

**ENGINEERING STANDARDS ORDINANCE  
TOWNSHIP OF LAPEER, MICHIGAN  
ORDINANCE NO. 37.1**

Land Development Improvements, Engineering Design and Construction Standards Ordinance: An Ordinance regulating the development of land; the type and quality of improvements required for land development; and standards for engineering design, preparation of plans and specifications, and construction of site improvements in the Township of Lapeer, Lapeer County, Michigan.

THE TOWNSHIP OF LAPEER ORDAINS:

**ARTICLE 1  
GENERAL PROVISIONS**

***Sec. 100 SHORT TITLE.***

This Ordinance shall be known and cited as the "Engineering Standards Ordinance."

***Sec. 101 PURPOSE.***

The purpose of this Ordinance is to regulate and control all land development within the Township of Lapeer and to promote the safety, public health, and general welfare of residents of the Township; to provide minimum requirements for Site Improvements for land development; to establish standards for engineering design and detailed engineering plans and specifications for Site Improvements; to provide for construction standards for land development Site Improvements; to promote the orderly layout and use of land; to control building development within the Flood Plain areas; and to establish uniform standards for private water and/or wastewater systems consistent with any future public water and/or wastewater system.

***Sec. 102 LEGAL BASIS.***

This Ordinance is adopted pursuant to, and in accordance with, Act 246, Michigan Public Acts of 1945, as amended, and Act 288, Michigan Public Acts of 1967, as amended, and should be read in conjunction with the Township Subdivision Ordinance, Township Zoning Ordinance, Township Flood Damage Prevention Ordinance, Mobile Home Park Control Ordinance and Township Building Code Ordinance.

***Sec. 103 SCOPE.***

This Ordinance applies to all land development causing or requiring the reshaping, grading or regrading of such land. The proposed installation of any improvements, including, but not limited to, public utilities such as gas piping, electric or telephone wiring (underground or overhead), oil piping, television cable, Regional Water Supply Transmission Mains, Regional Sanitary Sewer Interceptors, and/or Drainage Facilities, is subject to the provisions herein contained.

Site Grading, including fill and excavation, and site drainage requirements apply to all land within the Township. This Ordinance shall not apply retroactively to the development of land (except that any redevelopment or new construction shall comply with the applicable provisions of this ordinance) including:

1. Subdivisions or developments completed prior to the effective date hereto.
2. A single parcel, or a single lot in a Subdivision recorded prior to the effective date of this Ordinance, intended for only one or two family dwelling unit.
3. Agricultural purposes.

This Ordinance does not repeal, abrogate, annul, or in any way impair or interfere with existing provisions of other laws, ordinances or regulations, except as hereinafter provided. Where this Ordinance imposes a greater restriction or more demanding requirement upon land than is imposed or required by other Ordinances of the Township, the provisions of this Ordinance shall control.

4. The grading and/or regrading of vacant land with a total disturbance area less than five (5) acres. If requested by the Township, a copy of all permits required by other agencies shall be provided.

***Sec. 104 ADMINISTRATION.***

This Ordinance shall be administered by an employee or agent, designated by the Lapeer Township Board.

***Sec. 105 SITE IMPROVEMENTS REQUIRED FOR DEVELOPMENT OF LAND***

**A. SITE GRADING & DRAINAGE WATER COLLECTION & DISPOSAL**

1. It shall be unlawful for any person to change the drainage pattern of any land by excavating, grading or filling without first obtaining a Permit for Construction from the Township. Each site shall be graded for the purpose of directing surface water run-off to appropriate drainage water collection and disposal systems as is necessary,

and same shall be done in a manner which will not cause drainage water from the site to flow onto adjacent land nor obstruct the flow of existing drainage from adjacent properties. Drainage water collection and disposal systems shall be provided to collect surface water run-off and/or building foundation drain groundwater seepage. The drainage water collection system shall consist of enclosed storm sewers and water courses throughout the project. An extension of the storm sewer system shall be provided to furnish an outlet for foundation drain service pipes for each building. The collected drainage water shall be conveyed to a point of disposal that shall be a public stormwater drain.

2. When, in the opinion of the Township Engineer and/or the Lapeer County Drain Commissioner (when the drain outlet is directly or indirectly connected to an existing county drain), there is inadequate drainage water outlet capacity, and an adequate drainage water outlet cannot be reasonably engineered and constructed, the developer shall install an adequate detention basin with controlled outlet facilities to limit the rate of flow of drainage water from his site. Final approval of any plans which include a detention basin shall be conditioned upon an Operation and Maintenance Special Assessment District Agreement with the Township. The following shall apply:
  - a. Detention basins on private developments, where ownership will remain consolidated over an extended period of time, such as industrial sites, shopping centers, apartment complexes, etc. shall remain in private ownership, subject to Township review as to size, design and proper operation. Maintenance and liability shall remain with the property owner.
  - b. Detention basins serving predominantly single family areas or platted Subdivision, may be dedicated to the Township for ownership and maintenance, subject to the criteria established in .0502, Article V and subject to case-by-case review and approval by the Planning Commission and the Township Board. Such development shall be required to file a standing storm water facility operation and maintenance special assessment district agreement prior to final plat approval.
  - c. Sites for detention basins shall be shown on the preliminary and final plats.

**B. STREET AND PARKING LOT PAVEMENT AND RIGHTS-OF-WAY.**

1. All residential land developments, whether single-family or multiple-family, shall be served by paved roadways, having a width and type of pavement as indicated in Appendix "C".

2. Commercial and industrial developments shall be served by paved roadways. Paving for commercial and industrial developments shall be of the type and width as indicated in Appendix "C".
3. Commercial and industrial developments shall be served by paved driveways and parking lots.
4. Where any land development abuts or includes a proposed collector street as indicated on the Master Thoroughfare Plan, or where it is deemed essential by the Planning Commission or the Township Board to provide for continuity to other parts of the public road system through subject land development, the developer of such land development shall be responsible for the installation of the collector street or other local streets, with dedication, of the right-of-way to the use of the public for same.
5. Where the Township Zoning Ordinance requires off-street parking, each 90° parking space (or stall) shall be sized per Township Zoning Ordinance requirements. Parking areas shall be paved with either a concrete pavement or a bituminous aggregate surface course. All paved areas shall have concrete curbs adjacent to sidewalks and landscaped areas. Moreover, parking lots shall be designed in accordance with standards contained in this Ordinance and/or as required in Section 1905 of the Lapeer Township Zoning Ordinance.

**C. POTABLE WATER SUPPLY AND DISTRIBUTION SYSTEM.**

1. All developments shall be serviced by a potable water supply and distribution system acceptable to the Township. A site plan or a preliminary subdivision plat submitted to the Township shall be accompanied by data describing the type of potable water supply and distribution system that is to be provided for the development. See Section 14.054 for easement and design requirements.

**D. WASTEWATER COLLECTION AND DISPOSAL SYSTEM.**

1. All developments shall be serviced by a wastewater collection and disposal system acceptable to the Township, Lapeer County Health Department, and/or the MDEQ. A site plan or a preliminary subdivision plat submitted to the Township shall be accompanied by data describing the type of wastewater collection and disposal system that is to be provided for the development.
2. For all developments, the developer shall provide sanitary sewers to service each proposed building site and shall connect same to a public or private wastewater disposal system acceptable to the Township Engineer and the Lapeer County Health Department. If no existing Township wastewater disposal system is available, a system shall be provided by the developer and township utility easements conveyed.

The non-public system shall be operated and maintained by the property owner or owners serviced in compliance with applicable state law. Individual existing single and duplex family residential sites without access to public sanitary sewer may extend the public sewer system and connect thereto, or may develop an on site treatment system. All wastewater disposal systems shall be designed in a manner acceptable to the Township Engineer and the Lapeer County Health Department.

**E. FIRE PROTECTION**

All new commercial development greater than 5,000 square feet in gross floor area and residential developments greater than eight (8) dwelling units shall be required to provide an on-site source of water for fire protection. The plans shall include construction specifications for a dry hydrant connection and method of filling underground tanks. Open water sources may be permitted upon review by the Township Engineer and/or Fire Department.

**F. SIDEWALKS & BIKEPATH.**

1. When required by the Zoning Ordinance or an adopted non-motorized transportation plan, sidewalks shall be constructed completely across the project where it abuts existing or proposed public streets.
2. In all projects a sidewalk shall be provided within the right-of-way on both sides of all existing or proposed streets located within the project. The requirement for sidewalks on both sides of a local street may be waived by the Planning Commission when an acceptable and more imaginative alternative for pedestrian circulation is proposed by the developer. The requirements of this section include corner closures, interior and major road sidewalks.
3. The outside edge of the 5 foot wide sidewalk will normally be located one foot inside of the road right-of-way. For mobile home parks and multiple-family projects with private street systems, the walk may be located adjacent to the street pavement and the width shall be determined so the walk will have a usable width of 4 feet.
4. When required by the Zoning Ordinance or an adopted non-motorized transportation plan, a ten (10') foot bike trail shall be built at the location and of a cross section approved by the Township Engineer.

**G. UNDERGROUND WIRING.**

The developer shall provide for all local distribution lines for telephone, electric, television, and/or other similar services distributed by wire or cable to be placed underground entirely throughout the area to be developed for residential use, except for main supply and perimeter feed distribution lines which service areas outside the development area, and except for

surface facilities related to underground service (such as above ground closure or terminals) and such wires, conduits, or cables shall be placed within private easements which shall be provided to such service companies by the developer. All such facilities shall be constructed in accordance with standards of construction approved by the Michigan Public Service Commission.

## **H. GUARANTEE FOR COMPLETION OF SITE IMPROVEMENTS.**

After site plan approval by the Planning Commission or final preliminary subdivision approval by the Township Board, but before issuance of permit for construction, the developer shall provide the Township with a guarantee for the satisfactory completion of the required site improvements for the development. Such guarantee shall be in the form of a cash bond, or letter of credit, acceptable to the Township for a period of one (1) year. The amount of the deposit shall be equal to the estimated construction cost of said improvements as determined by the Township Engineer. The Township Board shall release funds proportionally from the deposit as site improvements are completed and approved by the Engineer. Provided, however, that if the improvements required by Section 105.E are not completed, the builder of a home or homes on a lot or lots within the land development, prior to the issuance of occupancy permits, shall provide the Township with a cash bond guaranteeing satisfactory completion of the requirements of Section 105.E, as amended. Occupancy permits shall not be issued until such improvements are installed or sufficient cash bonds are provided. The Township shall notify the applicant 60 days prior to expiration of any cash bond or letter of credit. The Township shall cash or collect the cash bond or letter of credit 30 days prior to expiration unless the applicant is granted an extension.

## **I. RESIDENTIAL PLOT PLAN SUBMITTALS**

Plot plans are required by the Township as an integral part of the permitting procedure for residential structures. For new buildings or expanding of existing buildings by 50% or more of the existing floor area, Township approval of both building plans and a plot plan must be secured before a building permit can be issued.

These requirements must be met before a plot plan receives approval. The following is not intended to be an exhaustive list of requirements, but rather a set of guidelines.

### **1. TOPOGRAPHICAL SURVEY REQUIREMENTS**

For lots platted within five years of plot plan submittal, no topographical survey is required unless a nonconformity to the subdivisions approved grading plan or drainage plan has been demonstrated.

For all lots platted over five years prior to the submittal of the plot plan, and all acreage/non-platted parcels, full topographic survey is required. Surveys require location and description of all underground utilities; rims and inverts of all manholes, catch basins and stop boxes; north arrow; property corners, irons, monuments and fences; a 50-foot grid of existing elevations - to 50 feet offsite (including lot corners); elevations must be corrected to conform to U.S.G.S./Township datum with the benchmark used being depicted on the plans; existing structures with finished grade and finished floor elevations of all structures on adjacent lots; all vegetation and trees on adjacent lots and lot to be developed; and the public drainage course to which the proposed lot will drain. This list is not intended to be all inclusive.

2. LEGAL DESCRIPTION

A complete and accurate legal description of the lot(s) to be developed must be included with the plan. The plan drawing must include lot dimensions and bearings, easements, address, lot number, name and R.O.W. width of adjacent street(s) and setback dimensions.

3. GRADING AND DRAINAGE

A grading plan is required with all plot plan submittals and must include the following information: Proposed elevations at all lot corners, along side lot lines immediately adjacent to existing and/or proposed structures, in swales and ditches at regular intervals not to exceed 50 feet, at all proposed building corners and at corners and centerlines of septic fields. The plan must contain sufficient information to detail the drainage of the lot. All site drainage must be directed to a public drain, natural water, course lake, or wetland. If no public drain is immediately available or adjacent to the site, it will be the responsibility of the site developer to extend drainage to the site from an approved outlet. When insufficient depth exists to service a site, it may be necessary for the developer to deepen the existing drain to service the site.

Existing elevations at property lines shall be met by new construction. In no case shall on-site drainage be directed to an adjacent site or shall existing offsite drainage patterns be interrupted.

Open drains will generally be permitted on site or offsite when existing offsite drains are not enclosed and extension of drainage to the site is necessary. Slopes of swales on site shall be 0.50% or greater.

4. The owner shall engage a Registered Professional Engineer or Licensed Land Surveyor who shall prepare plans for the work. Minimum plan scale shall be one (1) inch equals twenty (20) feet for less than five (5) acre sites, and of one (1) inch equals forty (40) feet for five (5) acres or more. The plot plan shall be signed by the Professional.

5. The owner shall be required to obtain a final grading certificate from the Township confirming the site was constructed in conformance with the approved residential plan prior to obtaining a Certificate of Occupancy.

**Sec. 106      *PROCEDURE FOR PROCUREMENT OF A PERMIT FOR CONSTRUCTION OF SITE IMPROVEMENTS AND/OR PUBLIC UTILITIES.***

**A.      GENERAL**

Except for agricultural purposes, it shall be unlawful for any person to begin the development of land (including grade alterations and fills) or install Public/Private Utilities within the Township without first obtaining a Permit for Construction.

**B.      PROCEDURE**

Any person desiring to proceed with the development of land or install Public Utilities shall apply for a Permit for Construction from the Township in accordance with the following procedures:

1.      **FOR PROJECTS WHERE THE CONSTRUCTION CONTRACTOR IS ENGAGED BY THE TOWNSHIP (OR BY THE COUNTY AGENT UNDER CONTRACT WITH THE TOWNSHIP).**
  - a.      Where the construction contractor is engaged by the Township, or by the County Agency under contract with the Township, the Contractor will not be required to acquire (nor have in his possession) a Permit for Construction. However, the Contractor shall restore all land and/or other physical features affected by the work to a condition equal to or better than that existing at the time construction was begun. Filling or grading of private lands in conjunction with such projects shall not occur without securing a permit to construct for the individual property.
  
2.      **FOR PROJECTS WHERE THE CONSTRUCTION CONTRACTOR IS ENGAGED BY A PUBLIC UTILITY COMPANY OTHER THAN THE TOWNSHIP.**
  - a.      The Public Utility Company shall prepare and present to the Township plans and specifications for the proposed utility, whether it be an underground utility or an overhead utility (including a single pole relocation), in accordance with the "Standard Utility Locations" indicated in Appendix "B". Furthermore, the Utility Company shall ascertain where the location (horizontally or vertically) may be in possible conflict with utilities proposed by the Township.
  
  - b.      Upon completion of the plans and specifications for the public utility, the Utility Company shall make an application for a plan review on a form furnished by the Township. As part of this application, the Utility Company shall submit the following:
    1.      Three sets of completed plans and specifications as proposed to be used for the construction of the utility;

2. A cash payment, computed according to the schedule indicated in Appendix "A", Section I, as the plan review - administration fee.
  3. Such other information and data as the Township Engineer deems necessary to enable the approval of the plans and specifications.
- c. Upon approval of the plans and specifications by the Township Engineer, but prior to commencement of construction, the Utility Company's Contractor shall apply for a Permit for Construction of a Public Utility of a form furnished by the Township. As part of this application, the Utility Company's Contractor shall submit the following:
1. Three sets of approved plans and specifications.
  2. A cash payment (in an amount as set forth in Appendix "A", Section III) to be held as a bond by the Township to guarantee that all land and/or other physical features affected by the work are restored to a condition equal to or better than that existing at the time construction was begun.
  3. Such other information and data as the Township Engineer deems necessary to enable the approval of the Construction Permit.
- d. After issuance of the Construction Permit, the Contractor may proceed with construction. The Contractor shall restore all land and/or other physical features affected by the work to a condition at least as good as that existing at the time construction was begun.
- e. Upon completion of the construction, the Utility Company's Contractor shall submit a request (along with any supporting data deemed necessary by the Township) for written approval and acceptance by the Township of the restoration work. Upon approval of the restoration work by the Township, the cash bond will be returned to the Contractor. However, if the Utility Company's Contractor does not act in a timely manner to perform the restoration work, the Township reserves the right to use whatever portion of the money as is reasonable and necessary to accomplish the restoration work and return the balance of the money to the Contractor upon completion of the restoration work.
- f. Upon completion of the work, record plans shall be submitted on a format approved by the Township Engineer.

3. FOR ALL OTHER DEVELOPMENT PROJECTS.

- a. The developer shall engage a Registered Professional Engineer, hereinafter called the developer's Engineer, who shall prepare plans and specifications for the proposed Site Improvements in accordance with current engineering design and plan preparation standards contained herein or otherwise adopted by the Township or set forth by the Township Engineer.
- b. Upon completion of the plans and specifications for the Site Improvements, the developer shall make an application for a Plan Review of a form furnished by the Township. As part of this Application, the developer shall submit the following:
  1. Three copies of completed plans and specifications as proposed to be used for the construction of the Site Improvements.
  2. A "Tabulation of Quantities" in sufficient detail to enable the Township Engineer to make a reasonable estimate of construction cost of all proposed work. The developer's Engineer shall prepare an estimate of construction cost of the proposed work which may be used in lieu of the Township Engineer's estimate. The estimate is to be based on the cost for the Township to publicly bid and construct the project.
  3. A cash payment, computed according to the schedule indicated in Appendix "A", to cover cost of the Plan Review Administration Fee.
  4. Such other information and data as the Township Engineer deems necessary to enable the approval of the plans and specifications.
- c. Upon approval of the plans by the Township Engineer, the Township Engineer will coordinate the securing of necessary approvals for the construction of any Township utilities from other reviewing agencies. The Applicant shall furnish such plans and other documents as are necessary to accomplish such approvals. However, after approval of the plans by the Township, the developer's Engineer shall obtain approval from the Lapeer County Road Commission, the Lapeer County Drain Commissioner (Drains), Lapeer County Soil Erosion Department, the Michigan Department of Transportation, or any other agency (where applicable) where the approval is not obtained by the Township Engineer. Also, the developer's Engineer shall forward plans to any public utility and/or other agency whose facilities

or rights-of-way may be affected by the proposed construction. In granting approval of the plans it shall be understood that the approval of such plans by the addition of the current construction detail sheets, standards, and/or construction specifications as applicable.

- d. Upon securing of approvals and construction permits from all other appropriate agencies, the developer shall make an Application for a Permit for Construction of Site Improvements on a form furnished by the Township. As part of this Application, the developer shall submit the following:
  1. Three sets of approved plans and specifications, including the executed Construction Contract Documents that shall contain as a minimum:
    - (a) Certificates of Insurance, showing current coverage for Commercial General Liability, Automobile Liability and Workers Compensation. Commercial General Liability must include coverage for underground and explosion hazards. Automobile Liability must include coverage for Non-Owned and Hired Autos. Lapeer Township must be named as an additional insured on the Commercial General Liability and the Automobile Liability. Certificates must include a 30 Day Notice of Cancellation provision. Adequate limits shall be determined by the Administrator. If any of the above coverage expires prior to project completion, it is the responsibility of the developer to provide the Township with new certificates at least 21 days prior to expiration.
    - (b) The Contractor's proposal form indicating his unit prices and total construction cost price for which he is to perform the contract.
    - (c) A guarantee for completion bond in accordance with 105H.
  2. A cash deposit, computed according to the deposit schedule indicated in Appendix "A" , from which the final cost of construction inspection, administration, and/or construction water and/or sewer usage and any related miscellaneous Township expenses shall be deducted.

3. Such other information and data as the Township Engineer deems necessary to enable the approval of the Construction Permit.
- e. Upon approval of the Construction Permit by the Township Engineer, the developer's construction Contractor shall perform the construction under detailed inspection by the Township Engineer.
- f. Upon completion of construction and prior to using any of the facilities covered under the construction permit, the developer shall apply for a written final approval and acceptance of the Improvements. As part of this Application, the developer shall submit the following:
  1. Sworn Statements and Waivers of Lien, indicating that all public improvements have been paid for in full.
  2. Two sets of record drawings (one mylar and one print) from the developer's Engineer indicating "as-built" measurements and/or "as-built" elevations for the improvements including "as-built" elevations of drainage swales, inverts of utilities, rim elevations, lead locations, field changes, etc. If the record plans are computer generated the Township Engineer may require submittal of CAD files in a format compatible with Township systems.
  3. An appropriate Transfer of Title for all parts of the improvements which will be Public Sewer and/or Public Water Main, together with copies of recorded easements for public utilities as signed by all persons having an interest in the land. A title search statement indicating the names of all persons of interest (certified by a recognized Title Insurance Company) shall accompany the copies of recorded easements.
  4. A Maintenance and Guarantee Bond, in the form of a cash bond or letter of credit, to the Township in an amount equal to 100% of the construction contract cost of all storm water management items, as determined by the Township Engineer, to guarantee for a period of one year from the date of final written acceptance of such improvements, the correction of any defects or deficiencies in the improvements covered under the construction permit.

**Sec. 107      STANDARDS FOR PREPARATION OF ENGINEERING PLANS AND SPECIFICATIONS**

**A.      GENERAL**

1.      All plans except plot plans submitted shall be on 24" x 36" (Minimum) white prints having blue or black lines and shall be neatly and accurately prepared. Judgement should be exercised in the design, layout and presentation of proposed improvements.
2.      Engineering plans shall have a scale, not to exceed one inch (1") equals forty feet (40') horizontal. Profile views shall have a scale of one inch equals four feet vertical and a horizontal scale compatible with the plan view.
3.      Any land development project requiring more than one sheet of plans must be submitted with a "general plan" having a scale of one inch (1") equals one hundred feet (100') (or larger scale) showing the overall project layout (including building locations) and indicating the location of all site improvements proposed.
4.      Street names, lot or property lines, and property identification and address numbers shall be shown on all plans.
5.      Sewers in easements shall be located at least three feet away from parcel or lot boundary lines. A variation to this requirement can be granted by the Administrator upon presentation of data indicating another location is best suited.
6.      Superimposed on a general plan of the site shall be a topographic survey and contour lines of the project area, including the area at least 100 feet outside of the project area. Additional topography may be required depending on existing drainage characteristics, or as required by Township Engineer. Where the contour of the land is such that contour lines do not provide enough information to evaluate a proposed grading scheme, spot elevations taken on a 50 ft. grid shall be shown instead. Contour lines shall be shown at intervals as follows:
  - a.      Where the general slope of the land is less than five percent (5%), the interval shall be one foot.
  - b.      Where the general slope of the land is five percent (5%) or greater, the interval may be two feet.

7. Any underground or overhead public utilities shall be located in the road (public or private) right-of-way or easement according to the schedule entitled "Standard Utility Locations" shown in Appendix "B".
8. All sewers and those water mains having a diameter of 6" or greater shall be indicated in profiles. There shall be a separate plan and profile view for each utility. However, it shall be the responsibility of the design engineer to ascertain that the depth of the storm sewer (or storm drain) does not interfere with the building service sewers crossing the storm sewer. Profiles shall indicate the size of pipe, class of pipe, slope of the utility, and control elevations of the utility. The existing and proposed grade lines shall be shown along the profile view of each utility. The profile shall show all points where utilities cross one another with elevations for each utility calculated and shown. The designer shall maintain a one (1) foot vertical clearance between underground utilities. Water mains shall have 18" vertical clearance from other underground utilities. Utility bedding details shall be provided.
9. Elevations shall be based on United States Geological Survey (USGS) datum. The Township Bench Marks shall be used where available and at least three bench marks shall be indicated on the plans for each forty acres or less of the project site area. A minimum of two bench marks shall be provided on each utility profile sheet.
10. Finish grade elevations planned for each structure shall be indicated on the plan view and the profile view.
11. A copy of the site boundary survey with computed control lines indicated, or a copy of the computed plan, if applicable, shall be submitted with the engineering plans.
12. Plans shall have all lettering a minimum height of one-tenth of an inch and be of such quality as to provide for a clear and legible micro-film record.
13. All plans and specifications submitted shall bear the seal and original signature of the Registered Professional Engineer responsible for their preparation.
14. The plans covering all of the required Site Improvements for a specifically designated area of the developer's land shall be submitted as one package before any plan review shall commence.
15. The plan shall contain a location map and any other pertinent data determined necessary by the Township Engineer to properly review the plan.

16. Soil borings must be obtained for any utility requiring excavations in excess of eight (8) feet. Boring locations shall be shown on the plans. The distance between borings and the depth of borings shall be subject to approval by the Township Engineer.
17. Following construction operations one mylar copy of as-built plans of water, sanitary sewer, storm sewer, roadway and grading improvements shall be submitted and certified by the Owner's Registered Professional Engineer that all work is in conformance with the approved plan. Additional As-Built information shall be provided as required by the Township digital submission requirements. See Appendix F for requirements.

**B. DETAIL SHEETS**

All sets of plans which include plans for storm sewers, water mains, sanitary sewer or paving shall include the current Township Detail Sheets applicable which shall be considered an inseparable part of the plans when said plans are approved.

***Sec. 108 SURVEY AND CONTROL MONUMENTS***

**A. INTENT AND PURPOSE**

1. The Township Board has determined that the North American Datum 1983 and the Michigan State Plane Coordinate System, shall be utilized in the performance of surveys to prepare plats and plans to improve consistency and increase accuracy, and thus to avoid disputes and other problems which arise from errors and misinterpretations resulting from the performance of surveys using many different datums and coordinate systems.
2. The Township, Lapeer County Remonumentation Program and National Geodetic Survey have established state plan coordinates on control monuments throughout the Township to be used as reference markers to be used during the performance of the survey for the new development.
3. It is the intent of this Ordinance to require utilization of the North America Datum 1983 with coordinate values based on the Michigan State Plan System, (MCS-83). It is also the intent of this ordinance to require coordinate units to be in meters and/or International Feet.

**B. REQUIREMENTS**

All condominium plans, wetland surveys, utility plans, subdivision plats, commercial plats and any other surveys to develop properties, except plot plans, that are prepared for submission to the Township shall conform to the following requirements;

1. The new adjusted coordinates of all points on plats and plans shall utilize the fixed positions of at least two (2) control monuments and the names of those control monuments shall be shown as references on the drawings.
2. Both hard copy and digital files of adjusted coordinates, along with the standard deviations (2 sigma, 95% confidence interval) of the new adjusted coordinates, combined scale factor and convergence shall be submitted to the Township. If orthometric elevations of the points are submitted to the Township, the method used to obtain the orthometric elevations shall be explained in the submitted documents along with their standard deviations (2 sigma, 95% confidence interval).
3. All new adjusted coordinates shall meet the positional accuracy requirements as specified in the State Survey and Remonumentation Commission's addendum to 1996 Grant Agreement entitled "Reporting State Plane Coordinate Data" (Remonumentation Commission approved November 8, 1995).

**C. PRESERVATION OF MONUMENTS**

1. Primary control monuments installed by the Township have been clearly marked, and shall not be disturbed, moved, removed, or otherwise modified under any circumstances.
2. In the event any person shall disrupt the precise position or location of any monument:
  - a. Such person shall immediately cause written notice to be provided to the Township.
  - b. The monument shall be properly reestablished pursuant to the directions, and under the supervision of the Township Engineer.
  - c. All costs and expenses of such monument re-establishment shall be borne by the person responsible for the disruption.

**ARTICLE 2  
DEFINITIONS**

***Sec. 200 RULES OF CONSTRUCTION.***

For the purpose of this Ordinance the following rules of construction apply:

- A. Words used in the present tense include the future tense; and in the singular, include the plural, unless the context clearly indicates the contrary.
- B. The term "shall" is mandatory; the term "may" is permissive.
- C. The word or term not interpreted or defined by this Article shall be used with a meaning of common or standard utilization.

**Sec. 201 TERMS DEFINED.**

Unless the context specifically indicates otherwise, the meaning of terms used in this Ordinance shall be as follows:

**"Adjusted Coordinates"** shall mean the coordinate values for the control monuments accepted by the Lapeer County Remonumentation Program established under Michigan Act 345 of the Public Acts of 1990, or those adjusted coordinate values published for control monuments accepted by the National Geodetic Survey.

**"Alley"** shall mean any dedicated public way affording a secondary means of access to abutting property, and not intended for general traffic circulation and not more than twenty (20) feet wide.

**"American Water Works Association"** or **"AWWA"** shall mean that national standards setting organization.

**"Board"** shall mean the Township Board of Trustees, Township of Lapeer, State of Michigan.

**"Building Service Sewer (Drainage water)"** shall mean any drainage water pipe extension from a building foundation drain outlet located five feet outside of a building or dwelling unit to a public stormwater drain.

**"Building Service Sewer (Wastewater)"** shall mean the sewer extension from a building drain outlet point located five feet outside of a building or a dwelling unit to a point of connection with a public sanitary sewer.

**"Building Service Water Supply Pipe"** shall mean any water supply mains, pipes, services, and/or appurtenances, except meters, that extend from a point of connection with the building water piping - located five feet outside of a building or a dwelling unit - to a point of connection with the public water supply system.

**"Control Monuments"** shall mean the permanent monuments installed throughout the Township to provide the professional surveyor and the land developer readily accessible control points with adjusted coordinates based on MCS-83 datum.

**"Customer Wastewater Disposal Outlet"** shall mean the point of connection to the public sewer.

**"Customer Water Supply Outlet"** shall mean either the outlet on the customer side of a "stop valve" near the public easement or public right-of-way line (in the case of a supply for a single building) or on the customer side of a master water meter where the Township has allowed the use of a master water meter to serve special types of customers.

**"Development"** or **"Developer's Project"** or **"Project"** shall mean a specifically designated site being developed (or proposed for development) by a Developer.

**"Ditch"** or **"Drainage Swale"** shall mean an open channel used to transport water, groundwater, surface water run-off, or drainage water from any source.

**"Drainage Facilities"** or **"Drainage Water Facilities"** shall mean any storm sewers, lakes, ponds, streams, rivers or storm drains, including facilities designated as County Drains, that receive water from lands owned by more than one Owner.

**"Dwelling Unit or Residential Structure"** A dwelling unit is any house or building or portion thereof having cooking facilities, which is occupied wholly as the home, residence or sleeping place of one (1) family, either permanently or transiently, and placed on a permanent foundation, but in no case shall a travel trailer, automobile chassis, tent or portable building be considered a dwelling. In case of mixed occupancy, where a building is occupied in part as a dwelling unit, the part so occupied shall be deemed a dwelling unit for the purpose of this Ordinance and shall comply with the provisions thereof relative to dwellings.

**"Easement"** shall mean an acquired legal right of a person, governmental agency or public utility for the specific use of land owned by others.

**"Foundation Drain Service Pipe"** shall mean a conveyance pipe that receives only foundation drain groundwater seepage, exclusive of directly and intentionally introduced surface water run-off.

**"International Foot"** or **"IF"** shall be defined as 0.3048 meters, to convert distance in meters to distance in international feet:

IF = 1/0.3048 x distance in meters.

**"Land Developer" or "Developer"** shall mean a person, firm, association, partnership, corporation, or any other legal entity, who intends to develop land by making various improvements to the land as described under "Site Improvements".

**"Land Development" or "The Development of Land"** shall mean the reshaping of the land environment to provide for the elements or amenities associated with community living. Items considered as these elements or amenities include any of the items listed under the definition for "Site Improvements."

**"Lapeer County Drain Commissioner" or "LCDC"** shall mean that person or agency responsible for drainage improvements under the jurisdiction of the State Drain Act, PA 40 of 1956, as amended.

**"Lapeer County Planning Commission" or "LCPC"** shall mean that agency responsible for county level planning and for Soil Erosion and Sedimentation Control Permits.

**"Lapeer County Road Commission" or "LCRC"** shall mean that agency responsible for the construction, operation and maintenance of county highways, road and streets.

**"Lot"** shall mean a parcel of land occupied, or intended to be occupied, by a main building or a group of such buildings and accessory buildings, or utilized for the principal use and uses accessory thereto, together with such yards and open spaces as are required under the provisions of the Zoning Ordinance. A lot may or may not be specifically designated as such on public records. Each such parcel shall also have its front line abutting a public street, private road, or a recorded easement.

**"Mains" or "Water Mains"** as applied to the water supply facilities and connections thereto, shall mean any water supply conveyance pipe larger than 2 inches in diameter.

**"Michigan Department of Environmental Quality" or "MDEQ"** shall mean the State Agency which regulates water supply facilities in the State and certain wastewater disposal facilities in the State.

**"Michigan Department of Transportation" or "MDOT"** shall mean the state agency which operates state roadways and federal expressways.

**"Michigan Water Resources Commission" or "Water Resources Commission" or "WRC"** shall mean the State Agency which regulates the discharge of wastewater and drainage water to the natural outlets of the waters of the State and provides various rules and regulations to control same.

"**MCS-83**" means the Michigan State Plane Coordinate System based on the North American Datum 1983 Geodetic Reference System established by Michigan Act 9 of the Public Act of 1964, as amended, commonly known as the State Plane Coordinate Act.

"**Mobile Home Park and/or Manufactured Home Park (Trailer Court)**" shall mean any plot of land upon which two or more mobile homes are located or any parcel of land licensed pursuant to the provisions of Act 419 of Public Acts of 1976.

"**NAD-83**" shall mean the North American Datum of 1983.

"**National Pollution Discharge Elimination System**" or "**NPDES**" shall mean that system required by the State of Michigan to regulate treatment and discharge of storm water and/or wastewater to the waters of the state.

"**Natural Outlet**" shall mean any drainage water outlet, including storm drains and sewers into a watercourse, pond, ditch, lake or other body of surface or groundwater.

"**New Adjusted Coordinates**" shall mean the adjusted coordinate values for all points contained in a new land development plat, plan or survey.

"**Open Drain**" shall mean a large open channel used to transport water, groundwater, surface water run-off or drainage water from any source.

"**Parking Lot**" shall mean a designated area used primarily for the off-street parking of motor vehicles.

"**Parking Lot Bay**" shall mean a portion of the width of a parking lot which includes a set of parking stalls on either side of a driveway provided for access to such parking stalls.

"**Person**" shall mean any individual, firm, company, association, society, corporation, governmental agency (including school district), or other legal entity.

"**Plat**" shall mean a map or chart of a subdivision of land as defined in Act No. 288 of Michigan Public Acts of 1967 as amended.

"**Plot Plan**" shall mean a scaled topographic drawing of existing and proposed modifications to land utilized for or zoned for single and duplex residential dwelling.

"**Preliminary Subdivision Plan**" shall mean a preliminary plat showing the salient features of a proposed subdivision of land submitted to an approving authority for purposes of preliminary consideration, as defined in Act No. 288 of Michigan Public Acts of 1967 as amended.

**"Private Wastewater Disposal System"** shall mean a septic tank with subsurface soil absorption facilities; wastewater treatment facilities; or similar methods of wastewater disposal that may be approvable by the Lapeer County Health Department and/or the State of Michigan Department of Environmental Quality.

**"Private Water Supply System"** shall mean any system by which potable groundwater is withdrawn and supplied that may be approvable by the Lapeer County Health Department and/or the Michigan Department of Environmental Quality.

**"Public Sanitary Sewer"** shall mean a sanitary sewer owned and operated by a governmental agency intended to be located in public easements or public rights-of-way that collects (or is intended to collect) wastewater from more than one user or premises and that is required to receive the approval and issuance of a construction permit from the Municipal Wastewater Control Section of the DEQ.

**"Public Sewer"** or **"Public Drain"** shall mean a common sewer or drain that serves more than one user or premises and is controlled by the Township or another governmental agency.

**"Public Utility Company"** or **"Utility Company"** shall mean a legally constituted firm, corporation, or agency - other than the Township or a County agency acting under a contract with the Township - that operates under a franchise or agreement approved by the Township for the purpose of installing and operating public utilities, including, but not limited to, gas piping, electric or telephone wiring (underground or overhead), oil piping, television cable, water supply, transmission mains, sanitary sewer interceptors, and/or drainage facilities. The Detroit Metro Water Department is a "Public Utility Company" under this definition.

**"Public Water Main"** shall mean a main, existing or proposed, in public easements or public rights-of-way that is intended to serve more than one user or premises and that is required to receive the approval and issuance of a construction permit from the Municipal Water Supply Section of the Michigan Department of Environmental Quality. The service pipe, extending from a public water main to a "Customer Water Supply Outlet," shall also be considered "Public."

**"Right-of-Way"** or **"R.O.W."** shall mean land dedicated, reserved, used, or to be used, for a street, alley, walkway, or other public purposes. This may be "Deeded" property or easement.

**"Sanitary Sewer"** or **"Wastewater Sewer"** shall mean a sewer, together with appurtenances, that carries liquid and water carried wastes from residences, commercial buildings, industrial plants, and institutions together with minor quantities or ground, storm and surface waters that are not admitted intentionally.

**"Services"** as applied to the water supply facilities and connections thereto, shall mean any water supply conveyance pipe, outside of a building.

**"Sewage Force Main" or "Force Main"** shall mean a wastewater conveyance pipe which carries wastewater under pressure.

**"Sewer"** shall mean a pipe or conduit that carries wastewater or drainage water.

**"Sight Distance"** shall mean the unobstructed (straight line) length of view as defined by the Lapeer County Road Commission.

**"Site Improvements" or "Improvements"** shall mean such operations, acts of construction, or changes affecting land that increases the value, utility, or habitability of the site and including, but not limited to, site grading; drainage water sewers, culverts, or drains; sanitary sewers; wastewater disposal facilities; water supply piping; water supply facilities; gas piping; oil piping; television cable; electric power supply wiring; telephone wiring; roadway surfacing or paving; parking lot paving; driveways; bridges; lakes, ponds, or lagoons; sidewalks; landscape walls and fences; and/or other appropriate appurtenant items.

**"Site Plan"** shall mean the plan required under the Township Zoning Ordinance for "Site Plan Review" for all projects other than a land subdivision plat.

**"Stop Valve" or "Curb Stop"** shall mean the valve placed on a building service water supply pipe, that is located at a "Customer Water Supply Outlet."

**"Stormwater Drain" or "Storm Drain" or "Storm Sewer"** shall mean a watercourse or a sewer intended for the conveyance of water, groundwater, surface water run-off, drainage water, or other water from any source exclusive of intentionally admitted wastewater.

**"Stormwater Inlet Structure"** shall mean a structure designed and constructed to intentionally admit surface water run-off, drainage water, or other water from any source exclusive of intentionally admitted wastewater.

**"Street"** shall mean any street, avenue, place, way, drive, lane, boulevard, highway, road, or other right-of-way that provides for vehicular or pedestrian access to abutting properties by the general public; and includes the land between the street right-of-way lines, whether improved or unimproved. An alley is not a street.

1. **"Street, public"** - shall mean a right-of-way that provides for vehicular and pedestrian access to abutting properties that is deeded or dedicated to the Lapeer County Road Commission, Michigan Department of Transportation, or other governmental agency authorized to own road R.O.W. and/or operate vehicular transportation facilities.
2. **"Street, private"** - shall mean a right-of-way or easement that provides for vehicular and pedestrian access to abutting properties for the general public, but is not deeded or dedicated

to the Lapeer County Road Commission, Michigan Department of Transportation or other related governmental agency for ownership, operation, or maintenance. The landowners of the property served by the private road are responsible for its maintenance.

3. **"Street, major"** - shall mean an arterial street which is intended to serve as a large volume trafficway for both the immediate municipal area and the region beyond, and is designated as a major thoroughfare, parkway, freeway, expressway, or equivalent term on the Major Thoroughfare Plan to identify those streets comprising the basic structure of the Major Thoroughfare Plan.
4. **"Street, local"** - shall mean any street, private or public, which is intended primarily for access to, or through, abutting properties. Local streets shall have, or shall be considered to occupy, a 66 foot wide right-of-way.
5. **"Street, collector"** - shall mean a street intended to carry traffic from local streets to major roads as designated on the Township Master Thoroughfare Plan. Collector streets shall have an 86 foot wide right-of-way.

**"Surface Water Run-off" or "Stormwater"** shall mean that part of rainfall or melting snowfall that reaches the stormwater drain as run-off from natural land surfaces, building roofs or pavements.

**"Tabulation of Quantities"** shall mean a list of construction items as usually used in the underground and pavement construction industry (e.g. as used by the Michigan Department of Transportation) and compatible with the Township construction specification items together with the quantity of each item planned to be constructed.

**"Thoroughfare Plan"** shall mean that portion of the Township's Master Plan that sets forth the location, alignment and dimensions of existing and proposed street rights-of-way adopted by the Township.

**"Township"** shall mean the Township of Lapeer, County of Lapeer, State of Michigan.

**"Township Engineer"** shall mean the staff registered Professional Engineer or the Consulting Engineer representing the Township in this position.

**"Trunk Storm Sewer"** shall mean a public storm sewer having a diameter of 24 inches or larger.

**"Utility Company's Contractor"** shall mean a construction contractor engaged by the utility company to install public utilities for the utility company; or, in the case where the utility company has a construction division that installs its own utilities, shall mean the utility company.

**"Underdrain Pipe"** shall mean a geotextile wrapped perforated pipe installed underground for the specific purpose of lowering a high groundwater condition or draining a granular subbase by receiving groundwater seepage and conveying it to a stormwater drain. Farm Drain Tile is not Underdrain Pipe.

**"Unpolluted Water"** or **"Drainage Water"** is water of a quality equal to, or better than, the effluent criteria currently in effect (as specified by the DEQ), or water that would not cause violation of receiving water quality standards and would not be benefitted by discharge to the Township sanitary sewers and wastewater disposal system.

**"User"** shall mean the owner or occupant of any premises connected with, and/or using, any of the facilities operated by the Department.

**"Wastewater"** or **"Sewage"** shall mean the spent water of a community, including liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and stormwater that may be present.

**"Wastewater Treatment Works"** or **"Sewage Treatment Plant"** shall mean facilities for treating wastewater, industrial wastes, and sludge.

**"Watercourse"** shall mean a natural or artificial open channel for the passage of water either continuously or intermittently.

**"Year of National Geodetic Survey Adjustment"** shall mean the specific adjustment year to which the published coordinates belong.

**ARTICLE 3**  
**SITE GRADING AND DRAINAGE WATER COLLECTION AND DISPOSAL**

***Sec. 301***      ***COLLECTION AND DISPOSAL PLAN***

A Site Grading and Drainage Water Collection and Disposal Plan is required for all Developments, except, if the building site is a site in a Subdivision or other project for which a general site grading plan has been submitted and approved, no separate grading plan or permit will be required. A rear yard (in the case of land subdivisions) or a general site enclosed storm drainage system shall be designed for all land development projects. If there are any upstream watershed drainage areas which need to be drained through the site under design consideration, sufficient capacity shall be provided to take fully developed upstream drainage into the system.

1. Each Subdivision shall have an overall grading plan showing grades for rear yards, sidewalks, and rear yard catch basins. Storm sewers, building finish floor grades, brick ledge (ground) grades and direction of surface drainage flow shall be shown.
2. Rear yard storm sewers shall be required in all subdivisions. Catch basins (2' minimum diameter) shall be placed at every other property corner so that every lot directly abuts a catch basin in at least one corner. All catch basin outlet sewers shall extend in sidelot easements to the public storm sewer in the road right-of-way.
3. Any required rear yard drain easements shall be a minimum of 20 feet wide. All side yard drain easements shall be a minimum of 20 feet wide. The Township Engineer shall require additional easement width when sewer size or depth, soils or other conditions warrant a wider easement. Easements are required for all public storm drains and private drains serving more than one parcel.
4. If no adjacent water course exists to effectively handle a concentrated water flow, adequate provisions must be employed to limit the water flow to the undeveloped sheet flow rate before the stormwater runoff enters upon adjacent properties.

***Sec. 302***      ***SITE GRADING***

1. Site grading for all building sites shall be reviewed to determine that proposed and/or actual site grading is proper and that drainage from land lying upstream is not obstructed and that downstream properties will not be diversely effected by run-off from the property under design consideration.

2. Before a Certificate of Occupancy for any building is issued, the Administrator shall approve the final site grading and drainage for each building; the Administrator shall require that a survey, drawing, and certificate, done by a Registered Professional Engineer or Registered Land Surveyor, be furnished by the developer indicating that the work has been done in conformity to the approved site grading and drainage plan.
3. It shall be unlawful for any person to interfere with, modify or obstruct the flow of drainage water across any property in any manner different from the approved plan. The exception to this requirement is grading plans for single-family or duplex dwelling units, which may be approved by the Township Engineer.
4. During periods of the year when weather conditions make site grading work unfeasible, a temporary Certificate of Occupancy may be issued, subject to the furnishing of a satisfactory Letter of Credit, or cash deposit in an amount determined by the Township Engineer guaranteeing the completion of the work when weather conditions permit.
5. Any property owner claiming to be aggrieved by any site grading work, or decision of the Administrator relative to site grading of a parcel of property, shall have the right to appeal the decision of the Administrator to the Lapeer Township Engineering Board of Appeals. Such an appeal must be requested in writing, stating fully and clearly the reasons for the request and including any supplemental information and data which may aid in the analysis of the proposed request. Written notice of the date and time of the hearing shall be delivered to the owner(s) of the property on which the grading work has, is or will be performed. In conjunction with a determination on the appeal, the Engineering Board of Appeals has express authority to assess as costs against the owner(s) of the property which the grading work has, is or will be performed, the amount of the filing fee to reimburse the Applicant in the case of a successful appeal. In the event such a reimbursement is ordered, the same may be paid out of any bond proceeds paid by the property owner in conjunction with the subject grading work.

***Sec. 303 SLOPES***

The limiting slopes for developments shall comply with the following provisions.

1. The fall of the land away from any building shall be a minimum of six (6) inches in the first twenty-five (25) feet. From this elevation the land shall slope to a drainage water collection swale at a minimum slope of one foot in one hundred feet (one percent).

2. The maximum slope of the land for the site shall not exceed one foot in four feet, unless specifically approved by the Township Engineer. Sodded swale or ditch slopes shall be a maximum slope of one foot vertically and three feet horizontally.
3. All buildings having foundation drains shall direct the flow of drainage water from such foundation drains into a storm sewer or a storm drain by means of an underground enclosed conveyance pipe 4" diameter (minimum). No building permit shall be issued for any building having a basement without a building service sewer (drainage water) with drainage to a storm sewer or storm drain. Sump and pump shall be required in basements. Pump size shall be adequate to carry intercepted groundwater.
4. Drainage water run-off from building roofs shall be piped to a point five (5) feet away from the outside walls of any building. No drainage water run-off shall be allowed on adjacent property. Drainage water, sump pump water and/or ground water shall not be discharged to the sanitary sewer system.
5. The longitudinal grade of any drainage swale shall not be less than 0.5 feet per 100 feet (0.5%). The maximum distance drainage water shall travel in a drainage swale without an intercepting yard catch basin shall be 300 feet. Planned final grade elevations shall be indicated on the plans at a maximum spacing of 50 feet.
6. Where required by the Township Engineer, a six (6) inch diameter geotextile wrapped perforated drainage pipe shall be provided for drainage with said pipe trench being backfilled entirely with pea gravel up to within four (4) inches of the grade line of the swale.

***Sec. 304 WETLANDS AND FLOODPLAINS***

The Owner or his agent shall submit a copy of any DEQ permit to work in or modify any wetland or floodplain. A copy of the permit(s), or a letter from DEQ stating that no permit is required, shall be submitted to the Township prior to obtaining approval of engineering plans.

If the confirmation is not in the form of a letter or official correspondence from the DEQ (i.e. a consultant or wetland professional has prepared as statement), then the Township reserves the opportunity to review the information and comment on its reliability. If there are any disagreements regarding the boundary and/or jurisdictional status of any wetland area, the Township reserves the right to require the Owner or his/her agent to obtain confirmation from DEQ.

In any event, approval of any plans or project by the Township does not relieve the Owner or his/her agent of the responsibility to obtain appropriate permits from the DEQ or other regulatory agencies

**Sec. 305      *RETENTION/DETENTION REQUIREMENTS***

- A. All subdivisions and other developments exceeding 30 gross acres shall be designed for a 100 year storm event and a maximum discharge of 0.40 cfs/acre. All other developments shall be designed for a 10 year storm event. In the event that the Township Engineer or Lapeer County Drain Commissioner determine that the receiving watershed or drain is not capable of safely transmitting this discharge rate, the developer shall either make downstream water course improvements to provide the required capacity, or shall design a detention or retention system capable of limiting the discharge to the approved rate.

Whenever the discharge from the fully developed site exceeds the approved discharge rate, a detention or retention system shall be constructed to comply with LCDC current edition of "Procedures & Design Criteria for Subdivision Drainage in Lapeer County", and the following requirements, whichever is more restrictive.

1. The 100/10 year storm design elevation for storage in the detention basin shall be at least two (2) feet below the low point of the watershed area draining into the detention basin.
2. If construction is approved with side slopes less than required, the detention basin shall be completely fenced. The fence shall be six feet high chain link. A suitable access roadway sixteen feet in width shall run from a hard surfaced roadway to an access gate in the detention basin. The access gate shall be a double opening gate at least fourteen feet in total width and shall be provided with proper locks. The bottom of the fence shall be six inches below the ground surface.
3. The side slopes of the basin shall be one foot vertical to six feet horizontal and the top of the slope shall be a minimum distance of twenty feet from any fenced enclosure or building.
4. The bottom of the basin shall have a minimum grade of one percent (1.0%). The slope of the gutter line to the outlet shall have a minimum grade of one-half percent (0.5%). Underdrains shall be constructed in the bottom of the

basin as required by the Township Engineer. All inlet and outlet pipes shall have a bar screen, flared end section, and rip-rap as required. An inlet manhole shall be provided on the inside of the fence.

5. The entire detention basin area must be seeded (MDOT Class A Seed) or sodded (MDOT Class B Sod) and the turf shall be fully established before the Township approves the detention basin for operation and maintenance.
6. An overflow system shall be provided. The overflow system shall consist of either a pipe having an invert at the design storage level elevation, a control structure or a concrete spillway with an invert one (1) foot above the design storage elevation. The concrete spillway shall extend from the inside bank slope to the outlet drain.
7. For basins with pumped outlets, a silt trap and bar screen shall be installed on the inlet pipe to the pump station. The screen clear opening shall be a maximum of two inches.
8. Pumping stations for de-watering of the detention basins shall include duplicate pumps with each pump capable of handling the design flow. The controls shall include a lead pump start and stop, a lag pump start and stop, an alternator for alternating the lead lag pump, a high water alarm system with a light and a horn, and a safety all pumps off control. The control panel, pumps, and wet well shall be installed inside of the fenced enclosure and the controls shall be installed in a suitable weather-proof and vandalproof enclosure. Vehicular access to the pumps shall be provided. Construction shall conform to federal, state, county and local codes.
9. Minimum isolation (setback) of detention basins shall be no less than twenty (20) feet from all buildings, property lines, and road easements.
10. Basin properties shall have a length-to-width ratio of not more than 2 1/2 to 1, unless otherwise approved by the Township Engineer.
11. Basins shall be designed to drain completely within twenty-four hours to forty-eight hours after a rain.
12. Pumps shall be located in close proximity to the entrance gate for easy access during all seasons. The size, make and type of pumps will be determined by the Township to facilitate maintenance.

13. Electrical service shall be extended inside the fence whether gravity flow or pumps are used.
  14. Where the basin abuts residential properties (existing or proposed), a dense hedge shall be planted along the inside perimeter of the fence. Trees may be required by the Township where the basin parallels a roadway and in other instances where improved aesthetics could be achieved without interfering with maintenance.
- B. Other acceptable methods of detention include inline drain storage, dished parking lots, underground storage and roof storage. Detention shall not be permitted in roadside ditches.
  - C. Retention may be provided in deep permanent lakes and ponds with minimum water depths exceeding 10'.
  - D. A signed maintenance agreement and approved plans for detention facilities and storm drainage facilities (which will not be owned and operated by the Road Commission or Drain Commissioner's Office), shall be in effect prior to Township approval of the final plat or site plan. The Developer/Builder shall be responsible for dewatering and maintaining the basin until it is accepted by the new owner or owners' association.

A proposed " Drainage Maintenance Agreement" shall be provided. All persons owning lands which drain to or from said drainage system shall hold said lands subject to a maintenance agreement. It shall appear as a deed restriction or covenant and be recorded with the Lapeer County Register of Deeds. A copy of the maintenance agreement shall be approved by the Township, following review by the Township Attorney, and shall include the following:

- 1) A method of initiating or financing whatever improvements and/or maintenance that may be needed from time-to-time in order to keep the facilities in good and useable condition. Provisions shall include the establishment of a special assessment district for payment of future drainage maintenance.
- 2) A workable method of apportioning the cost of maintenance and improvements.
- 3) The agreement shall also provide, that in the event the drainage system fails to meet the conditions prescribed in item one (1) above or as originally designed, that Lapeer Township may order repairs to be made and may levy said costs on the annual tax bill for the collection with the Township property tax. The Township may also collect said costs in any other manner approved by the Township Board.

E. The Developer and/or Builder shall escrow sufficient funds or otherwise assure adequate funds by creating a special assessment district to cover maintenance, operation and insurance liability costs for the expected life of the basin. The Developer and/or Builder shall escrow sufficient funds for the abandonment or refilling of any temporary detention basin.

F. Calculations submitted for the design of the detention ponds shall be based on the Oakland County method (a simplified method of retention design). All subdivisions and other developments shall be designed for maximum discharge (Qa) of 0.40 cfs/acres. Listed below is the detention basin design procedure for a ten year storm with a gravity outlet.

- \_\_\_\_\_ 1. Determine the amount of acreage (A) contributing runoff to the retention basin and its runoff coefficient (C).
2. Determine the maximum allowable outflow, (Qa), in CFS from the local municipal government regulations/ and/or existing outlet conditions. The requirement is 0.40 cfs/acres.
3. Calculate Qo (CFS/acre imperviousness)  
 $Q_o = \text{Allowable Outflow}(Q_a) = \text{Acreage}(A) \times \text{Runoff Coefficient}(C)$
4. Determine type of outlet that will be used. The outlet must be a gravity, orifice, or pump outlet.
5. Calculate the storage time, T, in minutes, from the orifice outlet storage time equation.  
$$T = -25 + \frac{\sqrt{6562.5}}{\sqrt{Q_o}}$$
6. Calculate the maximum volume of storage per acre imperviousness, Vs, from the orifice storage equation.  
$$V_s = \frac{10,500T - (40)(Q_o)(T)}{T+25}$$
7. Calculate the total Volume of storage, Vt, required for the entire site.  
$$V_t = (V_s)(A)(C)$$

**Sec. 306**

**SOIL EROSION PERMITS.**

Adequate soil erosion and sedimentation control measures shall be specified on the plans, and followed during construction, to conform to the requirements of Michigan Act 347, P.A. of 1972, entitled, "Soil Erosion and Sedimentation Control

Act of 1972." A soil erosion permit shall be acquired by the Developer from the Lapeer County Planning Commission, a copy of which shall be presented to the Administrator prior to issuance of a Construction Permit.

*Sec. 307*

***NPDES STORMWATER PERMITS.***

All sites shall obtain a NPDES Permit from MDEQ prior to construction as outlined by the State of Michigan requirements.

**ARTICLE 4  
STANDARDS FOR ENGINEERING DESIGN OF  
STORM SEWER SYSTEMS**

***Sec. 401 ROADWAY AND PARCEL DRAINAGE***

A. Storm water run-off drainage systems for roadways and individual parcels less than 30 acres shall be designed for a ten (10) year storm by means of the rational method formula:  $Q=CIA$ ; where Q is the peak rate of run-off in cubic feet per second, A is the area in acres, C is the co-efficient of run-off for the drainage area and I is the average rainfall intensity in inches per hour for a certain time of concentration. The rainfall intensity shall be determined by the formula:  $I=175/(T+25)$ ; where T is the time of concentration equal to the time required for a drop of water to run from the most remote point of the watershed to the point for which run-off is being estimated. In most instances, an initial T equal to 20 min. for residential areas can be used. Use T=15 min. in other land use areas. The Developer's Engineer shall use judgement in arriving at proper imperviousness factors, but, in general, the following factors are acceptable minimums:

1. Lawn areas - 0.2
2. Pavement and roof areas - 0.9
3. Overall area of single-family subdivision - 0.35
4. Overall area of multiple housing development - 0.55
5. Overall area of commercial development - 0.80
6. Overall area of industrial development - 0.80

The rational method may be used for areas up to 250 acres. Larger drainage areas shall be designed by a method approved by the LCDC and Township Engineer. Drainage of areas in excess of 30 shall be designed for 100 year flood flows. Flows shall be based on full development of the watershed.

B. Where open County drains are proposed for drainage water disposal, the Manning's formula shall be used for determination of flow depth and capacity. However, if the Township Engineer and/or the Michigan Department of Environmental Quality and/or the Lapeer County Drain Commissioner deem it advisable, the developer's Engineer may be required to furnish computations and plans showing the backwater curve for the open drain under one hundred-year-flood-flow fully developed upstream watershed conditions.

- C. Where possible, provide a minimum of three and one-half (3 1/2)) feet of cover from the top of finish road or earth grade to the horizontal centerline of any storm sewer. The 10 year storm hydraulic gradient shall be maintained below the top of the sewer pipe. The design elevation of the hydraulic gradient profile shall be indicated on the sewer profile view. Non submerged drain systems shall be designed to operate with the water surface elevation at or below the 0.8 rise level.
- D. Access manholes (4 foot minimum diameter) shall be provided along the storm sewer at every change of pipe size, change of grade, or change of direction. However, the maximum spacing for storm sewer manholes shall be as follows:

<u>Diameter of Sewer</u>	<u>Absolute Maximum Manhole Spacing</u>
12" to 42"	400'
48" to 60"	500'
66" and Larger	600'

NOTE: Height (Rise) of arch and elliptical pipe shall be used as the criteria for manhole spacing.

Leads twelve inches (12") or less in diameter may be core tapped directly into sewers forty two inches (42") and larger, except that taps shall not be made into a precast manhole tee pipe section. An access manhole or catch basin must located on the lead within 25 feet of the tap.

Manholes and catch basins shall be constructed utilizing precast concrete segments or Class A concrete block and mortar.

- E. Catch basins shall not be constructed over a main sewer line to replace manholes in street sewers or trunk sewers outside of streets. If a normal manhole location (outside of streets) coincides with a stormwater inlet structure location a catch basin may be used as a stormwater inlet structure in lieu of the manhole.
- F. An end section with prefabricated bar screen shall be installed on the end of all storm sewers 12 inches in diameter and larger which outlet into an open drain. Openings of the bar screen shall be no more than 6 inches on centers.
- G. In general, pavement type catch basins shall be located as follows:
  1. At or near the radius return of street intersections.
  2. At all low points in streets.
  3. At intermediate points along the street or parking lot such that there is a maximum pavement drainage area per structure depending on the infiltration rate of the manhole.

- H. Yard type catch basins shall be provided at all low points in drainage swales. Provide intercepting yard type catch basins such that not more than 300 feet of swale drainage runs into any one catch basin other than a low point catch basin where 600 feet of drainage is allowed.
- I. Improved open drains may be permitted under special circumstances approved by the Township Engineer. When open drains are used, the easement width shall be sufficient to accommodate a twenty (20) foot wide maintenance plateau (with a minimum slope of ten percent) on each side of the channel.
- J. The side slopes of open drains shall have a maximum slope of one (1) foot vertical to six (6) feet horizontal, except that a low flow channel may have side slopes of one (1) foot vertical to three (3) feet horizontal. Open drain side slopes shall have an established sod surfacing, or be seeded, fertilized and mulched, as soon as possible after construction. Sufficient measures shall be taken to conform to the erosion and sedimentation control requirements of applicable state, county or local ordinances.
- K. An extension of the storm sewer system shall be provided to furnish an outlet for foundation drain service pipe for any buildings not otherwise serviced; such extensions shall have a minimum diameter of six (6) inches.
- L. Pipe shall be designed for minimum velocity flow full of 2.5 ft./sec., and for maximum velocity of 8 ft./sec. In isolated circumstances, the Township Engineer may approve velocities between 2 to 10 ft./sec.
- M. Five feet of clearance shall be provided between open water course bottoms and other utilities.
- N. Design life of enclosed storm sewers and bridges shall be 50 years or more, except for driveway culverts in open ditch areas which shall have a design life of 20 years or more. Storm sewers shall have "premium" joints approved by the Township Engineer.

***Sec. 402 SEWER LOCATION***

Storm sewers shall be located in street right of ways or easements in accordance with Appendix B.

***Sec. 403 MATERIAL & WORKMANSHIP***

All materials and workmanship shall conform to the current edition of the MDOT "Standard Specification for Construction", LCRC and LCDC (if applicable), and the requirements of this ordinance. In the event of a conflict between the standards, the most stringent shall govern except when the Township Engineer agrees that a less stringent interpretation is appropriate for the intended use.

**ARTICLE 5  
STREET AND PARKING LOT PAVING**

***Sec. 501 DESIGN REQUIREMENTS***

- A. Paving for all streets located within dedicated public or private road rights-of-way shall be designed and constructed in accordance with the currently adopted specifications of the Lapeer County Road Commission, and the requirements of this ordinance, whichever is the more stringent requirement.
- B. Paving for all other streets and parking lots shall conform to the specifications of the Lapeer County Road Commission or the following specifications whichever is the more stringent requirement:

- 1. Air entrained concrete for pavement, sidewalks and curbs shall conform to current MDOT Standards for Grade 35P except that the concrete mixture shall contain no less than six (6) sacks of Type 1 or 1A cement per cubic yard. Calcium chloride compounds/admixtures are prohibited.
- 2. Asphalt pavement shall conform with current Michigan Department of Transportation Specifications Bituminous Pavement and shall have a minimum of six inches of MDOT Class II sand sub-base, eight (8) inches 21AA limestone or blast furnace slag surfaced with 3 1/2 inches of bituminous aggregate surface.

Bituminous pavement mixtures shall conform to current MDOT specifications. Unless otherwise approved by the engineer, the following mixtures shall be utilized for the pavement type.

Pavement Type	MDOT Bituminous Mixture
Commercial & Industrial Roads	4C
Residential Streets	13
Parking Lots	36A

- 3. The thickness and widths of the street pavements (back to back of curbs) shall be as indicated in Appendix "C" of this Ordinance.
- 4. Maximum allowable pavement grade shall be 6.00 percent.
- 5. Minimum allowable pavement grades shall be as follows:
  - a. Concrete pavement gutter grades - 0.40%.
  - b. Asphalt pavement gutter grades - 0.60%.
  - c. Concrete curb return at intersections - 1.00%

- d. Concrete pavement surface grade to gutter line - 0.50%.
  - e. Asphalt pavement surface grade to gutter line - 1.00%.
  - f. Gravel Roads 4.0% from the crown to the edge of gravel.
6. Whenever a change in the grade of 1% or more occurs, provide a vertical curve with a length determined (to the nearest 50 feet) by the following formula:  $L=1/2 (G1-G2)$ ; where L is the length in stations of 100 feet per each station and G1 - G2 is the algebraic change of grade in percent.
  7. Center line curve data (radius, deflection angle, degree of curvature and total arc length) for all street pavement curves shall be indicated on the plans, unless a final plat is submitted with the plans. All streets shall be designed for a minimum design speed of 35 mph.
  8. The top of curb (or edge of road) elevations every 50 feet and at the intersection of each property line extension to the curb line (or edge of pavement) shall be indicated on the profile view for each street.
  9. The minimum sight distances for all roads shall satisfy the Lapeer County Road Commission minimum criteria.
  10. Between reverse curves, there shall be a tangent section of: 50 feet for local streets; 100 feet for collector streets. For deflections of 75 degrees or greater, the curvature requirements shall be determined by the Township Engineer.
- C. When recommended by the engineer and required by the Planning Commission or Township Board (or when required by the agency that will/does own the road right-of-way) all street pavement in residential areas shall have 4" mountable curbs. Where the pavement is a boulevard section, island curbs shall be 7" high curbs. Current Lapeer County Road Commission Specifications shall be adhered to on public roads. All curbing and curb and gutter for streets and parking areas shall be reinforced concrete.
  - D. A detail shall be drawn for all intersections, "eyebrows" and cul-de-sacs. The detail shall show jointing and detailed pavement surface grades, including gutters and tops of curbs. The minimum scale of the detail shall be one inch equals thirty feet
  - E. At the end of a street that will be extended in the future, install a one foot header and standard road end barricade and sign.
  - F. Where the Township Zoning Ordinance requires off-street parking, the design of the parking area shall conform to the requirements as follows:
    1. All parking lot layouts shall be designed to meet the requirements of the Township Engineer and shall receive his written approval.
    2. All parking areas shall be paved with either 8 inches minimum thickness concrete or eight inches minimum thickness of stone aggregate topped with 3/2 inches of bituminous concrete surface course. A seven inch high concrete curb shall be placed on drive

entrances for the paved parking area. 6" minimum concrete curbing shall be required in all locations where pavement meets landscaping areas or sidewalk.

3. When the area is to serve three (3) or more automobiles, the individual car spaces shall be marked by painted on yellow stripes a minimum of 3" wide. The size of the parking space shall be as specified in the zoning ordinance.
4. Parking lot layouts for other than residential areas shall be designed in accordance with the general standards indicated in the Township Zoning Ordinance.
5. When sidewalks are provided adjacent to the parking area curbs where car overhangs occur, such walks shall be a minimum width of seven (7) feet as measured from the face of the curb.
- G. When required, sidewalks shall be a minimum width of five (5) feet. Sidewalks shall be constructed with concrete conforming to the requirements of Section 150.B.1. Sidewalks shall be 4" minimum thickness in pedestrian areas; 6" in vehicular traffic areas; and in driveways shall be 7" or match the pavement thickness, whichever is greater. Except where permitted for ramps, sidewalks shall be laid on a maximum grade of 8.3%, a maximum recommended grade of 5.0%, and shall have a cross slope of 1/8" per foot of width minimum and 1/2" per foot maximum.

***Sec. 502 MATERIALS AND WORKMANSHIP***

All materials and workmanship shall conform to the 2003 edition of the MDOT "Standard Specifications for Construction", as amended, LCRC published criteria, and the requirements of this ordinance. In the event of a conflict between standards, the most stringent shall govern except when the Township Engineer agrees that a less stringent interpretation is appropriate for the intended use.

**ARTICLE 6**  
**WATER SUPPLY AND DISTRIBUTION SYSTEM**

***Sec. 601 SYSTEM AND PLAN REQUIREMENTS.***

- A. All systems shall be designed to conform to the most stringent requirements of the MDEQ, current AWWA standards, the requirements of this ordinance.
- B. All water mains shall be shown in a plan view. Water main, at location of crossings with other utilities or drains, and those water mains six inches or larger in diameter shall also be shown on a profile view.
- C. The plan shall indicate the proposed finished grade elevations of all hydrants, gate wells, and/or other structures and, where a public main or hydrant is not located in a public street, an easement for the main and hydrants. The easement shall extend a minimum of six (6) feet each side of the center line of the main. Additional easement width may be required by the Township Engineer.
- D. The type, capacities, location, and layout of a building service water supply pipe shall comply with all requirements of the Township Engineer, the Fire Department, Lapeer County Health Department and the State of Michigan.
- E. The type of pipe and joints indicated on the plans shall be in accordance with the currently adopted Township Standards.
- F. All water mains shall be installed with a minimum cover of five (5) feet below finished grade. Where water mains must dip to pass under a storm sewer or sanitary sewer, the minimum acceptable clearance shall be eighteen (18) inches. At all open drain crossings a five and a half (5 1/2) feet minimum clearance between the proposed ultimate bottom of drain and top of water main shall be provided. The sections which are deeper than normal shall be kept to a minimum length by the use of vertical bends (maximum deflection allowed 45 degrees) properly anchored.
- G. Water mains other than hydrant leads shall be eight (8") inches minimum in diameter in single family or duplex uses. Residential six (6") inch water mains will be allowed in residential areas serving less than six dwelling units and less than six hundred (600) feet in length. Commercial, industrial and multi-family developments shall require 12" minimum diameter mains. No dead end water mains shall be created. Where no practicable means exists to loop a main during the current project, the Developer and/or Builder shall be required by the Township Engineer to provide stubs for future extensions and connections. All single hydrant leads longer than fifty (50) feet shall be eight (8) inches minimum diameter and shall be valved as a dead end main.
- H. All valves, except hydrant valves, shall be installed in a standard gate well. Valves shall be located in the system such that not more than four (4) valves need be turned off to isolate any individual section of water main. Moreover, sufficient valves shall be placed such that not more than thirty (30) dwelling units or service establishments shall be serviced within such section of water main that can be isolated. Where possible valves shall be located at street intersections five (5) feet from the intersecting street right-of-way line.

- I. Hydrants shall be installed along the water main at least every five hundred (500) feet. However, in no case shall any external part of any building be more than three hundred fifty (350) feet from a hydrant. In commercial or industrial districts, additional hydrants may be required. Hydrants shall be installed at the ends of all dead end water mains. When near a street intersection, hydrants shall be located a minimum of fifteen (15) feet from the intersecting street right-of-way line.
- J. Fire hydrants and valves shall conform to current Lapeer Township Standards or as directed by the Township Engineer..

***Sec. 602 WATER MAIN LOCATION***

Water mains shall be located in street right of ways or easements in accordance with Appendix B.

***Sec. 603 WATER TREATMENT PLANTS***

All water treatment plants serving more than one residential dwelling unit, or serving any commercial or industrial properties shall be designed and permitted by the State Safe Drinking Water Act. Plans shall be subject to review and approval by the Township Engineer.

***Sec. 604 MATERIALS AND WORKMANSHIP***

Materials and workmanship shall conform to AWWA C600, the standards in Appendix D, and any construction specifications promulgated by the Township Engineer.

**ARTICLE 7  
WASTEWATER COLLECTION AND DISPOSAL SYSTEM**

***Sec. 701 SYSTEM AND PLAN REQUIREMENTS.***

- A. All systems shall be designed to conform to the most stringent requirements of the MDEQ, Lapeer County Health Department, “Ten State Standards” and this ordinance.
- B. Separate sanitary sewers and storm sewers are required. No stormwater or groundwater shall be purposely introduced into any sanitary sewer.
- C. For every sanitary sewer project, there shall be indicated on the profile view a manhole with a 12" deep manhole sump to be used for testing for infiltration. This manhole generally shall be the first manhole upstream from the point of connection to the existing sanitary sewer system. No sanitary sewer section having an infiltration rate, or an exfiltration rate, of more than 50 gallons per inch of pipe diameter per mile of pipe per 24 hour period shall be approved for use. A low pressure air test may be required in lieu of an infiltration test.
- D. The minimum allowable size for public sanitary sewers shall be eight (8) inches diameter. The minimum size of building service sewer (wastewater) shall be four (4) inch diameter. A minimum of six inch building service sewer shall be provided for a building containing from one to twelve dwelling units (or equivalent), all commercial and industrial buildings; a minimum of eight inch building service sewer shall be provided for a building containing from thirteen to one hundred dwelling units (or equivalent). An approved cleanout will be installed at the sewer ROW or easement line when the lead is extended to the premises and every 100 feet along the service line.
- E. The following table of acceptable slopes for sanitary sewers shall be adhered to:

<u>Sewer Size</u>	<u>Minimum Slope</u>	<u>Maximum Slope</u>
4"	2.00%	6.5%
6"	1.00%	6.5%
8"	0.40%	5.0%
10"	0.28%	4.0%
12"	0.22%	3.0%
15"	0.15%	2.0%
18"	0.12%	1.5%
21"	0.10%	1.3%
24"	0.08%	1.2%

Gravity sewers shall be designed for a minimum velocity of 2.0 feet per second and a maximum of 8.0 feet per second. Where sufficient depth is available, the extreme upstream run of sewer without the potential for future extension shall have the minimum slope increased to develop a design velocity of 3.0 feet per second.

- F. Sanitary sewage force mains shall be designed for a minimum velocity of two (2) feet per second and a maximum velocity of ten (10) feet per second, unless otherwise approved. Force mains shall be shown in a profile view with grades and elevations indicated thereon. An air relief and cleanout assembly manhole shall be provided at high points. Access (cleanout assembly) manholes shall be provided along the force main at least every 600 feet.
- G. A building service sewer shall be indicated on the plans for each building in the project. Where sanitary sewers are planned along roadways, the building service sewers shall be extended across the roadways (to the right-of-way line) prior to paving.
- H. Manholes shall be provided along all sanitary sewers at:
1. Points of horizontal deflection;
  2. Points where the size of sewer is changed;
  3. Points where the slope of the sewer is changed;
  4. At junctions with other sewer lines;
  5. At the upstream terminus of a sewer run;
  6. Along the sanitary sewer at other locations such that the maximum spacing between manholes shall not exceed 400 feet.
- I. At manholes where size of sewer changes, match 0.8 diameter elevation points of inlet and outlet sewer. At horizontal deflections in the sanitary sewer greater than 45 degrees, a minimum of 0.10 feet additional adjustment in grade elevation shall be provided to allow for loss of head. However, additional elevation adjustments may be made when conditions allow same; provided that, when the invert of any inlet sewer is more than 18" above the outlet sewer, a drop assembly shall be provided. External drop connections will not be permitted unless special permission is granted by the Township Engineer.
- J. In general, sanitary sewers shall be located within a public street right-of-way or public easements adjacent to street R.O.W. Sanitary sewers shall not be located within rear lot easements, except in extremely unusual circumstances as determined by the Township Engineer. Where public sanitary sewers are located outside of public streets, they shall be placed in a recorded public utility easement that provides for unlimited access to the sanitary sewer for repairs, connections, and maintenance. The minimum acceptable width of easements for public sanitary sewers shall be 20 feet wide; except that, if adjacent and parallel to the public street, it may be reduced to 12 feet wide.
- K. The sanitary sewer trunk line shall be designed to have a minimum depth from finish grade elevation to top of sewer of eight and one-half (8.5) feet at local control points or nine (9) feet at locations where the sewer grade is parallel to the road grade. All sewer mains shall be constructed at the maximum practicable depth to facilitate future extensions of the main. In no case shall collector sewers be built with less than five (5) feet of cover.

- L. Each wye or terminus of building service sewer shall be plugged with an infiltration proof plug in accordance with current adopted Township standards.
- M. The type of pipe and joints for sanitary sewers shall be in accordance with currently adopted Township Standards.
- N. All Industrial and Commercial uses shall have a suitable control manhole together with such necessary meters and other appurtenances in the building sewer to facilitate observation, sampling and measurement of the wastes. Such manhole, when required, shall be accessible and safely located, and shall be constructed in accordance with plans approved by the Township Engineer. The manhole shall be installed in a public sewer or utility easement by the owner at his expense, and shall be maintained by him so as to be safe and accessible at all times.

***Sec. 702 SANITARY SEWER MAIN LOCATION***

Sanitary sewer mains shall be located in street right of ways or easements in accordance with Appendix B.

***Sec. 703 WASTEWATER TREATMENT PLANT***

Any wastewater treatment system or plant serving more than one residential dwelling unit, or serving commercial or industrial property shall:

- a. Conform to the State Clean Water Act, and obtain a valid discharge permit.
- b. Shall obtain a permit from the Lapeer County Health Department.
- c. Shall obtain a permit from the Michigan Department of Environmental Quality (MDEQ)
- d. Plans shall be subject to review and approval by the Township Engineer.

***Sec. 704 MATERIALS AND WORKMANSHIP***

Materials and workmanship shall conform to the requirements of MDEQ, the Standards in Appendix E, and any construction specifications promulgated by the Township Engineer.

**ARTICLE 8**  
**SIDEWALKS, DRIVEWAYS, PRIVATE UTILITIES**

**Sec. 801 OTHER SITE IMPROVEMENTS.**

**A. SIDEWALKS AND DRIVEWAYS.**

1. Sidewalks shall have a minimum thickness of 4 inches in pedestrian only areas and a minimum of 6 inches in areas where vehicular traffic will cross the walk. Sidewalks shall extend continuously thru all driveways.
2. The width of the walk shall be a minimum of 5 feet for public walks and a minimum of 4 feet for other than public walks and are subject to review and approval by the Township.
3. Single-family and two-family residential concrete driveways shall be a minimum of four (4) inches thick except that portion within the public right-of-way which shall be a minimum of six (6) inches thick. All other concrete drives shall be a minimum of six (6) inches thick except that portion within the public right-of-way which shall be a minimum of eight (8) inches thick. Bituminous pavement residential driveways are acceptable provided they have a minimum of six (6) inches of stone or slag base surfaced with three (3) inches of bituminous surface course. The developer's Engineer shall design an adequate base and surface thickness to be compatible with existing subbase conditions and anticipated design loads for all non-residential driveways.
4. Construction joints with a half inch premolded expansion filler shall be placed at maximum intervals of 50 feet. Contraction joints shall be placed at maximum intervals of five feet, or equal to the width of walk, whichever is greater. Expansion joints shall be placed at all curbs, at all intersecting walks and at all changes in direction.
5. Sidewalks shall be constructed along a planned longitudinal grade line. The maximum longitudinal slope shall be 5%. The transverse slope of the sidewalk shall be a minimum of 2% (1/4 inch per foot) and a maximum of 5%.
6. Concrete for sidewalks and driveways shall have a 28 day compressive strength of at least 3500 pounds per square inch.

**B. OTHER UTILITIES.** Unless otherwise approved by the Township Engineer, the installation of public utilities other than Township sanitary sewers, water mains, or storm sewers shall not be started until the finished grade has been established. The Utility Company's contractor shall be required to restore the ground to the finished grade. The drainage water swales shall be restored to a workable condition at least as good as existed prior to construction. Furthermore, all land and/or other physical features affected by the construction of the public utility shall be restored to a condition at least as good as that existing at the time construction was begun.

**C. BUILDING ELEVATIONS.** Outside building elevations, (either the brick ledge or ground grade) shall be determined by adding between 12 and 18 inches to the highest elevation of the road (centerline or top of curb) which is adjacent to the frontage of the lot. Building elevation variations (from the above requirements) can be made on corner lots or where setbacks substantially exceed the minimums established by the Zoning Ordinance

when approved by the Township Engineer. All site and plot plans submitted to the Township shall show all outside building elevations of structures on adjacent lots or lots in close proximity to the proposed structure for the purpose of the Township Engineer determining if the proposed outside building elevations and drainage are harmonious with the neighboring structures. The Township Engineer shall adjust proposed outside building elevations, if required, to maintain acceptable differentials between adjacent structures. In no case shall the outside building elevation be less than the established flood plain elevations.

The Township Engineer may consider stepped or multiple outside building elevations of individual structures in relationship to the road elevation, adjacent structure elevations, and/or the effect they may have on adjacent vacant lots and approve same, only if they are harmonious with existing house grades and are not detrimental to future construction on adjacent vacant lots. The Township Engineer, when reviewing and/or approving outside building elevation, shall review and approve the site storm drainage plan. A site or plot plan shall not be approved unless positive drainage exists or will be provided. No storm drainage shall be directed onto adjacent lots except in easements established to accommodate storm drainage. The Township Engineer shall review site plans only if they are complete in every respect and contain sufficient information to assure Ordinance compliance.

- D. **ENGINEERED SEPTIC FIELDS.** Engineered septic fields shall be defined as septic tank fields designed to be constructed above existing ground level. Building plans (site or plot plans) reviewed by the Township Engineer shall show final elevation and location of proposed engineered septic fields. Engineered septic fields shall not be approved by the Township Engineer unless provisions have been made to maintain existing drainage patterns and storm drainage is not directed onto adjacent lots except thru or across easements and/or natural defined water courses provided specifically for storm water run-off. Engineered septic fields located in front yards shall be designed to blend with surrounding areas, be landscaped and meet all other Ordinance requirements.
- E. **FILLING VACANT LOTS.** Vacant Subdivision lots or parcels shall not be filled unless a fill permit is obtained from the Township following approval of a plot plan by the Township Engineer. The requirements for obtaining a fill permit shall include but not be limited to providing a detailed grading plan showing existing and proposed grades of the lot or parcel to be filled, and existing grades on adjacent lots and/or structures, roads and related drainage, and a canal if applicable. A fill permit will not be issued unless the preceding requirements are met and all storm drainage is directed to a bonafide storm drainage outlet. In no case shall storm water be directed onto adjacent property. Fill permits for individual parcels or lots less than two (2) acres in size shall be issued for a 90 day period. Parcels and lots of two (2) acres or more shall be issued for a 180 day period. Fill permits may be renewed one time only. After filling is complete, final grading and the establishing of vegetative cover shall be required within 30 days.

***Sec. 802 CONSTRUCTION AND CONSTRUCTION INSPECTIONS.***

- A. All work covered under a Permit for Construction of Site Improvements shall be performed according to the approved plans and specifications and in accordance with the requirements of this Ordinance. By making an application for a Permit for Construction of Site Improvements, the Developer grants the Township the right to perform inspection of any work covered under the Permit and the Developer shall correct, at his expense, any work which is discovered to be done in conflict with the approved plans and specifications or in conflict with the requirements of this Ordinance.
  
- B. The fee for construction inspection as determined by the Administrator shall be deducted from the amount of the construction inspection deposit paid upon application for a Permit for Construction as set forth in Appendix "A". If the fee so determined exceeds the amount of the deposit, the Developer shall make up such deficiency in deposit by paying forthwith, upon discovery, an additional deposit to cover the cost of inspection until the job is completed and approved. Upon completion and final approval of the work, any money left in the construction inspection deposits account will be returned to the Developer.
  
- C. The Township reserves the right to inspect all work covered under the Permit for Construction of Site Improvements and intends to provide detailed inspection for all of the following:
  - 1. All of those types of construction where detailed inspection requirements are covered under the Engineering Standard Standards and other Township Ordinances.
  - 2. All sanitary sewers (public or private) including connections thereto;
  - 3. All water supply pipe (public or private) including connections thereto;
  - 4. All open and enclosed storm drains (public or private) including connections thereto, except in the case of those storm sewers considered private storm sewers in mobile home parks, that do not receive drainage water from premises other than the mobile home park site.
  - 5. All site grading and pavement for any site. The Township will provide inspection sufficient to verify compliance with requirements of Township ordinances for all private storm sewers, sidewalks, driveways, street pavements, and/or parking lot pavements. The Developer shall provide competent construction surveyors and inspectors for detailed inspection for all construction not inspected in detail by the Township.
  - 6. All landscaping and lighting required by ordinance.

**ARTICLE 9  
VARIANCES**

***Sec. 901 CRITERIA FOR GRANTING.***

The Engineering Board of Appeals may authorize a variance from the provisions of this Ordinance when it determines that undue hardship may result from strict compliance with specific provisions or requirements of this Ordinance. In granting any variance, the Engineering Board of Appeals may prescribe other conditions that it deems necessary or desirable for the public interest. No variance shall be granted unless the Engineering Board of Appeals finds;

- A. There are special circumstances or conditions affecting the situation such that a strict application of the provisions of this Ordinance would deprive the applicant of reasonable use of his property;
- B. That the variance is necessary for the preservation and enjoyment of the substantial property right of the applicant;
- C. That the granting of the variance will not be unduly detrimental to the public welfare or injurious to other property in the Township.
- D. That such variance will not have the effect of nullifying the interest and purpose of this Ordinance nor violate the provisions of other State or Federal Regulations.

***Sec. 902 APPLICATION.***

Any person may apply for such variance by requesting same in writing, stating fully and clearly the reasons for the request and including any supplemental information and data which he believes may aid in the analysis of the proposed request.

***Sec. 903 ENGINEERING BOARD OF APPEALS***

The Engineering Board of Appeals shall consist of the Township Supervisor, a representative from the Township Planning Commission, a representative from the Township Zoning Board of Appeals, and the Township Engineer. The Township Engineer shall not be a voting member of the board of appeals.

**ARTICLE 10  
EFFECTIVE DATE**

This Ordinance shall become effective thirty (30) days after the date of its publication.

**ARTICLE 11  
VALIDITY**

This Ordinance and the various parts, articles, sections, subsections and clauses thereof are hereby declared to be severable. If any part, sentence, paragraph, subsection, section or clause is adjudged unconstitutional or invalid, it is hereby provided that the remainder of the Ordinance shall not be affected thereby.

**ARTICLE 12  
VIOLATIONS AND PENALTIES**

Any person, firm or corporation who violates any of the provisions of this ordinance is responsible for a municipal civil infraction, subject to payment of a civil fine of not less than \$50.00, plus costs and other sanctions, for each infraction. Repeat offenses under this ordinance shall be subject to increased fines as provided for in the Lapeer Township Civil Infraction Ordinance, being Ordinance Number 35. Each day such violation continues shall be deemed a separate offense. The imposition of any sentence shall not exempt the offender from compliance with the requirements of this Ordinance.

The undersigned Supervisor and Clerk of the Township of Lapeer hereby certify that this Ordinance Amendment was duly adopted by the Township Board at a meeting held on the 18th day of December, 2007 and was published in the LA VIEW on the 10th day of January, 2008. This Ordinance Amendment shall be effective upon date of publication.

\_\_\_\_\_  
Scott Jarvis, Supervisor

\_\_\_\_\_  
Dawn Walker, Clerk

**APPENDIX "A"**  
**SCHEDULE OF FEES**

**I. PLAN REVIEW - ADMINISTRATION FEES.**

**A. Fee for a Public Utility Company other than the Township.**

1. For installations to be made as part of a Developer's Project, there shall be no separate charge.
2. For installations in locations other than a Developer's Project, the fee shall be at the rate of eight cents (\$.08) per foot of utility proposed to be constructed with a minimum fee per project of one hundred dollars(\$100.00).

**B. Fee for a Developer (Not Including a Public Utility Company).**

1. The charges to be paid to the Township for the plan review administration fee for a specific parcel of land on which the engineering plans are completed shall be as follows:
  - a. For a single dwelling unit site: \$ 270 for submittal review, \$150 for any subsequent reviews.
  - b. For projects with site improvement construction costs\* of \$35,000 or less, \$ 850.00.
  - c. For projects with site improvement construction costs greater than \$35,000 the fee shall be \$850.00 or 1.33% of the estimated site improvement construction costs which ever is greater. If more than one review is required, the Engineer shall charge the additional review fees on an hourly basis.

\*The site improvement construction cost shall be based on all site improvements (excluding buildings) which includes improvements constructed off-site for the benefit of the development. The tabulation of quantities and the construction cost estimate shall be submitted with the plans and shall be prepared by a registered Civil Engineer and shall bear the Engineer's Seal and signature. Unit costs utilized shall be based upon anticipated current prices for publicly bid project. If the Township Engineer determines that the submitted estimate is incorrect, he may prepare a revised estimate and require the applicant to pay the additional review fees and the cost of the estimate preparation.

If the multiple reviews are required, the Developer and/or Builder will be invoiced on an hourly basis for the additional review charges that exceed the above fee values.

**II. CONSTRUCTION INSPECTION CHARGES.**

A. To cover the cost of construction inspection, the Applicant shall pay a minimum cash deposit to the Township Water and Sewer Department based on the applicable one of the following conditions or based on construction schedule:

	<b>DEPOSIT AMOUNT</b>
1. For a construction cost estimated to be less than \$10,000.00 (plot plans included)	10% of Construction Cost Minimum of \$270.00.
2. For a construction cost estimated to be from \$10,000.00 to \$100,000.00	8% of Construction Cost Minimum of \$1,000.00.
3. For a construction cost estimated to be over \$100,000.00	6% of Construction Cost Minimum of \$6,000.00.

B. If multiple inspections are required, the Developer and/or Builder will be invoiced on an hourly basis for the additional review charges that exceed the above fee values.

**III. CASH BONDS - UTILITY COMPANIES.**

A. To guarantee the restoration of land and/or other physical features, affected by the construction of the public utility, the Utility Company's Contractor shall make a cash bond payment to the Township computed as follows:

<b>Item</b>	<b>Bond</b>
1. For a single or multiple pole relocation of for an overhead wire installation:	No Bond Necessary
2. For an underground utility installation within a Developer's Project:	\$0.50 per ft. of utility with a minimum of \$1,000/Project
3. For an underground utility installation outside of a Developer's Project:	\$2.50 per ft. of utility with a minimum of \$5,000/Project

**IV. FEES.**

A. Provided that all fees established by this Ordinance may be modified by Lapeer Township Board resolution.

**APPENDIX "B"**  
**SCHEDULE OF "STANDARD UTILITY LOCATIONS"**

SUBJECT UTILITY	LOCATION OF UTILITIES FROM CENTER LINE (1)					
	66'ROW (24' Pvmt with curbs and 26' Pvmt with Open Ditches) (2)	66' ROW (28' Pvmt with curbs)	70' ROW (36' Pvmt with curbs)	86'ROW (36' Pvmt with curbs)	86' ROW (48' Pvmt with curbs) (2)	120'ROW (65' Pvmt with curbs)
Sanitary Sewer (3)	36'B	36'B	41'B	49'B	49'B	50'B
Storm Sewer	21'A	21'A		31'A	31'A	40'A
Gas	24'B	24'B	26'B	34'B	34'B	51'B
Hydrants	22'B	22'B	24'B	24'B	28'B	38'B
Water Main	26'A	26'A	28'A	36'A	36'A	57'A
Sanitary Sewer (Second)(3)	-	-	-	49'A	49'A	66'A
Second Water Main (or Storm Drain)	-	-		-	-	57'B
DE - MBT Underground	-	-		-	-	53'B
DE - MBT (Overhead)	31'A	31'A	36'A	44'A	44'A	61'A/B
Curb Radius at Intersection	35'	30'	40'	30'	40'	40'

Notes:

- (1) A means west or south; B means east or north. In some existing streets where one or more of the utilities have been installed in a location other than described above, the location of remaining proposed utilities shall be determined by the Township Engineer with the concurrence of the Road Commission when appropriate.

Where, in the opinion of the Township Engineer, these locations are not desirable or possible, suitable adjustments may be made.

- (2) This is not a categorically approved width of pavement, but only an allowance assumed for purposes of this schedule.
- (3) Sanitary sewers shall be installed in twelve feet wide easements adjacent to street rights-of-way when and where 10' separations cannot be maintained between sanitary sewers and storm sewers and/or sanitary sewers and water mains. In no case shall available ROW and easement be less than two times the depth of the utility plus three (3) feet. Based on utility depth, size, soils and related conditions, the Township Engineer may require wider easements.

**APPENDIX "C"**  
**PAVEMENT REQUIREMENTS**

- I. GENERAL.** In all public and private streets, the requirements of the Lapeer County Road Commission, the current edition of the MDOT "Standard Specifications for Highway Construction 1990 Edition", and related documents shall govern except where this Ordinance imposes a higher or more demanding requirement. For all other streets the provisions of this Ordinance shall govern.
- II. RESIDENTIAL AREAS.**
- A. For proposed Subdivisions where the average width of lots is less than 98': Provide a concrete pavement (minimum eight seven inches thick) with concrete curb and gutter having a minimum width of 28 feet for local streets and 36 feet for collector streets; except, if a dual roadway with an island is proposed, each roadway shall be a minimum of 21 feet. As an alternative, bituminous aggregate pavements are acceptable provided they meet the above width requirements and shall have a minimum of six inches of MDOT Class II sand sub-base, eight (8) inches 21AA limestone or blast furnace slag surfaced with 3 1/2 inches of bituminous aggregate surface.
  - B. For proposed Subdivisions where the average width of lot is 98' or more: Provide a concrete pavement (minimum seven inches thick) with concrete curb and gutter having a minimum width of 24 feet for local streets and 28 feet for collector streets. As an alternative, bituminous aggregate pavements are acceptable provided they meet the above width requirements and shall have a minimum of six inches of MDOT Class II sand sub-base, eight (8) inches 21AA limestone or blast furnace slag surfaced with 3 1/2 inches of bituminous aggregate surface.
  - C. For improvements to existing local or collector roads minimum Lapeer County Road Commission requirements shall prevail.
  - D. For apartments, condominiums and mobile home parks, provide a concrete pavement (minimum seven inches thick) with concrete curb and gutter having a minimum width of 24 feet for local streets and 28 feet for collector streets except for a dual roadway with an island each roadway shall be a minimum of 21 feet. As an alternate, bituminous aggregate pavements are acceptable provided they meet the above width requirements and shall have a minimum of six inches of MDOT Class II sand sub-base, eight inches 21AA limestone or blast furnace slag surfaced with 3 1/2 inches of bituminous aggregate surface course.
  - E. When roadway curbing is not required, the minimum pavement width shall be 26' for local streets, 32' for collector streets.
- III. INDUSTRIAL AREAS.** Industrial street pavement designed for Class A all weather use shall be a minimum of nine inches thick concrete with curbs and gutter having a minimum width of 36 feet. Minimum road right-of-way shall be seventy (70) feet wide.

**IV. COMMERCIAL AND OTHER AREAS - PUBLIC OR PRIVATE STREETS.** Pavement (with curb and gutter where appropriate) shall be provided for the driving and service lanes of these developments. The width of pavement shall be such as to provide at least two - twelve foot wide driving lanes unobstructed by parked vehicles. Appropriate additional allowances shall be made for situations where a high incidence of temporary or permanent parking is anticipated. The concrete pavement shall have a minimum thickness of eight (8) inches. As an alternate, bituminous aggregate pavements are acceptable provided they meet the above width requirements and shall have a minimum of six inches of MDOT Class II sand sub-base, eight (8) inches 21AA limestone or slag surfaced with 3 1/2 inches of bituminous surface course.

**V. ALL PAVEMENTS.**

The Developer's Engineer shall design an adequate road base thickness to be compatible with the existing subgrade conditions and anticipated design loads. Bituminous pavement of an equivalent strength may be substituted for concrete pavement unless otherwise noted.

Concrete curb shall be MDOT C-4 on local streets not approved for four (4) inch mountable curbing. On major streets, curbs shall be MDOT F-4, or as directed by the road agency of jurisdiction. On open ditch road areas, concrete curb or curb and gutter shall be placed at all intersection radii and for a ten foot tangent section at the termini of all radii.

6" perforated edge drain is required along both pavement edges.

Existing paved or gravel roads with embankments to narrow to comply with the above stated pavement width may be paved to such widths as determined adequate by the LCRC based on traffic volumes and safety criteria.

***VI. ROAD SECTION NOMENCLATURE***

**APPENDIX "D"**  
**WATER SYSTEM REQUIREMENTS**

**I. GOVERNING STANDARDS AND SPECIFICATIONS.** All water main pipe, fittings, appurtenances, miscellaneous materials, methods of construction, and testing shall conform to the current edition of the following specifications; American Society for Testing and Materials (ASTM), American Standards Association (ASA), American National Standards Institute (ANSI), American Waterworks Association (AWWA), Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction, and the Michigan Manual of Uniform Traffic Control Devices (M.M.U.T.C.D).

**II. MATERIALS.** All water main pipe, fittings and appurtenances shall meet the following requirements and the requirements of ASTM, ANSI and AWWA current specifications.

**A. Pipe Materials**

1. Ductile Iron Pipe - ANSI/AWWA C151/A21.51 Class 54, double cement lined, push-on type joint.
2. Polyvinyl Chloride Pipe (PVC) - ANSI/AWWA C900, pressure Class 200 (DR 14), 4" through 12" only.
3. Concrete Pressure Pipe - AWWA C-301 prestressed, steel-cylinder type, rubber and steel joint.
  - a. 20" Diameter: Lined-cylinder type
  - b. 24" Diameter and Large : Embedded-cylinder type
4. The use of asbestos cement pipe and gray iron pipe will not be allowed.

**B. Fittings**

1. Ductile Iron - ANSI/AWWA C153/A21.53 (compact fittings) 350 psi pressure rating, double cement lined, with mechanical joint and retaining gland. (Except when otherwise indicated on the plans or authorized by the Engineer.)
2. Concrete Pressure Pipe - AWWA C-301 steel plate or casting as approved by the Engineer.
3. No Gray Iron Fittings will be allowed.

C. Joints

1. Push-on Type Joint - ANSI/AWWA C111/A21.11 (DIP with serrated brass wedges.)

- a. The required number of brass wedges per joint are as follows:

<u>Pipe Dia. (in.)</u>	<u>Number of Wedges</u>
6" - 12"	2
16" or Larger	4

- b. Push-on joints shall be Tyton, Super Belltite or approved equal.

2. Mechanical Joint and Bolts - ANSI/AWWA C111/A21.11

- a. All mechanical joints shall be wrapped with polyethylene for a minimum of 2 feet on each side of the joint.
  - b. When retainer glands are required, split retainers will not be allowed.
  - c. Bolts shall be "Cor-Ten" with T-Heads and Hex-Head nuts or approved equal.

3. Flanged Joints and Bolts - ANSI/AWWA C110/A21.10 with rubber, ring gaskets.

- a. All flanged joints exposed to earthen materials, shall be wrapped with polyethylene for a minimum of 2 feet on each side of the joint.
  - b. Flanged joints shall be used only when specified on the plans.

4. Restrained Joints

If specified, restrained joints shall be a boltless restrained joint with a rubber gasket (Clow super-lock or approved equal). The restraining mechanism shall be a ductile iron retainer. The pipe shall be supplied with a factory installed lock-ring welded to the plain end of the pipe to anchor the retainer.

In areas with weak soils where thrust blocking is not possible and with written approval of the Engineer, the joints may be restrained with rods (Star Industries joint restraint system or approved equal). All restraining rod joints shall be wrapped with polyethylene.

All pipe shall conform to ANSI/AWWA C111/A21.11 with a pressure rating of 350 psi.

D. Cement Lining, Coatings and Polyethylene Encasement

1. Cement-Mortar Lining - ANSI/AWWA C104/A21.4 double thickness.
2. Exterior Coating - ANSI/AWWA C151/A21.51 asphaltic coating material required.
3. Seal Coat - ANSI/AWWA C104/A21.4 asphaltic material.
4. Polyethylene Encasement - ANSI/AWWA C105/A21.5 installment method A.

E. Valves and Hydrants

1. Gate Valves

- a. Where called for on the plans, gate valves shall conform to ANSI/AWWA C-509 current specifications. The valve shall be cast with an iron body and bronze mounted with a bronze non-rising stem, double "O"-ring replaceable seals and mechanical joints. It shall be furnished with a two inch (2"), square operating nut.

Mueller resilient seated, with a non-rising stem, conforming to ANSI/AWWA C509 current specifications or equal as approved by the Township Engineer.

- b. All gate valves greater than sixteen inches (16") in diameter, shall be supplied with a bypass in accordance with ANSI/AWWA C-500 unless otherwise specified by the Engineer.

The bypass valve shall be a gate valve conforming to the requirements contained in these specifications. The bypass valve shall be independently supported within the valve chamber.

2. Tapping Valves

Tapping valves shall conform to the requirements of gate valves as specified herein. The valve shall be constructed to allow a tapping machine to tap directly through the open valve.

The valve shall be supplied with a flanged joint for connection to the tapping sleeve and a mechanical joint for connection to the branch water main. The tapping sleeves shall be ductile iron, split sleeves with mechanical joints and a flanged outlet.

3. Direction of Opening

All gate valves shall open counter clockwise.

4. Gate Wells

All valves, except hydrant isolation valves, shall be placed in a gate well.

5. Valve Boxes

Valve boxes shall be a 3-piece, screw type box (5 1/4 inch shaft) size cc. The box shall have a round base, sized to fit the valve, and a locking cover marked "water".

6. Hydrants

All fire hydrants shall be a dry-barrel type conforming to AWWA/ANSI C-502. The hydrants are to be supplied with a minimum valve opening of 5 1/4 inches and a six inch (6") mechanical joint inlet connection.

The hydrant shall be a "breakaway" type and shall be supplied without a drain outlet. All hydrants shall be connected to the main with a six inch (6") minimum branch and an independent gate valve of the same size with a valve box.

Hydrants shall be East Jordan Iron Works 5BR or approved equal. Hydrants shall have two 2 1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle, National Standard thread. All nozzles are to be located eighteen inches above the ground level. The operating nut shall be a 1-1/2 inch pentagonal nut opening in a counterclockwise direction. Hydrants shall be painted yellow. The depth of bury, for hydrants, shall not be less than five feet (5).

The following fire hydrant color code shall be incorporated on all hydrants by painting the caps.

<u>Main Size</u>	<u>Cap Color</u>
6" or less	Red
8"	Orange
10" & 12"	Green
16" & 20"	Brown
24" or larger	Light Blue

F. Special Pipe, Valve Wells and Concrete Products

1. River Crossing Pipe

All river crossing pipe shall conform to AWWA/ANSI C151/A21.51 current specifications. The pipe thickness class shall be in accordance with the project drawings or specifications. River crossing pipe shall be double cement lined (ANSI 21.4) and equal to "Usiflex Boltless Flexible Joint Pipe" by U.S. Pipe, or "Clow Ball and Socket Pipe" by Clow Corporation.

2. Valve Well

a. The valve well shall consist of a precast concrete riser, concentric cone and base section conforming to ASTM C-478 current specifications. The base section shall be cast with a groove of sufficient size to accommodate the riser section. All joints shall be mortared.

b. Frame and Cover

The valve well frame and cover shall be an East Jordan Iron Works E.J.I.W. 1040 frame with type C cover. The cover shall be marked with raised letters reading "WATER".

The frame shall be leveled with concrete brick with a maximum of three(3) leveling courses.

c. Steps

All valve well steps must be factory installed, "M.I.A Industries P.S.I. polypropylene", "M.S.U. #360 alu poly" manhole steps or approved equal, with foot recess. All steps shall be suitably scored to provide a non-slip surface. The maximum vertical spacing of the steps shall be sixteen inches (16") center-to-center.

3. Concrete

a. Concrete for plain anchors, thrust blocks, encasements, pipe bedding, mud mats and structure bases shall have a minimum compressive strength of 2500 psi at 28 days (minimum of 4 1/2 sacks of cement per cubic yard).

b. Concrete for reinforced anchorages, meter pits, headwalls, junction chambers, foundations and other structures shall have a minimum compressive strength of 3500 psi at 28 days (minimum of 5 1/2 sacks of air entrained cement per cubic yard) unless otherwise noted on the plans or in the specifications.

c. Concrete for cradles shall contain 5 sacks of air entrained cement per cubic yard. The concrete shall be mechanically mixed and have zero slump.

d. Reinforcing steel, when required, shall conform to ASTM A615 current specifications with a minimum yield strength of 60,000 psi, unless otherwise noted on the plans or in the specifications.

e. Water for concrete shall be clean, fresh, free from oil, acids, and organic matter.

4. Brick, Mortar, Grout and Miscellaneous

- a. All brick to be used in the construction of structures shall be concrete brick conforming to ASTM C55 current specifications, grade P-II. The brick shall have the following nominal size:

Depth	2 1/4" ± 1/4"
Width	3 5/8" ± 1/8"
Length	7 3/4" ± 1/4"

- b. Mortar for masonry work and pointing shall be composed of 2 parts of masonry sand and 1 part portland cement. The sand-cement mixture shall be dry mixed prior to the addition of water. Water shall be added to the mix until a stiff paste consistency is obtained.

Portland cement shall be air-entrained, type IA conforming to ASTM C150, current specifications.

Masonry sand shall meet M.D.O.T. 2NS or 2MS sand. On-site materials or natural bank-run sands will not be allowed for use as masonry sand.

- c. Grout mixtures, when called for on the plans, shall be composed of a non-shrink type mix, Seka Set or approved equal.
- d. Cement-sand backfill, when called for on the plans, shall consist of one part portland cement, dry-mixed with 10 parts of sand (by volume).

5. Bore & Case

- a. Casing - ASTM A-139 grade B with circumferential joints prepared for field welding.
- b. Skids, Position Braces and blocking -  
Wolmanized timber with notches for strapping.
- c. Strapping - Steel bands.

6. Services

- a. Copper pipe shall be constructed of Type K, soft temper copper tubing for underground use, in accordance with ASTM B-88 and B-251. Pipe weight shall exceed that specification Table II of B-251.
- b. Corporation stops, curb stops and fittings shall be fabricated brass.

### ***III. PIPE CLEARANCE OF ROCKS***

Ledge rocks, boulders, stones over 2 inches (2") in diameter and buried materials shall be removed to provide a clearance of at least six inches from any part of the pipe.

### ***IV. HANDLING OF PIPE AND MATERIALS***

Pipe shall be distributed at the site by the Contractor as required and care shall be exercised to prevent injury to the pipe in handling. Proper tools and methods for safely handling the pipe and other materials shall be provided and used by the Contractor.

All pipe and materials shall be protected from falling off of the truck to the ground or into the trench. Dropping of the pipe or materials from the truck will not be permitted and may be cause for rejection. When distributing the pipe along the line or storing near a road, the pipe must be kept clear of danger to passing vehicles.

All materials will be inspected before placing in the trench and if defective, marked rejected and removed from the site by the Contractor. Wherever the coating is found to be rubbed off, the part shall be brushed clean and recoated with an asphaltic coating to the satisfaction of the Engineer.

### ***V. PIPE INSTALLATION***

- A. Unless otherwise directed by the Engineer, the pipe shall be laid with the bell ends facing the direction in which the work is progressing. The assembly of several sections of pipe, prior to placement in the trench, will not be permitted.
- B. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be so marked and removed from the project site.
- C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe. The outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign materials before the pipe is laid.
- D. All foreign material shall be removed from the interior of the pipe and shall be prevented from entering the pipe while it is being placed. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
- E. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade as shown on the plans or as directed by the Engineer. The pipe shall be secured in place with the approved backfill material. The use of bricks, lumps of clay, wood, rocks, etc., for blocking the pipe will not be permitted.
- F. Maintain 5'-0" minimum cover over the top of the water main. Maintain 10' lateral separation and eighteen inches vertical separation between the outside of water mains and the outside of sewers, drains or catch basin leads.

## ***VI. PIPE BEDDING***

- A. Pipe bedding shall be defined as that material placed from a minimum of four (4) inches below the pipe to twelve (12) inches above the top of the pipe.
- B. Where pipe is to be bedded in sand, the material shall be Michigan Department of Transportation (M.D.O.T.) Class IIA and shall be placed by hand in six inch (6") layers and compacted to ninety-five percent (95%) maximum bulk density as determined by the Modified Proctor Method.
- C. A minimum of four inches (4") of bedding material, thoroughly compacted, shall be placed in a neatly excavated trench to obtain the required grade prior to laying the pipe. After the pipe has been laid the bedding material around the pipe shall be placed in six inch (6") horizontal layers, thoroughly compacted, to an elevation twelve inches (12") above the pipe. This initial backfill operation shall be maintained within 10 feet of the last pipe laid and extra care shall be taken to protect the pipe and joints from being disturbed.
- D. If, when any pipe is placed in the trench, the bedding is found to be improperly prepared to provide the required continuous bearing, the pipe shall be removed and the bedding corrected by further excavation or by placing gravel, pea stone, or crushed stone (no slag or cinders) in order to provide a subbase to insure the required bearing.

## ***VII. CONCRETE CRADLE***

Concrete cradles shall be used only when specified on the plans or as directed by the Engineer.

All bedding shall be thoroughly consolidated, and if through carelessness or for other reasons, the sub-grade may have been disturbed and refilling is necessary, the Contractor shall install, at his own expense, additional concrete cradling or other bedding as approved or required by the Engineer.

Concrete cradles shall have a minimum thickness of four inches (4") under the pipe and shall extend up the sides of the pipe equal to one-half (1/2) its outside diameter.

## ***VIII. CONSTRUCTION IN FILL SECTIONS***

Where it is necessary to lay pipe in a fill area, unstable or unsuitable material shall be removed and slopes steeper than one (1) to two (2) shall be stepped before the fill material is placed. The embankment shall be of suitable material on one (1) to two (2) fill slopes and shall be placed in layers not to exceed twelve inches (12") and shall be compacted to one hundred percent (100%) of maximum density to the top of the pipe. The embankment shall be not less than five (5) diameters plus four feet (4') wide at the invert of the pipe and shall be continued up to provide not less than one foot (1') of cover over the pipe.

**IX. BORING AND CASING**

- A. When boring is specified on the plans or directed by the Engineer, it is intended to be accomplished with the use of a conventional boring pit operation. If the Contractor hand tunnels, digs past or otherwise eliminates the need for the bore, it will be done at his expense and the quantity of deleted bore will be eliminated from the contract. Under no circumstances will the tunneling or boring of driveways be permitted.
- B. Casings shall be used under existing streets, highways, railways as called for on the plans, or as directed by the Engineer. Steel pipe casings shall meet the requirements of ASTM A-139 current specifications, grade B material. The pipe shall be prepared for field welding of circumferential joints.

The outside diameter and wall thickness of the pipe will be as shown below:

<u>Minimum Water Main Size (Inches)</u>	<u>Minimum Casing Casing O.D. (Inches)</u>	<u>Minimum Casing Wall Thickness (Inches)</u>
4"	12.75"	.375
6"	14"	.375
8"	16"	.375
12"	20"	.375
16"	24"	.406
24"	36"	.532

Skids, position braces and blocking braces shall be strapped to the water main pipe prior to installing the water main inside of a casing. All skids and braces shall be wolmanized timber and notched to accommodate the strapping bands.

Casings for bores shall be used only as directed by the Engineer. Both ends of the casing shall be bulk headed, with brick and mortar, after installation of the water main within the casing.

**X. JOINT ASSEMBLY**

- A. Push-on Joints

Push-on joints shall be assembled as follows:

1. Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.
2. Clean all dirt and foreign material from the plain end. Apply lubricant to the gasket and plain end in accordance with the pipe manufacturers recommendations.
3. Check that the plain end is beveled. Square or sharp edges may damage or dislodge the gasket and cause a leak. A heavy file or grinder may be used to remove any sharp edges.

Push the plain end into the bell of the pipe to the home position. Joint deflections shall be made after the joint is assembled. The backhoe bucket and the pipe choker shall not be used to push the pipe into the bell.

B. Mechanical Joints

Mechanical joints shall be assembled as follows:

1. Wipe clean the socket and plain end of all dirt and foreign material. Lubricate the socket, plain end and gasket with a soap solution before the joint is assembled. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge toward the plain end.
2. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Deflections shall be made after the joint is assembled but before tightening the bolts.
3. Bolts shall be initially drawn up snugly and uniformly on opposite sides of the pipe before final tightening. The bolts shall be tightened with a torque wrench to the normal range of 75 to 90 ft-lbs.

C. Joint Deflection

When it is necessary to deflect the pipe from a straight line, either vertically or horizontally, as called for on the plans or as directed by the Engineer, the deflection shall not exceed the following values:

Maximum Joint Deflection - Full Length Pipe

Nominal Pipe Size (in)	Push-On Joint		Mechanical Joint	
	Deflection Angle	Maximum Offset	Deflection Angle	Maximum Offset
4	3 - 30	14	6 - 15	23
6	3 - 30	14	5 - 20	20
8	3 - 30	14	4 - 00	15
12	3 - 30	14	4 - 00	15
16	2 - 15	8 ¼	2 - 40	10
24	2 - 15	8 ¼	1 - 45	7

\*Offsets are based upon 18 foot lengths of pipe

D. Pipe Cutting

Cutting pipe for insertion of valves, fittings, or closure pieces shall be done in conformance with all safety recommendations of the manufacturer of the cutting equipment. Cutting shall be done in a safe, workmanlike manner without creating damage to the pipe or cement-mortar lining.

Ductile iron pipe may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw. An oxyacetylene torch will not be allowed to cut the pipe.

The cut ends and rough edges shall be ground smooth, and for push-on joint connections, the end shall be beveled.

**XI. BACKFILLING**

Unless otherwise directed, all excavation shall be backfilled at least to a point one (1) foot above pipe immediately after installation.

A. Backfill Material

All backfill material shall be free from cinders, ashes, refuse, vegetable or organic matter, boulders, rocks or stones, or other materials which, in the opinion of the Engineer are unsuitable.

B. Backfilling Over The Pipe

From the center of the pipe to a point one foot (1') above the top of the pipe, the trench shall be backfilled with material shown in the Bedding Detail on the water main detail sheet, placed in six inch (6") layers and compacted to ninety-five percent (95%) of the maximum unit weight.

C. Drives, Parking Areas, Streets and Sidewalks

The trench backfill under driveways, streets, parking areas and sidewalks shall be M.D.O.T. granular material Class IIA hereinafter called sand. Sand backfill shall be placed in layers not to exceed twelve (12") inches and compacted to ninety-five percent (95%) of the maximum density as determined by the Modified Proctor Method. The sand backfill shall extend three (3') feet beyond the paved or gravel area.

For sidewalks, the sand backfill shall be constructed to the existing sidewalk grade or to a grade specified by the Engineer and maintained until the sidewalk can be placed.

Under all gravel areas (streets, driveways and parking lots, etc.) the sand backfill shall be constructed to an elevation twelve inches (12") below the finished grade. The top twelve inches (12") shall be filled with M.D.O.T. 23A aggregate immediately after the water main is backfilled. Failure to place the required aggregate within a reasonable distance of the present construction, as determined by the Engineer, may result in the halt of construction until the situation is corrected. The Contractor shall maintain the

gravel streets and parking areas in good condition and add additional aggregate as settlement takes place for the life of the contract.

Under all paved areas (streets, driveways, parking lots, etc.) excluding sidewalks, the sand backfill shall be constructed to an elevation twelve inches (12") below the existing pavement grade. The top twelve inches (12") shall be filled with M.D.O.T. 22A aggregate in four inch (4") layers and compacted to ninety-five percent (95%) of the maximum unit weight. The aggregate shall be placed immediately after the proposed line is installed to serve as a temporary drive or road in driving areas.

If permanent pavement restoration does not immediately follow the completion of backfill, the Contractor shall construct and maintain a temporary surface suitable for traffic. The temporary surface shall consist of two inches (2") of coldpatch asphalt surfacing replacing the upper two inches (2") 22A aggregate.

D. Backfilling To Grade

Backfilling to grade shall not fall more than one hundred (100) feet behind laying of pipe unless otherwise required by the Engineer. When practical, the Contractor shall "ramp" the backfill by machine. Where compaction of the backfill to the densities stated above is not required by the plans or specifications, excavated material shall be placed in the trench to the proposed ground elevation. Unless otherwise specified or shown on the plans, backfill so placed shall be mounded to allow for settlement and later graded to conform to original levels and appearance. During backfilling, all excess spoil shall be so mounded or removed from the site and disposed of by the Contractor. Wasting of spoil by grading over existing right-of-way will not be allowed. Any settlement of trenches occurring within the required maintenance period shall be filled and regraded immediately at the request of the Owner or Engineer.

E. Backfilling In Freezing Weather

No frozen material shall be buried more than twelve (12") inches below the final elevation of ground. No frozen material shall be buried under any paved area, roadway, driveway, shoulder area, drain or utility.

***XII. HYDROSTATIC TESTING***

**WARNING:** The testing methods described in this section are specific for water-pressure testing. These procedures should not be applied for air-pressure testing because of the serious safety hazards involved.

Prior to hydrostatic testing the Contractor shall verify with the local municipality if this test is to be performed before or after the disinfection has been performed.

A. Test Restrictions

The test pressure shall be 150 psi and may not vary by more than  $\pm 5$  psi for the duration of the test.

The hydrostatic test shall be of at least a 2 hour duration.

The maximum length of test shall not exceed 3000 feet in length.

The Contractor shall conduct the pressure test and must supply all equipment, materials and labor to conduct the test, including a pump, pipe connections, gauges, meters and other apparatus.

The Township must be present to witness the pressure test. New pipe installations may not be connected to the existing water system during the hydrostatic test.

The test shall be made against closed hydrant valves.

B. Allowable Leakage

The maximum permissible leakage during the hydrostatic test shall not exceed a rate of .18 gallons per inch diameter of main per 1000 lineal feet in 2 hours at a pressure of 150 psi.

If any pipe installation exceeds the leakage rate, the Contractor, at his expense shall locate and make approved repairs until the leakage is within the specified allowance. All leaks shall be repaired in the presence of the Engineer.

All visible leaks are to be repaired, regardless of the amount of leakage.

***XIII. DISINFECTING WATER MAINS***

Disinfection of water mains shall be done in accordance with AWWA C651 current specifications, Michigan Department of Public Health and the Detroit Water and Sewerage Department requirements.

Prior to disinfection, the Contractor shall verify with the local municipality whether the municipality, Detroit Water and Sewerage Department, or if the Contractor is to perform the disinfection. He shall also verify if the disinfection is to be performed before or after the pressure test.

        A. Basic Disinfection Procedure

1. Prevent contaminating materials from entering the water main during storage, construction or repairs.
2. Remove by flushing or other means, those materials that may have entered the water main.
3. Add the chlorinating agent to remove any residual contamination that may remain and flushing the chlorinated water from the main.
4. Determine the bacteriological quality by laboratory test after disinfection.

B. Acceptance

Before the water main is placed in service, two water samples taken 24 hours apart from the newly installed main, shall be tested for bacteriological quality. The tests must be performed by a qualified laboratory and must show the absence of coliform organisms.

If the tests show the presence of coliform organisms, the main shall be rechlorinated until satisfactory results are obtained.

C. Disposal of Chlorinated Water

Caution shall be exercised in disposing of heavily chlorinated water to avoid upsetting environmental conditions. If necessary, contact the local sewer department for conditions of disposal to a sanitary sewer.

In very critical areas a chemical neutralizing agent may be required to remove the chlorine. Chemical neutralizing agents shall be used only as directed by the Engineer.

***XIV. PLACING MAINS IN SERVICE***

After receiving approvals of the hydrostatic test and chlorination test, the Contractor shall make the final connection to the existing water system.

After placing the new main in full service and prior to leaving the site, the Contractor shall dewater all hydrants.

**APPENDIX "E"**  
**SANITARY SEWER SYSTEM REQUIREMENTS**

**I. GOVERNING STANDARDS AND SPECIFICATIONS.** All sanitary sewer pipe, fittings, appurtenances, miscellaneous materials, methods of construction, and testing shall conform to the current edition of the following specifications; American Society for Testing and Materials (ASTM), American Standards Association (ASA), American National Standards Institute (ANSI), American Waterworks Association (AWWA), Michigan Department of Transportation (M.D.O.T.) Standard Specifications for Construction, and the Michigan Manual of Uniform Traffic Control Devices (M.M.U.T.C.D).

**II. MATERIALS - FORCEMAINS.** All sanitary sewer forcemain pipe, fittings and appurtenances shall meet the following requirements and the requirements of ASTM, ANSI and AWWA current specifications.

**A. Pipe Materials**

1. Ductile Iron Pipe - ANSI/AWWA C151/A21.51 Class 54, double cement lined, push-on type joint.
2. Polyvinyl Chloride Pipe (PVC) - ANSI/AWWA C900, pressure Class 200 (DR 14), 4" through 12" only.
3. Concrete Pressure Pipe - AWWA C-301 prestressed, steel-cylinder type, rubber and steel joint.
  - a. 20" Diameter: Lined-cylinder type
  - b. 24" Diameter and Larger: Embedded-cylinder type
4. The use of asbestos cement pipe and gray iron pipe will not be allowed.

**B. Fittings**

1. Ductile Iron - ANSI/AWWA C153/A21.53 (compact fittings) 350 psi pressure rating, double cement lined, with mechanical joint and retaining gland. (Except when otherwise indicated on the plans or authorized by the Engineer.)
2. Concrete Pressure Pipe - AWWA C-301 steel plate or casting as approved by the Engineer.
3. No Gray Iron Fittings will be allowed.

C. Joints

1. Push-on Type Joint - ANSI/AWWA C111/A21.11 (DIP with serrated brass wedges.)

- a. The required number of brass wedges per joint are as follows:

<u>Pipe Dia. (in.)</u>	<u>Number of Wedges</u>
6" - 12"	2
16" or Larger	4

- b. Push-on joints shall be Tyton, Super Belltite or approved equal.
2. Mechanical Joint and Bolts - ANSI/AWWA C111/A21.11
  - a. All mechanical joints shall be wrapped with polyethylene for a minimum of 2 feet on each side of the joint.
  - b. When retainer glands are required, split retainers will not be allowed.
  - c. Bolts shall be "Cor-Ten" with T-Heads and Hex-Head nuts or approved equal.

3. Flanged Joints and Bolts -ANSI/AWWA C110/A21.10 with rubber, ring gaskets.

- a. All flanged joints exposed to earthen materials, shall be wrapped with polyethylene for a minimum of 2 feet on each side of the joint.
  - b. Flanged joints shall be used only when specified on the plans.

4. Restrained Joints

If specified, restrained joints shall be a boltless restrained joint with a rubber gasket (Clow super-lock or approved equal). The restraining mechanism shall be a ductile iron retainer. The pipe shall be supplied with a factory installed lock-ring welded to the plain end of the pipe to anchor the retainer.

In areas with weak soils where thrust blocking is not possible and with written approval of the Engineer, the joints may be restrained with rods (Star Industries joint restraint system, Ebaa iron megalug, or approved equal). All restraining rod joints shall be wrapped with polyethylene.

All pipe shall conform to ANSI/AWWA C111/A21.11 with a pressure rating of 350 psi.

D. Cement Lining, Coatings and Polyethylene Encasement

1. Cement-Mortar Lining - ANSI/AWWA C104/A21.4 double thickness, with asphaltic coating.
2. Exterior Coating - ANSI/AWWA C151/A21.51 asphaltic coating material required.
3. Seal Coat - ANSI/AWWA C104/A21.4 asphaltic material.
4. Polyethylene Encasement - ANSI/AWWA C105/A21.5 installment method A.

E. Valves

1. Gate Valves

- a. Where called for on the plans, gate valves shall conform to ANSI/AWWA C-509 current specifications. The valve shall be cast with an iron body and bronze mounted with a bronze non-rising stem, double "O"-ring replaceable seals and mechanical joints. It shall be furnished with a two inch (2"), square operating nut.

Mueller resilient seated, with a non-rising stem, conforming to ANSI/AWWA C509 current specifications or equal as approved by the Township Engineer.

- b. All gate valves greater than sixteen inches (16") in diameter, shall be supplied with a bypass in accordance with ANSI/AWWA C-500 unless otherwise specified by the Engineer.

The bypass valve shall be a gate valve conforming to the requirements contained in these specifications. The bypass valve shall be independently supported within the valve chamber.

2. Tapping Valves

Tapping valves shall conform to the requirements of gate valves as specified herein. The valve shall be constructed to allow a tapping machine to tap directly through the open valve.

The valve shall be supplied with a flanged joint for connection to the tapping sleeve and a mechanical joint for connection to the branch water main. The tapping sleeves shall be ductile iron, split sleeves with mechanical joints and a flanged outlet.

3. Direction of Opening

All gate valves shall open counter clockwise.

4. Gate Wells

All buried valves shall be placed in a gate well.

**III. MATERIALS - GRAVITYSEWER.** All sanitary sewer main pipe, fittings and appurtenances shall meet the following requirements and the requirements of ASTM, ANSI and AWWA current specifications.

A. Pipe Materials & Fittings

1. A.B.S. Plastic Truss Pipe - ASTM D-2680 with type SC joints
2. P.V.C. Plastic Truss Pipe - ASTM D-2680 with gasketed joints conforming with ASTM D-3212.
3. P.V.C. Solid Wall Pipe - ASTM D-2466, Schedule 40 or 80; or ASTM D-2241, SDR 23.5 or heavier; with gasketed joints conforming to ASTM D-3212.
4. A.B.S. Solid Wall Pipe - ASTM D-2751, SDR 23.5 or heavier; with type SC joints per ASTM D-2235.
5. Reinforced Concrete Pipe - 18" or larger  
- ASTM C-76 wall C with ASTM C-361 joints and gaskets (synthetic rubber) bells and spigots shall be epoxy coated.
6. Ductile Iron Pipe - ANSI/AWWA C151/A21.51 Class 54, double cement lined with push-on type joints.
7. House Leads - Shall be 6" minimum solid wall PVC or ABS pipe conforming to the above noted specifications.

Ductile iron pipe shall be used at all water main and sanitary sewer crossings with less than two (2) feet of vertical clearance or when the sanitary sewer crosses above the water main. The ductile iron sewer shall be of equal size or larger as the proposed sewer and shall extend from manhole to manhole.

Bowing or warping of ABS and plastic pipe can occur with temperature fluctuations. The Contractor shall store and protect the pipe to minimize bowing. Nominal 12'6" pipe lengths having deviations from straight greater than 1" shall not be used.

Where specified on the contract drawings or approved by the Owner, ductile iron pipe may be used between existing manhole and an infiltration test manhole. Concrete pipe, sanitary manholes and junction chambers shall be manufactured with Type II, IP or IIA Cement.

The Contractor shall submit certificates of material compliance with all ASTM Specifications for all sanitary sewer, fittings and joint material to the Township Engineer. Certification forms and applicable test results shall be provided the field inspector with each pipe delivery. Certification forms shall include project name, location, contractor and test lot number. The test result shall show the lot size for the particular material. All pipe and fittings shall be suitably marked to provide manufacturer's name, lot or production number, ASTM designation nominal diameter and SDR number, where applicable. Fittings, however, need not contain lot or production number. Pipe shall have a "home" mark. Truss pipe with an absence of filler material at the ends greater than 1/4" deep shall be subject to rejection.

**IV. LOCATION OF PROPOSED SEWER.** Generally the location on the plans will be followed, but in the event the Owner desires a shift of line to avoid unforeseen inhibitions or to ease the burden of installation, the shift to higher or lower ground grades within the confines of the road width or dedicated easement shall be revised upon the direction of the Engineer. If the Contractor desires such a shift, he must have the approval of the Design Engineer for any location revision. The Township Engineer, however, reserves the exclusive right to determine the feasibility of such a shift and to so order. The Contractor shall not arbitrarily shift the sewer location. If a shift in location entails an increase or decrease in the cost of construction, said revised cost must be approved prior to constructing the sewer.

**V. EXCAVATION AND PREPARATION OF THE SITE.** Preparation of the site includes protecting and maintaining all conduits, wires, pipes, sewers, drains, fences, hydrants, pavements and sidewalks that are to remain in place; providing and maintaining all facilities required to protect the work, adjacent property, and the public from damage, injury, or loss; providing and maintaining protection for trees, shrubs, landscape work, and lawns which are to remain in place, and the removal of other items.

All excavation except as otherwise specified or permitted shall be open cut from the surface. All work shall be done to line and grade as established on the plans and in accordance with grade stakes set by the Design Engineer or licensed surveyor. Prior to construction, the Contractor shall verify the line and grade stakes as set and thereby shall assume all responsibility for their accuracy.

The trench shall be excavated so that the pipe can be installed to the alignment and grade required.

The excavation shall be of sufficient widths and depths to provide adequate room for construction and installation of the work to line, grade, and dimensions called for on the plans. In order to reduce the load on the pipe and to avoid possible failures from excessive loads, the width of the trench from the invert to a height twelve inches (12") above the top of the pipe shall not exceed the widths as follows:

The maximum width of trench at top of pipe shall be as follows:

<u>Pipe Diameter</u>	<u>Trench Width</u>
Through 15"	30"
18" to 36"	O.D. + 12"
42" and Over	O.D. + 24"

If any of the foregoing widths of trench are exceeded, unless otherwise shown on the drawings, the Contractor shall install, at his own expense, concrete cradling, or other approved bedding to support the added load of the backfill.

When stone bedding is used, a minimum of six inches clearance shall be provided on each side of the pipe. When sand bedding is used, the maximum trench width shall be maintained to allow the specified compaction of the bedding.

Where, through the Contractor's construction procedure or because of poor existing ground conditions it is impossible to maintain alignment and grade properly, the Contractor shall excavate below grade and replace with large size aggregate or slag in order to provide a subbase to insure that the pipe will maintain correct alignment and grade.

Where the bottom of the trench at subgrade is found to consist of material which is unstable to such a degree that it cannot be removed and replaced with an approved material compacted in place to support the pipe properly, the Contractor shall construct suitable supports approved by the Township Engineer.

The excavation shall at all times be finished to the required grade for an adequate distance in advance of the completed sewer, but, unless otherwise permitted by the Engineer, not more than 100 feet of trench shall be open at one time in advance of the sewer.

Excavated materials to be used for backfill shall be temporarily stored along the trench, in a manner that will not cause damage to trees, shrubs, fences, or other property, nor that will endanger the trench by imposing too great a load thereon. Distances from the edge of the trench shall be in accordance with current safety regulations.

Ledge rocks, boulders, stones over 2 inches (2") in diameter and buried materials shall be removed to provide a clearance of at least six inches from any part of the pipe.

The excavation shall be kept dry until the backfilling has been completed above the pipe. In water-bearing sand, quicksand or ground containing an excessive amount of water, the Contractor shall provide, install, maintain, and operate suitable well points, tight sheeting, connecting manifolds, and reliable pumping equipment and operate same to insure proper construction of the work.

Drainage or discharge lines shall be connected to adjacent storm water drains or extended to nearby water courses wherever possible. In any event, all pumping and drainage shall be done without damage to any highway or other property, public or private, and without interference with the rights of the public or private property owners.

**VI. LAYING OF SEWER.** All pipe shall be laid with the bell ends up grade to the line and grade as called for on the plans. Each pipe as laid shall be laid by the Contractor with a laser beam and checked with line and grade poles to insure that this result is obtained. The use of bricks, lumps of clay, wood, etc. to level the pipe will not be permitted. Any pipe found more than one-fourth inch (1/4") off grade or more than two inches (2") out of line shall be relaid properly by the Contractor.

Pipe shall be laid from the lower end of the sewer upwards. It will not be permitted for a Contractor to commence construction at any intermediate location in a sewer line other than the lowest elevation without permission from the Engineer, and the sole responsibility to assure that the sewer is installed to the correct line and grade shall remain the Contractor's.

The pipe shall be laid to provide equal clearance on both sides of the pipe in the trench. After the pipe is laid, care in backfilling and other operations shall be taken so as not to disturb its line and grade. The finished work shall be straight and shall be sighted through between manholes.

Each pipe shall be inspected for defects prior to being lowered into the trench and the inside of the pipe and outside surface shall be free of earth or foreign material. Lowering of the pipe into the trench shall be accomplished in a manner which will avoid injury to the workmen and damage to the pipe.

All pipe shall be laid on an even firm bed with bellholes in the bedding for bell and spigot pipes and to a uniform line and grade with the groove or bell ends up grade. The spigot end of the pipe shall be centered in, shoved tight, and secured against the bell or socket of the previously laid pipe to form a smooth and continuous invert. If the joints do not remain tightly closed, a cable and winch, or other approved means shall be used to maintain a tight joint.

Where pipe is laid in wet trenches or trenches with running sand, the Contractor shall provide and use mechanical means for pulling the pipe home in making the joint and for holding the pipe joints tight until completion of the line. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position or other approved means.

During the process of laying the pipe, care shall be taken to protect both the pipe and the joint from disturbance. At the close of each day's work, or at such time when pipe is not being laid, the open end of the pipe shall be protected with a close-fitting stopper.

As work progresses, the interior of the sewer shall be cleaned of all dirt, jointing material and any foreign material. On small sewers, where cleaning after laying may be difficult, a swab or drag shall be kept in the pipe and pulled forward past each joint immediately after its completion.

Upon commencing construction of any main or lateral sewer, the Contractor shall continue diligently until the sewer and sanitary building leads are completed before he proceeds to another sewer.

**VII. BORE AND CASE FOR SEWER PIPES.** The outer steel casing shall be of sufficient strength to meet the loading conditions of H-20 loading for pavements, Cooper E-72 loading for railroad crossings and shall meet the following minimum required wall thickness:

<u>Pipe Size</u>	<u>Recommended Minimum Casing Diameter</u>	<u>Minimum Wall Thickness</u>
6"	12"	.375
8"	16"	.375
10"	18"	.375
12"	20"	.375
15"	24"	.406
18" & 21"	36"	.532
24"	42"	.563
27" & 30"	48"	.625
36"	54"	.688
42"	60"	.750
48"	66"	.813

The inside diameter of all other casing pipes shall be a minimum equal to the outside diameter of the bell or hub end of the pipe plus 5 inches. The casing diameter and wall thickness shown on the detailed plans shall govern in case of a conflict with these specifications.

The casing shall be new pipe with a minimum wall thickness of 0.375". In accordance with Lapeer County Road Commission standards, the augers shall not extend beyond the end of the casing and the casing shall not be pushed unless the auger is turning. The auger head shall be four (4") inches behind the end of the casing. The space between the sewer and casing pipe shall be filled with pea pebble. The ends of the casing shall be sealed after the sewer pipe is installed through the casing. Size of the casing shall be as required to allow the sewer pipe to be pushed through on correct alignment and grade.

The bore shafts shall be filled to the spring line of the pipe with suitable bedding material to adequately support the pipe and to prevent a shear at the ends of the casing.

The Contractor shall protect all utility poles and trees in the area of the work from danger of collapse due to the excavation.

Utility poles which cannot be supported by the Contractor to the satisfaction of the affected utility company shall be tunneled or bored. The length of the tunnel or bore shall be as necessary to adequately protect the pole, but not less than ten (10) feet. Size will be as determined by the sewer pipe to be pushed through the tunnel or bore. Tunneling and boring will be incidental to construction unless a pay item is provided in the Proposal.

Machines shall freely excavate no closer to the base of a tree than the radius of the tree in inches converted to feet for trees less than twenty-four (24) inches in diameter, and no closer than twelve (12) feet if the tree is more than twenty-four (24) inches in diameter. Tunneling or boring the root system is required between the points so determined.

**II** **CONSTRUCTION IN FILL SECTIONS.** Where it is necessary to lay pipe in a fill area, unstable or unsuitable material shall be removed and slopes steeper than one (1) to two (2) shall be stepped before the fill material is placed. The embankment shall be of suitable material on one (1) to two (2) fill slopes and shall be placed in layers not to exceed twelve inches (12") and shall be compacted to one hundred percent (100%) of maximum density to the top of the pipe. The embankment shall be not less than five (5) diameters plus four feet (4') wide at the invert of the pipe and shall be continued up to provide not less than one foot (1') of cover over the pipe.

**IX. PIPE BEDDING.**

- A. Pipe bedding shall be defined as that material placed from a minimum of four inches (4") below the pipe to the centerline of the pipe or to a point twelve inches (12") above the sewer, as shown in the Standard Details for the project.
- B. Where pipe is to be bedded in sand, the material shall be Michigan Department of Transportation (M.D.O.T.) Class 2 and shall be placed by hand in six inch (6") layers and compacted to ninety-five percent (95%) maximum bulk density as determined by the Modified Proctor Method.
- C. When the pipe is to be bedded in stone, the stone shall be "walked in" to insure suitable support under the haunches of the pipe.
- D. Wyes shall be bedded with one bag of dry mix concrete per wye to prevent shear loading.

**X. CONCRETE CRADLE.** All bedding shall be thoroughly consolidated, and if through carelessness, or for other reasons, the sub-grade may have been disturbed and refilling is necessary, the Contractor shall install, at his own expense, such concrete cradling or other bedding as is approved or required by the Engineer.

Concrete cradle shall be constructed of concrete containing five (5) sacks of cement per cubic yard, with a minimum thickness of four inches (4") under the pipe and extending up the sides of the pipe equal to one-half (1/2) its outside diameter.

Concrete cradle shall have no slump and shall be mechanically mixed.

**XI. BACKFILLING.** Unless otherwise directed, all excavations shall be backfilled at least to a point one foot (1') above pipe immediately after installation.

A. Backfill Material

All backfill material shall be free from cinders, ashes, refuse, vegetable or organic matter, boulders, rocks or stones, or other materials which, in the opinion of the Engineer, are unsuitable.

B. Backfilling Over the Pipe

From the center of the pipe to a point one foot (1') above the top of the pipe, the trench shall be backfilled with material shown in the Standard Bedding Details, placed in six inch (6") layers and compacted to ninety-five percent (95%) of the maximum unit weight.

C. Drives, Parking Areas, Streets and Sidewalks

The trench backfill under drives, parking areas, streets and sidewalks shall be approved sand or other specified material placed in layers not to exceed twelve inches (12") in thickness and thoroughly compacted to ninety-five percent (95%) of maximum density as determined by the Modified Proctor Method. This backfill shall include the area to three feet (3') outside of the curb or three feet (3') outside of shoulders where no curb exists, unless otherwise required by the Owner. Except under sidewalks, this fill shall be constructed to an elevation eight inches (8") below the proposed grade of the surfacing. The top eight inches (8") shall be 22A aggregate (M.D.O.T. Designation) thoroughly compacted in four inch (4") layers and maintained until the original type of surfacing shall be properly placed. In sidewalks, the sand shall be constructed to the existing sidewalk grade or to a grade specified by the Engineer and maintained until the sidewalk can be placed.

Upon unimproved or gravel streets the specified backfill shall be constructed to an elevation eight inches (8") below the proposed finished grade. The top eight inches (8") shall be filled with M.D.O.T. 23A which shall be placed immediately after the sewer is backfilled. Should the Contractor fail to place the required slag within a reasonable distance of the present construction as determined by the Engineer, then all pipe installation shall halt until this situation is corrected. During the life of the Contract, the Contractor shall maintain the roadway in good condition and if necessary add additional slag as settlement takes place.

Upon paved streets or other improved areas, unless the Contractor, with the approval of the Engineer, restores the permanent pavement immediately following the completion of backfilling as the construction proceeds, the Contractor shall construct and maintain a temporary surface suitable for traffic. Unless otherwise specified, a temporary surfacing shall consist of six inches (6") of compacted M.D.O.T. 22A slag or gravel and two inches (2") of cold patch asphalt surfacing which shall be rolled to

correspond with the adjacent pavement. Said temporary surfacing shall be maintained in acceptable condition until the pavement is replaced.

D. Backfilling to Grade

Backfilling to grade shall not fall more than one hundred feet (100') behind laying of pipe unless otherwise required by the Engineer. When practical, the Contractor shall "ramp" the backfill by machine. Where compaction of the backfill to the densities stated above is not required by the plans or specifications, excavated material shall be placed in the trench to proposed ground elevation. Unless otherwise specified or shown on the plans, backfill so placed shall be mounded to allow for settlement and later graded to conform to original levels and appearance. During backfilling, all excess spoil shall be so mounded or removed from the site and disposed of by the Contractor. Wasting of spoil by grading over existing right-of-way will not be allowed. Any settlement of trenches occurring within the required maintenance period shall be filled and regraded immediately at the request of the Owner or Engineer.

E. Backfilling in Freezing Weather

No frozen material shall be buried more than four feet (4') below the final elevation of ground. No frozen material shall be buried under any paved area, roadway, driveway, shoulder area, drain or utility.

F. Sanitary Sewer Wyes and Risers

Wye branches, stubs or risers fitted with suitable stoppers, as approved by the Engineer, shall be constructed at such locations as are called for on the plans or as determined by the Engineer.

Risers shall be six inch (6") diameter and conform to the current specifications for sewer pipe with premium joint. They shall connect to wye branches constructed as part of sewer lateral and shall include a forty-five (45) degree bend and straight pipe laid along the side of the trench to reach the height specified.

Backfill of all risers shall be carefully placed and tamped sufficiently to insure against damage from backfill settlement.

## ***XII. SANITARY MANHOLES.***

### **A. General**

1. All manholes shall be constructed of precast reinforced concrete (manufactured with Type IIA cement), and shall be the eccentric cone type. All manholes for pipe sizes thirty-six inch (36") diameter and smaller shall be the precast flexible-joint type, unless otherwise specified.

Pipe shall not extend into a manhole beyond the inside face of the manhole wall. Field cutting of pipe to be used at manholes shall be done in a neat, workmanlike manner, using methods approved by the Engineer. Exposed ends of reinforcing steel shall be cut flush with the pipe end.

Concrete placed inside precast flexible-joint manholes to form the channel through the manhole shall not be placed between the pipe and the opening in the manhole base section so as to interfere in any way with the flexibility of the joint. Concrete shall be made with Type II, IP or IIA cement.

2. Adjustment shall be made by using Grade A brick.
3. Joints between riser sections shall be the modified tongue and groove with synthetic rubber gaskets conforming to ASTM 361 Specifications.
4. When a separate base riser and base slab are allowed, the joint between a precast riser section and the base of the structure shall be set in a full bed of non-shrink grout.

### **B. Materials for Manholes**

1. All manholes shall rest on a minimum eight inch (8") thick 3,000 psi concrete base. Precast concrete bases may be used if a uniform bearing is provided. The base shall provide a minimum of six inches (6") beyond the outside diameter of the structures, unless precast concrete bases are used. If precast bases are used, they shall protrude a nominal four inches (4") beyond the outside diameter of the structure. All concrete bases shall be cast utilizing Type II, IP or IIA cement.

The bottom precast section of flexible-joint manholes shall consist of a base integrally cast with a riser section. The base shall contain reinforcement at least equal to, and which shall be adequately tied to, the reinforcement in the riser section. Holes for pipe shall be cast in the riser section so as to provide a minimum clearance of two inches (2") between the inside bottom of the base section and the outside wall of the pipe.

2. Pre-Cast Manholes

Lifting holes in all pre-cast concrete sections shall be filled with a non-shrink grout, Seka Set or equal.

Joints and gaskets for pre-cast concrete manholes shall be modified tongue and groove conforming to ASTM C361 specifications.

3. The joint between the pipe and the base section of precast flexible-joint manholes shall be a mechanically-compressed flexible joint, such as the Res-Seal, Link-Seal, or Press Wedge II, or equal flexible-rubber manhole joint. The joint shall be capable of meeting infiltration requirements and shall permit a deflection of at least six (6) degrees in all directions as measured from all centerline of the pipe.
4. Water for concrete and for mortar shall be clean and fresh, free from oil, acids and organic matter.
5. Mortar for pointing of joints shall be composed of Type IIA Portland cement and shall be of non-shrink type mix, Seka Set or equal. No lime shall be used in the mortar.
6. The frame and cover shall be as watertight bolt down design. Raised lettering on the cover shall indicate "Sewer".
7. Manhole steps shall be plastic coated steel meeting the requirements in ASTM D2146-77, Type II, Grade 49108, "M.I.A. Industries" polypropylene manhole step, MSU #360 ALU Poly manhole step or approved equal with foot recess and suitably scored to provide a nonslip surface.

C. Adjusting Manhole

Where called for on the plans or authorized by the Engineer, existing covers to be changed eighteen inches (18") or less shall be removed and brickwork added or removed to adjust the cover to the proper elevation.

D. Reconstruction Manholes

Where called for on the plans, existing manholes shall be reconstructed to the required line and elevation as shown on the plans, using the covers from the existing structures or providing new covers where so specified. Precast manholes shall be reconstructed by removing cone and/or riser sections and replacing them as required to meet the changed line and/or elevations.

This item shall apply where the elevation of the top of cover is to be changed more than eighteen inches (18"), or where the cover grade adjustment would result in a distance from the top of cover to top of cone exceeding 18".

E. Drop Connections

All drop connections shall be internal drop connections and are required when the invert of the incoming sanitary sewer is greater than 18 inches above the invert of the outgoing sanitary sewer. All drop pipes shall be constructed as shown on the standard detail sheet.

F. Abandoning Manholes

When abandoning any manhole, it shall be pumped dry and all pipes entering or leaving the manhole shall be bulkheaded with an eight inch (8") brick bulkhead. Manholes less than three feet (3') in depth shall be abandoned by completely destroying and removing the structure from the site. Manholes more than three feet (3') deep shall be destroyed to an elevation three feet (3') below the finished grade and the destroyed portion shall be removed from the project site. After the above conditions have been completed, the excavation shall be backfilled with sand well compacted in six inch (6") layers to the subgrade elevation or finished elevation of the project.

G. Stubs, Connections, Bulkheads and Miscellaneous Items of Work

Tapping existing manholes, for sewers 6" through 15" shall be accomplished utilizing the Kor-n-Seal method.

When tapping existing manholes for an 18" diameter or larger sewer, the Contractor shall drill holes at four inches (4") center to center with a star drill around the periphery of the opening to create a plane of weakness before breaking out the wall.

Where called for on the drawings, existing sewers shall be connected in strict conformance with the plans, with all work done with special care and in a workmanlike manner.

Unless otherwise noted on the drawings, stubs shall consist of two (2) full lengths of sewer pipe with removable, watertight, stoppers, compatible with the pipe used and as approved by the Engineer.

When connections are made with sewers carrying sewage, special care must be taken to insure that no part of the work is built under water. A flume or dam must be installed and pumping maintained, if necessary. The new work shall be kept dry until completed and any concrete or mortar has set up.

### ***XIII EPOXY COATING OF PIPE AND STRUCTURES.***

When required, a minimum coating (or lining) of 30 dry mils of coal tar epoxy shall be applied to the inner surfaces of concrete pipe, sanitary manholes or junction chambers. The Contractor, or manufacturer, shall apply the epoxy in one coat (a prime coat is also allowed) after preparing the concrete surface by sandblasting and dust removal, or as otherwise recommended by the manufacturer of the epoxy. The epoxy shall be applied to dry concrete surfaces and dry cured for 72 hours at 50°F.

The coal tar epoxy shall be CTE-200 manufactured by Wise Chemical Company of Pittsburgh, PA or equal.

The Contractor shall repair any damaged or missing epoxy on precast products prior to installation.

The plans, proposal or Engineer shall indicate what portions of concrete pipe barrel inside surface shall be coated. Normally, the entire interior surface shall be coated.

Unless otherwise provided, the exposed interior surface of manholes, including base and risers, shall be coated when specified. Junction chambers shall be coated as directed. If not otherwise provided, the base, roof, interior walls and manhole riser sections shall all be coated.

### ***XIV. TESTING.***

#### **A. General**

All sanitary sewers and laterals shall have acceptance tests conducted for tightness. Tests shall follow the backfilling of trenches and be prior to the connection of live leads or laterals.

All sewers twenty-four inch (24") in diameter and smaller shall be tested using low pressure air and where the ground water is above the sewer invert may also be tested for infiltration. In areas where the ground water is more than five feet (5') above the sewer invert, the Contractor shall air test with the dewatering system turned off and after the ground water has returned to its normal level.

All sewers above twenty-four inch (24") in diameter shall be tested using infiltration or exfiltration tests.

The Contractor may, at his option, test any or all of the sewer lines prior to backfilling. However, such tests shall be in addition to the required test following the backfilling of the trench.

Following the completion of the first section of sewer, if the Engineer feels that there is some question as to the installation of the sewer, the Engineer may direct the

Contractor to conduct a presumptive test to check his installation for defective pipe or faulty joints before it is completely covered with backfill material.

The Contractor shall make provisions for determining the ground water level prior to testing, and the level will be confirmed by the Engineer.

All tests shall be observed by the Engineer. Testing schedule and procedures may be required by the Engineer prior to the start of the work.

Truss and plastic pipe shall also be tested with a mandrel for deflection. Deflection limits shall not exceed 5% after 30 days, and 7% after 24 months.

The Contractor shall provide the necessary materials, equipment and personnel to conduct the tests.

Acceptance test sections shall generally be limited to a maximum length of one-half mile, including laterals. The Owner reserves the right to test shorter pipe length segments if it is deemed necessary to assure that no segment exceeds the infiltration limit. In no case shall the length be less than between two manholes.

The Contractor shall clean and flush the pipe prior to conducting acceptance tests.

For those sections of sewer that cannot pass the acceptance test, TV, segmented testing or visual inspection shall be made to examine the length of sewer being tested to locate possible cracks, breaks, bad joints or misaligned pipe sections. Any cracks, breaks, bad joints or misaligned pipe sections located by the inspection shall be removed and replaced by the Contractor, or the Engineer may order the reconstruction of the defective portion of the sewer. After all repair work has been completed, the test shall be repeated. Final acceptance of the sewer being tested will not be made until satisfactory tests have been made.

All visible leakage in sewers or manholes shall be repaired even though acceptance tests have been satisfactory.

#### B. Presumptive Tests

After the pipe section to be checked is plugged, air shall be supplied to the pipe section at a rate sufficient to maintain an internal pressure of 4.0 psig. The exposed surface of the pipe, fittings and plugs shall then be sprayed with a foamable soap solution to detect by foam any abnormal leakage due to cracks, holes or improperly sealed joints. All sources of abnormal leakage shall be corrected. After all corrections are made, air shall again be added until an internal pressure of 4.0 psig is obtained. The pressure shall then be allowed to decrease to 3.5 psig, at which time a stop watch shall be started to determine the total time required for the internal pressure to decrease to 2.5 psig.

If the time, in sections, for air pressure to decrease from 3.5 psig to 2.5 psig is greater than the holding time listed in the air test tables contained in the Low Pressure Air Test for Sanitary Sewers Manual published by the National Clay Pipe Institute, the pipe shall be presumed free of defects (in accordance with ASTM C12-82).

### C. Air Testing

#### 1. General

Test equipment shall include source of compressed air, air hose, plugs, hose connections, shut off valve, throttling valve, cage cock, monitoring pressure gauge, delicate 0.1 psi graduated pressure gauge and stop watch.

In all test pressures noted, a pressure adjustment of 0.433 psi pressure for each foot of ground water level above the invert of the pipe being tested shall be added.

Safety precautions shall be carefully observed by the Contractor during air testing, recognizing the danger from plugs blowing out. No person shall be allowed in manholes during testing.

#### 2. Isolate Pipe to be Tested

The section of pipe to be tested is plugged at each end. The ends of all branches, laterals and wyes which are to be included and in the test are plugged. All plugs are carefully braced to prevent slippage and blow-out due to the internal pressure.

#### 3. Add Air

Supply air to the pipe section. Monitor the air pressure so that the pressure inside the pipe does not exceed 5.0 psig, plus adjustment for ground water.

#### 4. Stabilize

When pressure reaches 4.0 psig, throttle the air supply so that the internal pressure is maintained between 4.0 and 3.5 psig, plus adjustment for ground water, for at least two (2) minutes. If plugs are found to leak, bleed off the air, tighten the plugs and begin again supplying air.

#### 5. Determine Rate of Air Loss

The control equipment consists of pressure gauges, valves and a pocket stop watch. After the temperature has been allowed to stabilize for the two (2) minute period, the air supply is disconnected and the pressure is allowed to decrease to 3.5 psig. At 3.5 psig the stop watch is started to determine the time required for the pressure to drop to 2.5 psig (NOTE: make proper

pressure adjustment for ground water, where applicable, in determining the beginning and end of the period for the 1.0 psig pressure drop). The pipeline shall be considered acceptable if the time interval for the 1.0 psi pressure drop is greater than the holding time listed in the following air test table.

MINIMUM AIR TEST TIME  
FOR VARIOUS PIPE SIZES

<u>Nominal Pipe Size, In.</u>	<u>T (Time) Min./100 Ft.</u>
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6

D. Infiltration/Exfiltration Tests

In sanitary sewers, weirs shall be placed temporarily for testing purposes in such manholes as necessary to measure the amount of infiltration. Such tests will be at the option of the Engineer and may be any length of sewer between two (2) manholes, the entire length of sewer under contract or any combination of sewer reaches.

The allowable amount of infiltration shall not be more than 50 gallons per inch diameter of the sewer laterals per mile of sewer per twenty-four (24) hours. The allowable amount of infiltration shall include the infiltration into manholes.

If, in the Engineer's opinion, there is not sufficient ground water for infiltration testing of various sections of sewer, then exfiltration tests will be conducted. The allowable amount of exfiltration shall not be more than 50 gallons per inch diameter of the sewer and laterals per mile of sewer per twenty-four (24) hours.

E. Deflection Tests

The completed installation shall be tested by the Contractor upon completion of the air test for pipe deflection. The maximum allowable deflection at the time of initial testing is 5%. The Contractor shall be required to replace, at no additional cost to the Owner, any pipe line where the out of round deflection exceeds 5%. The testing and replacement costs will be at no expense to the Owner.

All pipe shall be tested using a 9 sided mandrel for horizontal and vertical deflection, no earlier than 30 days following initial construction and any reconstruction.

The Owner reserves the right to re-test for deformation within the first 24 months after the project has been accepted. If any ABS or truss pipe are found to exceed a maximum allowable deflection of 7% it shall be replaced by the Contractor at no cost to the Owner, by the Contractor.

F. Television Inspection of Sanitary Sewers

As part of the final inspection, the Contractor shall provide for television inspection of the various sanitary sewer lines installed under this contract.

The Contractor shall arrange for, engage and pay all expenses involved for the services of a competent company to perform this television inspection. The inspection shall be carried out under the direct supervision of the Engineer with all television inspection being observed by representatives of the Owner, Engineer, and the Contractor.

Any television viewing performed in the absence of the Engineer and a representative of the Owner (such as the Owner's Engineer) will not be considered as a part of the final inspection.

All television inspection shall be recorded on a video tape and turned over to the Township for ready reference at a later date. The tape must be as specified under "Audio-Visual Record of Construction Site".

The inspection shall involve the visual observation by closed circuit television of all sanitary sewer eight (8) inches in diameter and larger installed as part of this contract. The inspection shall be performed at a rate of speed which will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment of line or grade, location of all wye openings and any defects or items of poor workmanship which may appear. Any items which, in the opinion of the Engineer, require repair shall be precisely located and photographed along with a detailed statement of the condition. The Contractor shall take immediate action to repair all such defects including any visual infiltration at any specific location, even though the infiltration limits as specified have not been exceeded for the entire length of sewer being inspected. Following completion of the repair, the Owner or the Engineer at their discretion, may require a second television inspection of the repaired area. The Contractor shall arrange for and pay all costs involved in performing the reinspection.

As a part of the television inspection, the precise location of each wye shall be noted in relation to the downstream manhole. These locations shall be entered on the wye location sheet as supplied by the Project Engineer and verified by comparison with the locations as established at the time of construction. Any discrepancies in location between the field location record and the television inspection record shall be reconciled and the proper location of the wye determined as a part of the television inspection. Two copies of all notes, photographs, wye locations and other pertinent information shall be made as a part of the television inspection. One set of this information shall be turned over to the representative of the Project Engineer upon the

completion of the inspection of each line. The second copy of the information shall be held by the television inspection company until completion of the project at which time it shall be neatly assembled and turned over to the Engineer as a complete, comprehensive report on the television inspection of the project.

- XV. *BARRICADES AND WARNING SIGNS.*** Protection of the work, property and persons within the scope of this project shall be in accordance with the Michigan Manual of Uniform Traffic Control Devices.

Where work is carried on, in or adjacent to any street, alley or public place, the Contractor shall, at his own expense, furnish and erect such barricades, fences, lights and danger signals, shall provide such watchmen and shall take necessary precautionary measures for the protection of persons or property and of the work. Barricades shall be painted white or yellow, so as to be visible at night. The paint shall be renewed as often as necessary to keep the barricades substantially covered. From sunset to sunrise, the Contractor shall furnish and maintain at least one (1) light at each barricade.

A sufficient number of barricades shall be erected to keep vehicles from being driven on or into any work under construction. The Contractor shall furnish watchmen in sufficient numbers to protect any new work. Failure to comply with this requirement will result in the Owner shutting down the work until the Contractor shall have provided the necessary protection. In areas where the Contractor's work may impede or otherwise interrupt normal traffic flow, the Contractor shall, at his own expense, provide a flagman. In the event that the Contractor blocks off a road, the Contractor shall provide necessary detour signs to re-route traffic properly. No road may be blocked off, or otherwise closed to traffic until the Contractor has received written permission as to the time and place (and any other pertinent information) from the appropriate highway agency of jurisdiction.

The Contractor will be held responsible for all damage to the work due to failure of barricades, signs, lights and watchmen to protect it, and whenever there is evidence of such damage, if found prior to acceptance, the Owner may order the damaged portion immediately removed and replaced by the Contractor at his own expense. The Contractor's responsibility for the maintenance of barricades, signs and lights and for providing watchmen shall not cease until the project has been accepted by the Owner. This work will be incidental to the construction except when the pay item "Traffic Maintenance and Control" is provided.