is installed within a paved street, the street shall be paved prior to the mandrel testing when required by the Ottawa County Road Commission or the Township.

MANDREL TEST SIZES (SDR -26)

<u>Pipe Diameter</u>	<u>Mandrel Diameter</u>	<u>Test Measurement</u>
8"	7.12"	6.91"
10"	8.87"	8.60"
12"	10.54"	10.22"
15"	12.90"	12.51"
18"	15.76"	15.28"
21"	18.57"	18.01"
24"	20.87"	20.24"

The test measurement is the height of the mandrel as it rests with two fins on a flat surface.

MANDREL TEST SIZES (SDR -35)

<u>Pipe Diameter</u>	<u>Mandrel Diameter</u>	<u>Test Measurement</u>
8"	7.56"	7.33"
10"	9.45"	9.16"
12"	11.25"	10.91"
15"	13.80"	13.38"
18"	16.80"	16.29"

The test measurement is the height of the mandrel as it rests with two fins on a flat surface.