



# **GROVELAND TOWNSHIP ENGINEERING DESIGN STANDARDS**

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# Groveland Township

## Engineering Design Specifications

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# **I. General Requirements and Procedures**

The site plan review process will follow the procedures and standards prescribed by Groveland Township Ordinance Chapter 54 – Zoning of Groveland Township, Chapter VI - Site Plan Review. These engineering standards are not intended to repeal, abrogate, annul or in any manner interfere with the existing regulations or laws of Groveland Township, nor to conflict with any statutes of the State of Michigan or Oakland County, except that these standards will prevail in cases where these standards impose a greater restriction than is provided by the existing statutes, laws or regulations.

## **A. Preliminary Site Plan**

1. The preliminary site plan process will follow the procedures and standards prescribed by Sections 54.1131 through 54.1139 of Chapter 54– Zoning of Groveland Township Code of Ordinances and the requirements specified herein.
2. Groveland Check List for Preliminary Site Plans
  - a. Topography
    - i. A complete topographical survey, at two (2) foot intervals, prepared by a licensed and registered, in the State of Michigan, surveyor is required for all proposed projects. The topographic survey shall present the current conditions of the site. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements with liber and page number shall also be shown on the plan view of the existing conditions.
    - ii. A minimum of two benchmarks are required. All benchmarks shall be clearly indicated on the plans. All elevations shall be to North American Vertical Datum 1988 (NAVD-88), or most current national datum.
    - iii. Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. On-site, intermittent elevations and/or defined contours contour interval shall not exceed 2 foot intervals) are required to establish the existing site drainage.
    - iv. Existing features shall be located and shown within 100’ of the project. Existing features to be shown shall include, but may not necessarily be limited to the following items:
      1. Ditches
      2. Culverts
      3. Water supply system, storm water management and/or sanitary sewer (septic system) facilities, including inverts and casting elevations at all structures.
      4. Gas, telephone, electric and cable television lines, including manholes, lighting structures and/or utility poles
      5. Pedestrian facilities
      6. Trees (8” in diameter measured at 4’ above ground) and other landmark vegetation
      7. All streams, lakes, wetlands and/or county drains with names shown
      8. Existing buildings and structures

9. Any pavement areas, including gravel
  10. Fences, signs, retaining walls, etc
- v. Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:
    1. Right-of-way or easement line
    2. Ditch centerline
    3. Top of bank
    4. Edge of shoulder
    5. Edge of pavement and/or top of curb
    6. Crown or centerline
- b. Water Supply System
    - i. Domestic and commercial water supply systems shall meet the current requirements of the State of Michigan, Oakland County Health Division and the agency supplying water for the system.
    - ii. Fire protection wellheads shall be located to provide 500-foot radial coverage, or coverage radius approved by the Groveland Township Fire Chief, of all existing and proposed permanent structures.
    - iii. No parking within 20' of any fire protection well head.
  - c. Sanitary Sewer
    - i. Domestic and commercial sanitary systems and septic systems shall meet the current requirements of the State of Michigan, Oakland County Health Division and the agency receiving sanitary sewer discharge from the system.
  - d. Storm Water Management Systems
    - i. Preliminary design calculations prepared in accordance with the Rules of the Oakland County Drain Commissioner's Office (OCDC) Procedures and Design Criteria for Storm Water Management Systems, latest revision, shall be provided on the plans.
    - ii. Restricted discharge rates and/or improvements to downstream drainage courses may be required by the OCDC. Any necessary improvements shall be shown on the plans.
    - iii. Proposed collection points, system layout, sizes and outlets must be shown on the site plan. Also show preliminary invert elevations and top of casting elevations.
    - iv. Where required, a minimum 25' wide easement must be shown on the plans. For storm sewers proposed to be more than six (6) feet deep the minimum easement width shall be such that the side slope of excavation does not exceed 3 feet horizontal to 1 foot vertical plus 10 feet. The greater width of the two shall be applied to determine easement width.
    - v. Any storm water discharge(s) into wetlands or waters of the State will require the review and approval of the Michigan Department of Environmental Quality (MDEQ).
    - vi. Means of providing detention, other than detention or retention, are discouraged, but will be considered on a "case by case" basis:

1. Underground storage systems
  2. Oversized storm pipes
- e. Paving Improvements
- i. Paving improvements for parking lots, internal roads and pedestrian facilities on private sites shall be designed in accordance with the requirements prescribed herein.
  - ii. All roads must conform to the requirements prescribed in the Road Commission for Oakland County (RCOC) Procedures and Guidelines for Developing Public Roads, latest revision. Private roads, when permitted, shall conform to the requirements of the Township Zoning Ordinance Article V Sect. 54-983 (Private Streets).
  - iii. On-site Paving Requirements:
    1. Pavement cross-section must be shown in accordance with Township requirements
    2. Bituminous pavements shall have a minimum slope of 1.0% and a maximum slope of 6.0%
    3. Concrete pavements shall have a minimum slope of 0.5% and a maximum slope of 6.0%
- f. Site Grading and Earthwork
- i. Sufficient proposed grades shall be indicated on the plans to ensure that:
    1. Drainage is adequately discharged offsite with proper detention or properly retained on site
    2. No upstream drainage is restricted
    3. The site in general drains without standing water
    4. No downstream properties experience flooding due to drainage related to the development
  - ii. Elevation representing the finished grade, abutting the structure, and the first floor grade must be indicated. Each elevation shall be clearly labeled as either finished grade or first floor grade.
  - iii. Proposed grading shall meet abutting property line elevations. A maximum slope of 1 vertical to 4 horizontal may be employed to meet existing grades at property lines. Grading along existing or proposed property lines shall be in accordance with the Rules of the Oakland County Drain Commissioner Procedures and Design Criteria for Storm Water Management Systems, latest revision.
  - iv. Easement from adjacent property owner will be required for any grading necessary on offsite property. All offsite easements required to complete the work shall be obtained prior to the start of construction.

## **B. Engineering/Construction Plans**

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1. The engineering/construction plan process will follow the procedures and standards prescribed by Sections 54.1131 through 54.1139 of Chapter 54– Zoning of Groveland Township Code of Ordinances and the requirements specified herein.

2. The applicant shall submit a total of five (5) sets of Engineering/Construction plans for review. The plans, completed application form and required fees shall be submitted to the Groveland Township Planning Division. The Township Planning Department will forward the application and Engineering/Construction plans to the necessary staff, consultants and other reviewing agencies as appropriate. All reviews will be submitted back to the Township Planning Division. It is the responsibility of the applicant to provide plans to be reviewed by outside agencies (i.e. RCOC, OCDC, MDEQ, etc) directly to that agency.
3. Three copies of a detailed itemized construction cost opinion for all public water facilities, public sanitary sewer facilities, storm sewer, retention/detention basins, grading and paving shall be submitted to the Township Planning Department at the time of the initial Engineering/Construction plan submittal. The cost opinion must be signed and sealed by the applicant's design engineer.
4. If plan revisions are required following the review, the applicant shall prepare revised plans accompanied by a complete list of all changes, certified as such by the applicant's design engineer. Full sets of plans must be resubmitted to the Township Planning Division. Submittals will not be reviewed unless they are received from the Township Planning Division.
5. Groveland Township Check List for Engineering/Construction Plans
  - a. General Requirements
    - i. Submittal on 24" x 36" white paper having blue or black lines with a minimum horizontal scale of 1" = 50' and vertical of 1" = 5'. Other acceptable scales are 1" = 20'; 1" = 30' and 1" = 40'.
    - ii. General plan at 1" = 100' or 1" = 200' when size of site prohibits a single plan sheet. Street names, units, utilities, pavement, site dimensions, phase lines, lot lines and lot numbers shall be shown.
    - iii. A location map showing section number(s) and major thoroughfares in the project area shall be provided and shown on the cover sheet of the plans.
    - iv. Lot number, parcel dimensions and adjoining rights-of-way shall be shown.
    - v. Plans must be signed and sealed by a professional engineer registered in the State of Michigan.
    - vi. Name, address and phone number of the applicant and the design engineer shall be shown on the plans.
    - vii. Legal description of property shall be provided on the plans.
    - viii. The overall site layout shall be primarily unchanged from the "approved" preliminary site plan.
    - ix. Both existing and proposed utilities must be a minimum of 10' from existing or proposed buildings.
    - x. North arrow, scale and MISS DIG notice must be shown on the plans.
    - xi. The storm water management facilities, sanitary sewer facilities and water main facilities shall be shown on the same plan view. The landscaping plan shall be overlaid in light scale for reference; plantings must not interfere with utilities.
    - xii. When more than three (3) plan sheets are in a set, a cover sheet with an index shall be provided and each plan sheet shall include a title block providing a summary of the information presented on that sheet.

- xiii. Adequate space must be provided to allow for turning movements of vehicles including trucks and fire engines per AASHTO guidelines.
  - xiv. Provide a minimum of 2 benchmarks. The benchmarks must be referenced to the North American Vertical Datum of 1988 (NAVD '88), or most current national datum. All benchmark locations shall be clearly indicated on the plans.
- b. Topography
- i. A complete topographical survey, at two (2) foot contour intervals, is required for all proposed projects. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements with liber and page number shall also be shown on the plan view of the existing conditions. Existing site contour lines shall be provided at a maximum of 2' intervals
  - ii. Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. On-site, intermittent elevations and/or defined contours (minimum contour interval of 2 feet) are required to establish the existing site drainage.
  - iii. Existing features shall be located and shown within 100' of the project. Existing features to be shown shall include, but may not necessarily be limited to the following items:
    - 1. Ditches
    - 2. Culverts
    - 3. Water supply system, storm water management and/or sanitary sewer facilities, including inverts and casting elevations at all structures.
    - 4. Gas, telephone, electric and cable television lines, including manholes and/or utility poles
    - 5. Pedestrian facilities
    - 6. Trees (8" in diameter measured at 4' above ground) and other landmark vegetation
    - 7. All streams, lakes and/or county drains with names shown
    - 8. Existing buildings and permanent structures
  - iv. Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:
    - 1. Right-of-way or easement line
    - 2. Ditch centerline
    - 3. Top of bank
    - 4. Edge of shoulder
    - 5. Edge of pavement or top of curb
    - 6. Crown or centerline
- c. Water Supply System
- i. Water distribution system improvements shall be designed in accordance with the requirements of the Michigan Safe Drinking Water Act, Act 399 of the Public Acts of 1976, as amended; as well as the latest revisions of the standards prescribed by the American Water Works Association (AWWA), Oakland

County Health Division (OCHD), the agency supplying water for the system standards, and as specified herein.

- ii. Plan and profile views shall be provided for all proposed water mains including fire protection wells. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  1. A water main quantity list shall be provided on the cover sheet of the detailed engineering plans.
  2. The following information must be shown in the plan view of the proposed water supply system improvements:
    - a. Type, class and size of pipe
    - b. Length between fittings and/or appurtenances
    - c. Where required, a dedicated water main easement must be shown on the plans. The easement width shall be the greater of the following: the width of an excavation such that the side slope of excavation does not exceed 3 feet horizontal to 1 foot vertical plus 10 feet, or 20'. Where water main is adjacent to and parallel to the right-of-way, a water main easement must be extended across the entire frontage of the property.
  3. The following information must be shown in the profile view of the proposed water supply system improvements:
    - a. Type, class and size of pipe
    - b. Length between fittings and/or appurtenances
    - c. Top of casting elevation on valve wells and/or boxes as well as the finished grade for fire protection wells
    - d. Crossing of all existing and proposed utilities, including leads
    - e. Granular backfill, trench details, special bedding, bores and/or other special construction methods
    - f. Existing and proposed ground elevations
- iii. Fire Protection Wells
  1. Generally, fire protection well heads shall be spaced such that not more than 500' of fire hose would be required to reach the farthest corner of any proposed building. Spacing of fire protection wells around multiple, commercial or manufacturing establishments shall be considered on an individual basis and shall be determined by consultation with the Township Engineer and the Township's Fire Chief.
- d. Sanitary Sewer
  1. Sanitary sewer facilities shall meet or exceed the requirements of the State of Michigan Health Department, the Oakland County Health Division (OCHD) and the agency receiving sanitary sewer discharge from the system. In addition, sanitary sewer facilities shall be designed in accordance with the requirements of Part 41 of Act 451 of the Public Acts of 1994, as amended, the most recent revision of the Recommended Standards for Sewage Works by the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (commonly known as the "Ten States Standards") and as prescribed herein.

- e. Storm Water Management Systems
  - i. Storm water management systems shall be designed in accordance with the Rules of the Oakland County Drain Commissioner’s Office (OCDC) Procedures and Design Criteria for Storm Water Management Systems, latest revision. The basis of detention pond sizing shall be the 100-year storm event. The basis of retention pond sizing shall be two back-to-back 100-year storm events.
  - ii. Restricted discharge rates and/or improvements to downstream drainage courses may be required as prescribed by the Oakland County Drain Commissioner’s Office. Any necessary improvements shall be shown on the plans.
  - iii. Where an approved point of discharge is not available on the site, the applicant shall make such offsite drainage improvements as are necessary to provide positive drainage to an approved outlet, as determined by the Township Engineer and/or the OCDC. Such improvements shall be located in an easement secured by the applicant. The easement shape and width shall be subject to Township approval.
  - iv. Plan and profile views shall be provided for all proposed storm water management system improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented. If possible, paving improvements shall be shown in the same view.
    - 1. Design calculations for all components of storm water management systems, including but not necessarily limited to storm sewers, channels and detention facilities shall be provided on the plans.
    - 2. A drainage area map shall be included on the plans. The map shall define the areas tributary to catch basins and inlets (including upstream and offsite areas). The design calculations shall include the determination of the weighted runoff coefficients for the areas tributary to each specific inlet or outlet. The design calculations shall also include justification for the initial time of concentration used for the storm sewer design calculations.
    - 3. The following information must be shown in the plan view of the proposed storm sewer system improvements:
      - a. Size, material and type of pipe;
      - b. Length between structures;
      - c. Slope of sewer between structures;
      - d. Where required, a dedicated storm water easement must provided. The easement width shall be in accordance with the following:
        - 1. A minimum of 20’ for enclosed storm drains
        - 2. A minimum of 24’ plus the top width of the channel for open swales
      - e. Top of casting and all invert elevations at each structure
      - f. Progressive numbering system on structures
    - 4. The following information must be shown in the profile view of the proposed storm sewer system improvements:

- a. Existing and proposed ground elevations
  - b. Size, material and type of pipe
  - c. Length between structures
  - d. Slope of sewer between structures
  - e. Hydraulic gradient between structures
  - f. Top of casting and all invert elevations at each structure
  - g. All utility crossings
  - h. Special backfill areas (i.e. sand)
  - i. Progressive numbering system
  - j. Adjacent existing or proposed utilities plotted where parallel
- v. Components of storm water management systems shall be designed in accordance with the requirements of the OCDC, as noted previously. The OCDC design criteria shall apply to all storm water management system components, regardless of whether the facilities will be publicly dedicated or privately maintained at the completion of the project.
- 1. Where public sewer construction is proposed, the Oakland County Drain Commissioner's office standard detail sheets must accompany the plans.
  - 2. Any system proposing private storm water management facilities shall provide a maintenance agreement for the storm water management system.
- vi. Any development proposing detention, retention and/or storage systems are required to obtain soil borings from a licensed and registered, in the State of Michigan, Geotechnical Engineer. Borings shall be conducted to a minimum depth of 20-feet from the proposed bottom elevation in any areas of proposed storm water storage. All soil boring shall be filled with bentonite or other means approved by the Township Engineer, in no case shall the boring be left unfilled or create a public hazard. Soil boring logs shall be presented on the plans. Soil borings shall have the following information:
- 1. Soil composition (sand, silty sand, organic matter, etc.) based upon USGS classification system
  - 2. Ground water elevation, if encountered
  - 3. Depth of boring
- a. Paving Improvements
- i. All roads proposed for construction in Groveland Township shall be public roads under the jurisdiction of Road Commission for Oakland County (RCOC) unless otherwise permitted by Township ordinance. Plans for such roads and/or accompanying sidewalks/bikepaths shall be prepared in accordance with RCOC "Procedures and Guidelines For Developing Public Roads", latest revision. In addition to any submittals required for RCOC approval, plans shall also be submitted to Groveland Township for review of the proposed road improvements in relation to other existing and proposed facilities. The applicant shall submit two (2) sets of RCOC approved paving plans to the Township upon County approval. Private roads, when permitted shall conform to the requirements of the Township Zoning Ordinances Article V Sec 54-983 (Private Streets).

- ii. Paving improvements for parking lots, internal roads and pedestrian facilities on private sites shall be designed in accordance with the requirements prescribed herein.
- iii. Areas where refuse dumpster rest shall be constructed of concrete. The cross-section shall be designed to accommodate the loading for the fully loaded dumpster and truck utilized for removal of refuse.
- iv. Concrete curb and gutter will be required for all private roadway construction and parking lot construction with the following exceptions:
  - 1. Industrial storage yards not used for regular road vehicle parking
  - 2. Bituminous curb may be substituted for concrete curb and gutter in commercial parking lot construction.
- v. Underground storm sewers, including edge drains for parking lots and roads, shall be designed and installed with all paving improvements which require concrete curb and gutter or asphalt curb. Where pavements are to be constructed over clay soils or other poorly drained soils and a granular subbase is used, an approved subdrainage system shall be installed. Edge drain shall extend a minimum of 50-feet, in each direction, under the curb line from any installed catch basin or inlet located in the curb line.
- vi. Plan and profile views shall be provided for all proposed paving improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically aligned. If possible, storm water management improvements shall be shown on the same plan sheet as the paving improvements.
  - 1. The plans shall include typical cross section(s) showing dimensions, materials, type and thickness of the proposed paving improvements.
  - 2. The following information shall be shown in the plan view of the proposed paving improvements.
    - a. Existing right-of-way or road easement as well as the proposed right-of-way or road easement
    - b. Centerline alignment, including curve data, stationing, edge of pavement and/or curb. Centerline and stationing are not required for parking lots
    - c. Location of existing and proposed topographic features, including utilities
    - d. Parking lots shall have spot grades provided in a grid pattern. The grid spacing shall not exceed 25 feet by 25 feet.
    - e. Location of existing and proposed traffic control devices (both permanent and temporary for construction)
    - f. Location of existing and proposed street-light poles
    - g. Location of all existing trees
    - h. Location of all existing and proposed pedestrian facilities.
  - 3. The following information shall be shown in the profile view of the proposed paving improvements. Profiles are not required for proposed parking lots.

- a. Existing and proposed ground elevation at the centerline (for rural roads) or top of curb (for urban roads) and gutter pan or centerline of ditch
- b. Location of all drainage structures, within the roadway influence
- c. Percent of grade and vertical curve data
- d. Utility crossing information

vii. Cross Sections

- 1. Dimensional widths and thickness of materials and associated road features shall be designed in accordance with the typical road cross sections prescribed by the RCOC. The cross section requirements will be based on the functional class of the road as designated by the RCOC.
- 2. For parking lots and internal roads at nonresidential sites, the cross section requirements will be based on the functional class of the public road serving the property. The minimum width for an internal drive shall be 26' measured from the back-of-curb to back-of-curb or edge of pavement to edge of pavement for non-curbed internal roads.
- 3. Pedestrian facilities shall be designed in accordance with the requirements prescribed by the RCOC and current requirements of the Americans with Disabilities Act (ADA).

viii. Horizontal Alignment

- 1. Horizontal alignment of pavement and associated road features shall be designed in accordance with the requirements prescribed by the RCOC.
- 2. Pedestrian facilities will be located within the right-of-way with the permission of the RCOC. The horizontal alignment of pedestrian facilities shall be as close to parallel as practical to the right-of-way or easement.

ix. Vertical Alignment

- 1. The vertical alignment of all public roads, internal roads and parking lots shall be designed in accordance with the requirements prescribed by the RCOC.

b. Site Grading and Earthwork

- i. All proposed developments should be graded such that water runoff will be intercepted within the boundaries of the site and conducted through a storm water management system to an approved point of discharge.
- ii. Easements for surface drainage shall be dedicated and recorded.
- iii. For perimeter lots, the drainage easement width shall be 20' minimum, and for abutting lots with a common rear yard lot line, the easement width shall be at least 10' on each lot.
- iv. The following information must be shown in the plan view of the proposed grading:
  - 1. Grading plans shall be drawn to a scale of 1" = 50' or larger.
  - 2. The grading plans shall show the existing elevation topography either by contour method or grade point grid method.
  - 3. High and low street grade points, slope direction (by arrow) and the location of all catch basins, inlets and drainage ditches shall be shown on the grading plan.

4. A detail of the typical lot drainage pattern shall be shown on the grading plan with all grade control points identified. This will include the first floor (F.F.), or the foundation grade (F.G.) elevations, high point (grade break), drainage arrows and additional spot elevations to clarify site grading.
  5. The location(s) of any retaining wall creating a difference in height in excess of 18” from top of wall to bottom of wall.
- v. The following information shall be presented for retaining walls, sheeting, bracing and shoring operations.
1. All retaining wall, sheeting, bracing and shoring operation designs shall be accompanied by a signed and sealed letter from the engineer of record certifying that structures have been designed in accordance with all applicable structural design codes (with the codes identified), and that all applicable safety factors, standards and codes (identifying safety factors) have been met or exceeded. A qualified geotechnical engineer shall review the soil conditions.
  2. Type of retaining wall or structure
    - a. Concrete Walls and Structures
    - b. Block and Timber Retaining Walls and Structures
- c. Soil Erosion & Sedimentation Control
- i. Soil erosion and sedimentation control measures shall be incorporated into the design and construction of all projects as specified in Soil Erosion Act, Part 91 of PA 451 of 1994, as amended. All projects shall be designed and constructed so as to minimize soil erosion and sedimentation impacts to the environment.
  - ii. All proposed temporary and permanent soil erosion and sedimentation control measures shall be shown on the plans. All soil erosion control measures shall be identified in accordance with the Michigan Unified Keying System.

## **C. Fees**

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1. The applicant shall pay all fees established in Chapter 18 – Fees, of the Groveland Township Code of Ordinances.
  - a. The applicant shall establish a construction inspection escrow account in accordance with Chapter 18 – Fees, of the Groveland Township Code of Ordinances and as specified herein to cover costs associated with the inspection of public utilities and private road improvements and all facilities related to these improvements and/or as directed by the Township.
  - b. The construction inspection escrow deposit amount will be determined based upon the following methods:
    - i. The deposit may be based on the estimated duration of the construction operations based on typical construction production rates. The Township Engineer will complete the estimate for the escrow deposit.
    - ii. The deposit may be adjusted based on the schedule proposed by the applicant’s contractor. Said schedule shall be provided to the Township Engineer no later than 2 weeks prior to the preconstruction meeting.
  - c. The applicant shall deposit the inspection escrow monies with Groveland Township at least 48 hours prior to the preconstruction meeting.

- d. Inspection related fees will be invoiced monthly against the inspection escrow account based upon the established hourly rate by Groveland Township and/or the Township Engineer. If the escrow account is exhausted before the work is completed, the work will be stopped until the applicant deposits additional escrow monies with Groveland Township. Prompt attention to reestablishing this deposit will prevent the project construction from being stopped and/or occupancy permits withheld. At the conclusion of the work and the acceptance of record plans, any funds remaining in the inspection escrow account will be returned to the applicant.
- e. Any facilities requiring inspection that are installed without inspection will not be accepted by the Township.

#### **D. Guarantees**

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1. The applicant shall furnish security and guarantees outlined in Chapter 54 – Zoning Article VII – Site Improvement Section 54-1161. Security and guarantee is required for completion of the project as depicted on the approved final site plans. The applicant shall post with Groveland Township a two-year Maintenance and Guarantee Bond in an amount equal to 100% of the installation cost of the public utilities, private road and private storm facilities after final acceptance. It should be noted that other agencies having jurisdiction over the project or any portion thereof might also require performance and/or maintenance guarantees.

#### **E. Permit Requirements**

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1. The applicant shall be responsible for obtaining all permits required for the project prior to the start of construction operations. Copies of all necessary permits shall be forwarded to both the Township Planning Department and the Township Engineer prior to the start of any construction operations. Permits necessary for the project include, but are not necessarily limited to, the following:
  - a. Groveland Township Building Permit: The applicant shall obtain a building permit as prescribed by Section 54-1574 of Chapter 54 – Zoning of Groveland Township Code of Ordinances.
  - b. Oakland County Drain Commissioners Office Soil Erosion and Sedimentation Control Permit: This permit is required prior to final site plan approval. The applicant shall obtain a soil erosion permit as prescribed.
  - c. Permit for Water System Construction: Construction of private water facilities (wells) requires the permitting of the State of Michigan and/or Oakland County Health Division (OCHD), dependant upon the size. The construction of public facilities require the review and permit of the controlling agency and the MDEQ.
  - d. Permit for Wastewater Systems Construction, Alteration, Addition or Improvement: Construction of public and/or private sanitary sewers requires the permitting of the State of Michigan and/or Oakland County Health Division (OCHD), dependant upon the size.
  - e. Permit to Construct, Operate, Maintain, Ingress/Egress, Use and/or Remove pavement within a County Road Right-of-Way: All work in right-of-way under the jurisdiction of Road Commission for Oakland County requires a permit from the Road Commission for Oakland County (RCOC). The applicant shall be responsible for coordinating any reviews, fees, etc., directly with the RCOC.

- f. Oakland County Drain Commissioner’s Office Approval: Any work associated with storm water management facilities that are to be dedicated to the Oakland County Drain Commissioner’s office or connections to previously established county drains shall be reviewed and approved by the Drain Commissioner’s office. The applicant shall be responsible for coordinating any reviews, fees, etc., directly with the Drain Commissioner’s office.
- g. Michigan Department of Environmental Quality (Wetlands, Inland Lakes and Streams): It is the applicant's responsibility to obtain MDEQ permits as required by Act 451 of the Public Acts of 1994. Applicable sections of the act include, but are not necessarily limited to, Part 301 – Inland Lakes and Streams, and Part 303 – Wetland Protection.
- h. Michigan Department of Environmental Quality (N.P.D.E.S.): It is the responsibility of the applicant to obtain any necessary certificates of coverage and/or permits related to N.P.D.E.S. Phase I and Phase II requirements.
- i. Permit for Use of State Trunkline Right-of-Way (Michigan Department of Transportation): All work in state trunkline right-of-way is under the jurisdiction of the Michigan Department of Transportation (MDOT) requires a permit from MDOT. The applicant shall be responsible for coordinating any reviews, fees, etc., directly with MDOT.
- j. Other Permits: Other agencies from which the applicant may need a permit will need to be designated on the approved plan. The applicant shall be responsible for coordinating any reviews, fees, etc., directly with the agencies having jurisdiction. Additional agencies may include but are not limited to electric, gas, telephone, cable, etc.

## **F. Field Requirements**

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1. Prior to starting any construction operations, the applicant must obtain all required permits, provide copies of all necessary permits to the Township and Township Engineer and attend a preconstruction meeting. Unless otherwise specified, all meetings will be held at the Groveland Township Hall. The applicant shall be responsible for arranging all meetings including notifying all required attendees in writing. Attendees at the preconstruction meeting (as well as any project progress meetings) shall include representatives from the Township, the Township Engineer (if requested by the Township), the applicant, the applicant’s design engineer and the applicant’s contractor. In addition, representatives from any utility companies whose facilities may be affected by the project as well as any state, county or other agencies having jurisdiction over portions of the project shall be invited to attend. It shall be the responsibility of the applicant to contact the Township and Township Engineer (if requested by the Township) a minimum of 10 calendar days prior to the start of construction to schedule the preconstruction meeting. The preconstruction meeting shall be scheduled a minimum of 5 days prior to the start of construction. The preconstruction meeting will not be scheduled or conducted until all required approvals and documentation is received by the Township Planning Department.
2. The applicant shall be responsible for ensuring that all construction operations are conducted in conformance with the current MIOSHA safety standards. In addition, the applicant shall provide to the Township in writing a copy of the site safety plan, prior to the scheduling of a pre-construction meeting. The submission of a safety plan does not in any way imply, direct or require the Township, Township’s agent, Township Engineer or Township Engineer’s agent to verify or enforce compliance with the submitted safety plan.

The submission does not abrogate the applicant or applicant's agent from complying with and/or enforcing the requirements of the submitted safety plan and MIOHSA requirements.

3. The Township or its designated representative will provide observation of all public utilities and improvements. Observation will be full time on storm sewers, sidewalks, approaches, on-site paving and private road paving. The Road Commission for Oakland County will provide inspection for work in existing public right-of-way and on any road improvements that will be dedicated as public facilities. The Oakland County Drain Commissioner's office will provide inspection for work associated with county drains. The Township or its designated representative may provide assistance observing portions of the project for the other agencies.
4. The applicant or the applicant's contractor shall notify both the Township and Township Engineer a minimum of 3 working days prior to the start of any construction operations.
5. All improvements requiring observation shall be field staked in accordance with the approved engineering/construction plans. The applicant shall be responsible for the field staking. Copies of "cut sheets" shall be provided to the Township Engineer prior to the start of installation.
6. Deviations from the approved construction plans that are determined by the Township or its designated representative to be significant will require review and approval of the Township Engineer prior to staking and construction of the revised work. Deviations that are deemed to be significant will need to be submitted in writing (with revised plans as necessary) to the Township and Township Engineer for review. Some deviations from approved plans may require review and approval by the Township Planning Commission.
7. At the completion of the installation of all underground utilities and paving improvements, said facilities will be subject to a substantial completion inspection. Within 30 days of the substantial completion inspection, a post-construction meeting will be held. The post-construction meeting will serve to finalize all punchlist items, exchange construction observation daily reports and to discuss guarantee reduction as well as the final acceptance process. Attendees at the post-construction meeting shall include representative from the Township, the Township Engineer (at the request of the Township), the applicant, the applicant's design engineer and the applicant's contractor. The applicant shall be responsible for notifying all required attendees in writing as well as requested punchlist items from all other agencies having jurisdiction over portions of the project.
8. During the time between the substantial completion inspection and final acceptance of the underground utilities and paving improvements, said facilities will be subject to periodic inspection by the Township or its designated representative during the completion of all surface improvements (commercial buildings, residences, etc.). Upon the completion of all improvements associated with the project, all underground utilities and paving improvements will be subject to a final inspection. No facilities to be designated as public will be accepted until they have passed the final inspection. The applicant shall be responsible for providing all labor and equipment to accommodate inspection of the system(s) by the governing municipality and/or agencies having jurisdiction over the project.

## **G. Record Plan Requirements**

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1. It is required that the applicant provide a complete digital file of the approved detailed engineering/construction plans to Groveland Township at the time of the pre-construction meeting. Requirements for digital file format are included in Appendix B – Digital Plan Requirements.

2. The applicant has 90 days after the completion of the utility construction to prepare and submit to the Township Engineer an approvable set of record plans. These record plans will be submitted in a digital format and on good quality Mylar. Digital record plan specifications are included in Appendix A – Record Plan Requirements
3. In the event the applicant fails to submit the required approvable record plans to the Township Engineer within the 90-day period, the Township will utilize the applicant's bond and utilize it to have the required record plans prepared by the Township Engineer. If it is determined that the applicant has failed to submit the required plans within the allotted time, the Township will direct the Township Engineer to prepare the plans utilizing the digital plans previously submitted. Once this notification to proceed has been given to the Township Engineer, delivery of the record plans to the Township will be made within 90 days of that date.

## **H. Contacts**

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1. Groveland Township  
Planning Division  
4695 Grange Hall Road  
Holly, MI 48442  
(248) 634-4152  
(248) 634-4151 fax
2. Groveland Township Fire Department  
Station #1  
14645 Dixie Highway  
Holly, MI 48442  
(248) 634-7722  
  
Station #2  
3091 Grange Hall Road  
Holly, MI 48442  
(248) 627-6500
3. Sanitary (Septic) Sewer and Water Main (Wells)  
Oakland County Health Division  
1200 North Telegraph, Building 36 East  
Pontiac, Michigan, USA, 48341  
(248) 858-1280  
(248) 858-0178 fax
4. Roads  
Road Commission for Oakland County  
31001 Lahser Road  
Beverly Hills, MI 48025  
(248) 858-4804
5. Storm Water Management  
Oakland County Drain Commissioner's Office  
Public Works Building (#95)  
One Public Works Drive  
Waterford, Michigan 48328  
(248) 858-0958

6. Township Planner and Landscape Architect Consultant  
 Vilican Leman  
 24725 W 12 Mile Road Suite 306  
 Southfield, MI 48034  
 (248) 356-8181  
 (248) 356-0902 fax
7. Township Engineer  
 Orchard, Hiltz & McCliment, Inc.  
 34000 Plymouth Road  
 Livonia, Michigan 48150  
 (734) 522-6711  
 (734) 522-6427 fax
8. Township Engineer  
 Wehner Engineering and Construction Consultants  
 Mr. Kenneth H. Wehner, P.E.  
 6265 Tripp Road  
 Holly, Mi 48442  
 (248) 634-4088  
 (248) 634-0688 fax
9. Township Attorney  
 Williams, Williams, Ruby & Plunkett, P.C.  
 380 North Old Woodward Avenue, Suite 300  
 Birmingham, MI 48009  
 (248) 642-0856
10. Wetlands, Lakes and Streams  
 Michigan Department of Environmental Quality  
 301 E. Louis Glick Highway  
 4<sup>th</sup> Floor  
 State Office Building  
 Jackson, Michigan 49201  
 (517) 780-7900
11. State Environmental Health Section  
 Michigan Department of Environmental Quality  
 Water Division  
 525 West Allegan  
 P.O. Box 30273  
 Lansing, MI 48909-7773  
 (517) 373-7917
12. State Trunkline Right-of-Way Permit  
 Michigan Department of Transportation  
 800 Chanter Road  
 Jackson, Michigan 49201  
 (517) 780-7500

13. Gas

Consumers Energy  
Main Replacement Team  
Noble Second Floor  
3200 Hobson  
Detroit, Michigan 48201

14. Electric

DTE Energy  
Case Manager  
1970 Orchard Lake Road  
Sylvan Lake, MI 48320  
(248) 745-5020

15. Telephone

AT&T  
502 Beach, Room 402  
Flint, MI 48502-1210  
(810) 768-0105

16. Cable Television/Telephone

Comcast Cable Communications, Inc.  
3008 Airpark Drive South  
Flint, MI 48507  
(810) 235-7471

## II. Topography

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### A. General

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1. A complete topographical survey, at two (2) foot contour intervals, is required for all proposed projects, prepared by a licensed and registered, in the State of Michigan, Surveyor. A metes and bounds legal description of the project site shall be provided on the plans. Property lines shall be indicated by bearing and distance in the plan view. All existing easements with liber and page number shall also be shown on the plan view of the existing conditions.
2. A minimum of two benchmarks are required. All benchmarks shall be clearly indicated on the plans. All elevations shall be to North American Vertical Datum – 1988 (NAVD-88), or current national datum.
3. Existing offsite elevations must be given at a minimum of 50 feet and 100 feet abutting the entire perimeter of the site. Grades will be indicated at all property corners and along all property lines. On-site, intermittent elevations and/or defined contours (minimum contour interval of 2 feet) are required to establish the existing site drainage.
4. Existing features shall be located and shown within 100 feet of the project. Existing features to be shown shall included, but may not necessarily be limited to the following items:
  - a. Ditches.
  - b. Culverts.
  - c. Water supply system, storm water management and/or sanitary sewer facilities, including inverts and casting elevation at all structures.
  - d. Gas, telephone, electric and cable television lines, including manholes and/or utility poles.
  - e. Pedestrian facilities.
  - f. Trees (8" in diameter measured at 4' above ground) and other landmark vegetation
  - g. All streams, lakes and/or county drains with names shown.
  - h. Existing buildings and permanent structures.
5. Existing adjacent roads and existing right-of-way or easement lines shall be shown on the plans and shall extend across the entire site with grades shown on both sides of the road for:
  - a. Right-of-way or easement line.
  - b. Ditch centerline.
  - c. Top of bank.
  - d. Edge of shoulder.
  - e. Edge of pavement or top of curb.
  - f. Crown or centerline.

### **III. Water Supply System**

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#### **A. General**

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1. Water distribution system improvements shall be designed in accordance with the requirements of the Michigan Safe Drinking Water Act, Act 399 of the Public Acts of 1976, as amended; as well as the latest revisions of the standards prescribed by the American Water Works Association (AWWA), Oakland County Health Department (OCHD), and as specified herein.
2. Plan and profile views shall be provided for all proposed water main including fire protection well(s). The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  - a. A water main quantity list shall be provided on the cover sheet of the detailed engineering plans. The quantity list shall be delineated by existing or proposed road right-of-way or easement.
  - b. The following information must be shown in the plan view of the proposed water supply system improvements:
    - i. Type, class and size of pipe;
    - ii. Length between fittings and/or appurtenances;
    - iii. Water service locations and sizes;
    - iv. Where required, a dedicated water main easement must be shown on the plans. The easement width shall be the greater of the following: the width of an excavation such that the side slope of excavation does not exceed 3 feet horizontal to 1 foot vertical plus 10 feet, or 20'. Where water main is adjacent to and parallel to the right-of-way, a water main easement must be extended across the entire frontage of the property.
  - c. The following information must be shown in the profile view of the proposed water supply system improvements:
    - i. Type, class and size of pipe;
    - ii. Length between fittings and/or appurtenances;
    - iii. Top of casting elevation on valve wells and/or boxes as well as the finished grade for fire protection wells;
    - iv. Crossing of all existing and proposed utilities, including leads;
    - v. Granular backfill, trench details, special bedding, bores and/or other special construction methods;
    - vi. Existing and proposed ground elevations.
  - d. Design details of joints and joint restraint, including any necessary design calculations, shall be provided on the plans.

#### **B. Design Criteria**

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1. Water Main
  - a. Water main shall be designed and constructed with a minimum 5½' depth of cover over the top of pipe as measured from the proposed finish grade. A minimum 18"

vertical clearance shall be maintained between water mains and other underground utilities. Where the vertical alignment of the water main must be deflected in order to achieve the required vertical clearance, the length of the deeper main shall be kept to a minimum and standard 45° bends shall be used to effect the necessary deflection.

- b. A minimum 10' horizontal separation shall be maintained between water main and sanitary sewers and/or storm sewers. A minimum 5' horizontal separation shall be provided between water mains and other underground utilities and/or structures.

## 2. Joint Restraint

- a. Joints shall be restrained per manufacturer or as approved by Township Engineer, tied or harnessed at all deflections of 1 1/4° or greater, behind tee outlets, at protection well shoes, at plugs or caps and at any crosses to prevent lateral movement of the pipe.
- b. A joint restraint schedule, provided by the pipe manufacturer, shall be presented on the plans.
- c. Concrete thrust blocks will not be permitted, unless specifically allowed by the Township Engineer. Where allowed, concrete thrust blocks shall bear against undisturbed earth in all instances and shall have sufficient bearing area to develop the full resultant axial thrust of the pipe at test pressure. The concrete thrust block shall not cover fastener nuts and/or threaded connections that would hinder future maintenance or repairs of fittings or valve assemblies.

## 3. Fire Protection Wells

- a. For the purposes of providing fire protection to the public, all buildings and structures shall have water supply for firefighting purposes, that will provide a reasonable degree of protection to life and property in accordance with the standards set forth in NFPA-1231, as amended, in accordance with the following requirements:
  - i. For residential protection, one fire protection well for every 1,000 feet of road frontage for every eight conventional homesites and one fire protection well for every 500 feet of road frontage for clustered homesites, which shall be supplied.
  - ii. For nonresidential protection, one fire protection well for every 200 feet of development frontage, capable of supplying water at sufficient volume and duration to satisfy applicable building and fire codes.
  - iii. A minimum of one (1) fire protection well shall be established for any development.
- b. The fire protection well shall meet or exceed the following requirements:
  - i. A residual pressure of 20 pounds per square inch
  - ii. Maintain a flow rate of 300 gallons per minute of flow
- c. The distance of the wells from buildings will depend on the height of the building. The well will be located at least a distance equal to the height of the building from the building's exterior walls. At a minimum, fire wells shall be located at least 25' from exterior wall of any masonry building, and at least 50' from any exterior wall of frame or equivalent construction, including brick and stone veneer.
- d. All buildings with sprinkler systems shall have a fire protection well located within 100' of the fire pumper hose Siamese connection located on the building exterior.
- e. No domestic service connections will be permitted from fire protection wells.

## C. Materials

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1. Water Mains
  - a. All water mains shall be ductile iron pipe manufactured in accordance with AWWA C151 (ANSI A21.51), latest revision thereof. Pipe shall be a minimum standard wall thickness Class 54 for pipe diameters of 6" thru 16" inclusive, thickness Class 55 for 20" ductile iron water main and thickness Class 56 for ductile iron water mains larger than 20".
  - b. Ductile iron pipe shall be standard cement double thickness lined in accordance with AWWA C104 (ANSI A21.4), latest revision thereof. Pipe exterior shall be seal coated with an approved bituminous seal coat.
  - c. If other materials are proposed for use, the applicant shall furnish the necessary design data for the proposed depth and operating conditions. Use of materials other than ductile iron will not be allowed unless approved by the Township Engineer.
  - d. The use of asbestos pipe material is prohibited.
2. Fittings
  - a. Fittings shall be ductile iron, 350 psi working pressure rating, meeting the requirements of AWWA C110 (ANSI A21.10), or AWWA C-153 (ANSI A21.53) compact fittings, with cement mortar lining. Cement mortar lining shall meet AWWA C104 (ANSI A21.4) specification for a double thickness lining with a bituminous seal coat.
  - b. Fittings for pipe materials other than ductile iron will be allowed upon the review and approval of the Township Engineer. The applicant shall furnish the necessary design data for the proposed depth and operating conditions.
3. Joints
  - a. Joints shall be push-on type meeting the requirements of AWWA C111 (ANSI A21.11). Mechanical or flanged joints will be allowed for special applications, subject to the approval of the Township Engineer. Sealing gaskets, retainer glands and lubricants for joints shall meet pipe manufacturer's specifications.
  - b. Rubber gaskets and lubricant shall be furnished with the pipe and shall meet the pipe manufacturer's requirements. Restrained joints shall be installed in accordance with that described in the Joint Restraint Section.
  - c. Sealing gaskets, retainer glands and lubricants for joints shall meet pipe manufacturer's specifications.
  - d. Where bell and spigot pipe and fittings may be necessary for occasional connections to existing water mains, shop drawings of such pipe and fittings shall be submitted to the Township Engineer by the applicant for approval.
4. Joint Restraint
  - a. Ductile Iron Joints where required shall be restrained by an approved mechanical restraining gland or instant push-on restraining device.
  - b. Push-on Joints shall be restrained with approved instant joint-retaining device such as Field Lok Gasket manufactured by U.S. Pipe Company or approved equal. Other acceptable manufactures include American Lok-Ring, Flex-ring, or Fast-Grip Gaskets, and TR Flex by U.S. Pipe. A restraining schedule must be provided by the pipe supplier or manufacture and must be submitted and approved by the Township Engineer prior to installation.
  - c. Mechanical Joint-Retaining Glands where allowed shall be the "Megalug Series" as

- manufactured by EBAA Iron or approved equal.
- d. Thrust blocks, where allowed, shall be made of 3,000 psi concrete and of adequate size and shape to resist all design working and surge pressures to which the main will be subjected. A detail of any proposed thrust blocks shall be provided on the plans.
  - e. All joint materials and lubricants shall be furnished with the pipe, including all material required for connection to existing water mains and appurtenances.
  - f. Harnessed joints and steel reinforced concrete anchorage will be required on pipes larger than 16" diameter.
5. Fire Protection Wells
- a. Fire protection wells shall be installed with Groveland Township Fire Department approved fitting(s). The fitting(s) shall have either a 4" or 5" diameter Storz connection. Alternative methods of Fire Department connections are only permitted with the written approval of the Groveland Township Fire Chief.
  - b. The Fire Department fitting(s) and well head shall be painted Rustoleum "Fire Hydrant Red" or approved equal.

## **D. Construction Methods**

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### 1. General

#### a. Certification and Inspection

All pipe and fittings delivered to the job shall be accompanied by certification papers showing that pipe and fittings have been tested in accordance with the applicable specifications and that pipe and fittings meet the specifications for this project. All pipe and fittings will be inspected upon delivery to the job site. No cracked, broken or damaged pipe or fitting will be allowed. The applicant at his expense will immediately remove rejected pipe and fittings from the job site.

No pipe or fittings known to be defective shall be allowed. Any piece found to be defective after it has been laid shall be removed by the proprietor and replaced with a sound piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut shall be square and ground smooth. Cut surfaces of ductile iron pipe shall be painted with two coats of approved asphaltum metal protective paint where required by the Township Engineer.

#### b. Excavation

Excavation, bedding, and backfill for open cut pipe installations structures shall be accomplished in accordance with requirements in the Grading and Earthwork Section.

### 2. Laying Pipe

#### a. Handling Pipe and Fittings

All pipes and castings shall be unloaded and distributed along the line of work in such manner and with such care as will effectually avoid damage to any pipe or fitting. Dropping pipe or fittings directly from the truck will not be permitted. Care must also be taken to prevent abrasion of the pipe coating. Wherever the coating may have been rubbed off, the part shall be recoated as may be required by the nature of the pipe coating.

b. Placement of Pipe

Each pipe shall be inspected for defects prior to being lowered into the trench. The inside of the pipe and the outside of the spigot shall be cleaned of any dirt or foreign matter.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in the direction of flow. Pipes shall be laid on a minimum 4" sand cushion. A 6" sand cushion shall be provided if called for on the plan details. If the subgrade has been disturbed so that refilling is necessary to bring the pipe to grade, such refilling shall be done with MDOT 6A coarse aggregate thoroughly tamped in place. Bell holes shall be excavated so that the full length of the pipe barrel will bear uniformly on the sand cushion.

Pipes shall be centered in bells or grooves and pushed tight together to form a smooth and continuous invert. After laying pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be re-laid properly.

c. Line and Grade

Pipe shall be carefully laid to line and grade and shall have bearing over its entire length except at joints where the joint hole shall be of such size as to give adequate room for working. Pipe shall be laid with a minimum cover as shown on the standard details.

d. Excavation Below Bottom of Pipe

As a result of construction procedures or where excavation has not uncovered a stable foundation subgrade at a depth of 6" below the bottom of the proposed pipe, excavation shall continue downward below the bottom of the proposed pipe to reach stable foundation soil. The space resulting from such excavation and the pipe bedding shall be filled and constructed with MDOT 6A coarse aggregate and bedding as specified in the Grading and Earthwork section.

e. Laying and Bedding of Pipe

Pipe installation shall be made in accordance with the published installation guide of the pipe manufacturer except as otherwise specified herein. Whenever instructions given by the manufacturer are at variance with the provisions specified herein, the laying standards provided herein shall govern.

Proper tools, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gauges, etc. shall be provided at the site of the work for installation of the pipe.

Immediately before laying each section of pipe or fitting, it shall be thoroughly cleaned of all debris; dirt or other accumulated foreign material. It shall be inspected for damage to the coating or pipe material and repairs shall be made where required. If deemed irreparable by the Township Engineer, then it shall be removed from the job site. Care shall be taken to keep the interior of previously laid pipe clean and free from dirt and other foreign material. Bulkheads or other means shall be used at the open end of the previously laid pipe for this purpose.

After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe, the pipe shoved into proper position in the collar or bell and brought into true alignment. The pipe shall then be secured with MDOT 2NS natural sand that is carefully tamped under and on each side of the pipe.

f. Concrete Cradle for Pipe

Where required, pipe shall be installed with a cradle of MDOT Grade S3 concrete.

Each pipe shall rest on a 6" minimum thickness bed of dry mix concrete that is shaped to fit the bottom of the pipe. The dry mix concrete shall be MDOT Grade S3.

After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be filled to a level equal to a point 1 foot above the top of the pipe with MDOT Grade S3 concrete. The concrete shall have a 5" slump and be mechanically vibrated to insure complete filling of the annular space between the excavated face of the original ground and the outside face of the pipe.

g. Pipe Placed in Casings:

Pipes will be placed in casing pipe in the locations shown on the drawings. Under this work the contractor will place the carrier pipe, fill the annular space between the casing and carrier pipe, place bulkheads, and complete all backfilling.

For road crossings, all void spaces between the casing pipe and the carrier pipe will be filled with sand meeting the requirements of MDOT 2NS natural sand. Sand will be placed by flushing or other methods approved by the Township Engineer. The contractor will furnish the Township Engineer with information on the quantity of sand placed.

The annular space at the ends of the casing pipe will be bulkheaded with a minimum of 8" thick solid masonry with a ½" fiberboard cushion between the masonry and carrier pipe.

All necessary skidding materials required to protect the carrier pipe will be furnished. Skidding materials shall be pressure treated wood 4"x 4" lumber and shall be notched so that metal wire or straps that brace the skids to the water main can not slide during installation.

h. River Crossings

River crossing shall be made with a freely deflecting locked joint pipe. Pipe shall be ductile iron with bell ball type joint. Pipe shall be the same class and grade as called for on the plans and in the laying schedule. Ball joint river crossing pipe may be installed by pulling or floating across the river.

Trench shall be backfilled with clean washed stone.

i. Jointing

Restraints shall be applied to all joints that deflect pipe equal or greater than 1 ¼ °, including tees, protection well shoes, reducers, plugs and caps. For push-on joints, approved restraints are required at the joint and in each direction at an adequate distance to resist the axial thrust of the test pressure. Where mechanical joints are allowed by the Township Engineer proper restraints shall also be installed in each direction at an adequate distance in combination with approved mechanical restraints at the joint.

No thrust blocks shall be installed in combination with approved restraints unless specified by the Township Engineer.

All joint materials shall be assembled in accordance with standard practice, the manufacturer's recommendations and as specified on the plans.

j. Backfill shall be placed in accordance with the Grading and Earthwork Section.

3. Structures and Appurtenances

Valves, fittings and protection wells shall be installed using current standards for joints being used for this project. Wherever adapters are required to connect the proposed water main with an existing pipe of another material, the nominal inside diameter of the adapter shall not be smaller in diameter than either of the adjacent pipes. Special machined faced parts shall be provided where required to connect to existing mains.

Air release valves shall be provided at high points on water transmission mains.

a. Fire Protection Wells

At points indicated on the drawings, a protection well assembly will be installed consisting of a protection well and all pipe necessary for a complete job.

Each protection well will be set plumb and braced firmly in this position. Connection of the protection well to the branch will be made by means of mechanical joints, as herein specified under jointing.

After the protection well has been set, an additional 1' depth of gravel will be spread and tamped around the protection well. When this has been done, the remaining backfill will be placed and compacted, taking care at all times to avoid jarring the protection well.

b. After protection wells have been set and tested, the part above ground will be painted with two coats of first quality metal protective paint. The color shall be Rustoleum "Fire Hydrant Red" or approved equal.

4. Cleaning

Prior to hydrostatic testing, newly constructed water mains less than 24" in diameter shall be thoroughly flushed to remove all accumulated debris that may have entered the line during construction. Flushing shall include the use of a "polly pig" or approved equal equipment, to remove accumulated deposits. The frequency of running the "polly pig" through the water mains shall be determined by the debris discharging from the effluent. Several passes with the "polly pig" through the newly constructed system may be required before the main is acceptable. Procedures for use of the "polly pig", or approved equal equipment, shall be per the manufacturer's specifications. Mains 24" in diameter and larger shall be manually cleaned and inspected during installation.

5. Testing

a. Hydrostatic

After pipe-laying and backfilling, the proprietor shall complete all work necessary to perform hydrostatic testing. These tests shall be conducted no more than 60 days after the completion of installation.

The hydrostatic testing shall be conducted in accordance with AWWA C600, latest revision.

The proprietor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible leaks and cracks, and retests with his own personnel to ready the water mains for final hydrostatic inspection and testing. Immediately after the water mains have passed such preliminary tests, the proprietor shall perform a final hydrostatic inspection and test.

The hydrostatic test shall be conducted before the new water main is connected to the existing water system, except as specified below. The proprietor shall furnish all necessary personnel, temporary blow-offs, plugs, bracing, test pumps and all other necessary apparatus for conducting the test. Testing shall be conducted under the observation of the Township Engineer.

At the option of the Township Engineer, testing may be performed against closed valves providing that the new main to be tested and the testing apparatus shall have first been flushed and chlorinated in accordance with accepted procedure. After chlorination and subsequent flushing, a sample of water must show safe bacteriological results through a test by a recognized laboratory. In the event of an unsatisfactory hydrostatic test the proprietor will cut the new main, install caps or plugs, pressure test and re-chlorinate.

Before applying test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of highest elevation in the pipe and such openings subsequently closed, prior to test, with tight threaded brass plugs.

For ductile iron water main, test pressure shall be maintained at 150 psi at the point of highest elevation in the test section by pumping potable water into the pipe for a period of at least 2 hours and in all cases long enough to permit assurance of a satisfactory test. Leakage is measured by the quantity of water pumped into the pipe to maintain 150 psi.

According to AWWA C600, for ductile iron water main, the leakage during the test shall not exceed a rate of:

$$L = \frac{S * D \sqrt{P}}{133,200}$$

Where: L = Allowable Leakage (gallons per hour)

S = Length of Pipe Tested (feet)

D = Nominal Pipe Diameter (inches)

P = Average Test Pressure (psi)

Minimum size pressure gauge is to be 3½” in 1 pound increments. Any faulty pipe, fittings, gate valves or other accessories disclosed by testing shall be replaced with sound materials and the test shall be repeated as often as necessary until the specified requirements have been met.

b. Fire Protection Well Testing

Each protection well assembly shall be tested. Test shall consist of flushing the protection well for a minimum of 10 minutes. The applicant shall provide all necessary equipment (pumps, flow meters, fittings, etc.) and labor for making the tests and hoses for disposal of water. A testing schedule and method of disposing of flushing water shall be submitted to the Township Engineer and Fire Department for approval. The testing schedule shall be coordinated with the Fire Department, Groveland Township and the Township Engineer.

## IV. Sanitary Sewer Systems

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### A. General

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1. Sanitary sewer facilities shall meet or exceed the requirements of the Oakland County Health Division (OCHD) and the agency receiving sanitary sewer discharge from the system. In addition, sanitary sewer facilities shall be designed in accordance with the requirements of Part 41 of Act 451 of the Public Acts of 1994, as amended, the most recent revision of the Recommended Standards for Sewage Works by the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (commonly known as the “Ten States Standards”) and as prescribed herein.
2. Plan view shall be presented for all sanitary sewer systems including force mains, where an on-site sewage disposal system is proposed. The following information shall be shown in the plan view of the proposed sanitary sewer system improvements:
  - i. Size, material and type of pipe
  - ii. Length between structures;
  - iii. Slope of sewer between structures;
  - iv. Where required, a dedicated sanitary sewer easement must be shown on the plans. The easement width shall be the greater of the following: the width of an excavation such that the side slope of excavation does not exceed 3 feet horizontal to 1 foot vertical plus 10 feet, or 25'. Where sanitary sewer is adjacent to and parallel to the right-of-way, a sanitary sewer easement must be extended across the entire frontage of the property.
  - v. Top of casting and invert elevations at each structure;
3. Plan and profile views shall be provided for all other proposed sanitary sewer system improvements including force mains. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  - a. Sanitary sewer design flow computations, the sanitary sewer district map and a sanitary sewer quantity list shall be provided on the cover sheet of the detailed engineering plans. The design flow computations and sanitary sewer district map shall include both current and future service populations and areas. The quantity list shall be delineated by existing or proposed road right-of-way or easement.
  - b. The following information must be shown in the plan view of the proposed sanitary sewer system improvements:
    - i. Size, material and type of pipe
    - ii. Length between structures;
    - iii. Slope of sewer between structures;
    - iv. Where required, a dedicated sanitary sewer easement must be shown on the plans. The easement width shall be the greater of the following: the width of an excavation such that the side slope of excavation does not exceed 3 feet horizontal to 1 foot vertical plus 10 feet, or 25'. Where sanitary sewer is adjacent to and parallel to the right-of-way, a sanitary sewer easement must be extended across the entire frontage of the property.
    - v. Top of casting and invert elevations at each structure;
    - vi. Progressive numbering system on structures.

- c. The following information must be shown in the profile view of the proposed sanitary sewer system improvements:
  - i. Existing and proposed ground elevations;
  - ii. Length, type, class, size and slope of pipe between structures;
  - iii. Top of casting and all sewer inverts at all structures;
  - iv. All utility crossings;
  - v. Special backfill areas, i.e. sand;
  - vi. Provisions for infiltration testing;
  - vii. Progressive numbering system on structures;
  - viii. Adjacent existing or proposed utilities plotted where parallel.

## **B. Materials**

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### 1. Septic Systems

Septic systems shall be constructed using materials approved by the Oakland County Health Division.

### 2. Sanitary Sewer Pipe

- a. Gravity sanitary sewer pipe shall conform to the following American Society for Testing and Materials Specifications:
  - i. Reinforced concrete Sewer Pipe, ASTM C76, latest revision.
  - ii. Polyvinyl chloride (PVC) or ABS plastic and Perlite concrete truss pipe as manufactured by Contech Construction Products or equal; conforming to the requirements of ASTM D-2680, latest revision.
  - iii. PVC pipe and fittings shall conform to requirements of ASTM D-3034, latest revision. Solid wall PVC pipe shall have a sidewall dimension ratio (SDR) no greater than 23.5. Deflection of pipe shall be limited to a maximum of 5.0%.
- b. Force main pipe shall be one of the following:
  - i. Ductile iron pipe conforming to the material requirements prescribed in the Water Supply System section of these standards.
  - ii. PVC pressure pipe conforming to the requirements of ASTM D-3034, latest revision (SDR 21 minimum).

### 3. Pipe Joints

- a. Pipe joints for gravity sanitary sewer shall conform to the following requirements depending on the allowable type of pipe used:
  - i. Modified Grooved Tongue (MGT) joints for concrete pipe shall have a rubber gasket snapped into a groove cast in to the tongue. MGT joints shall be lubricated and coupled in accordance with the pipe manufacturer's printed instructions.
  - ii. Rubber gasket joints for concrete pipe shall be in accordance with ASTM 443 Specification for "Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets," latest revision. The rubber gasket joints shall be lubricated and coupled in accordance with the pipe manufacturer's printed instructions.

- iii. Joints on ABS truss pipe shall consist of ABS plastic couplings chemically cemented to the ends of the pipe being connected. Solvents and methods used in making the chemical bond shall be in accordance with ASTM D2680 and the manufacturer's printed instructions. The installation technique shall conform to ASTM D-2321, latest revision.
    - iv. Joints for PVC pipe shall be push-on type or solvent cemented joints in special applications as specified by the Authority's Engineer. Push-on type joints shall conform to ASTM Specification D-3212, latest revision. Solvent-cemented joints, where specified, shall conform to ASTM Specification D-2680, latest revision.
  - b. Joints and fittings for force mains shall be equal to the Groveland Township requirements for pressure pipe used in the domestic water distribution system.
- 4. Manholes
  - a. Manholes shall be constructed of precast reinforced concrete sections in accordance with Oakland County standard details.
  - b. Precast reinforced concrete manhole sections shall conform to requirements of the ASTM C478 "Specifications for Precast Reinforced Concrete Manhole Sections," latest revision.
  - c. Precast manhole joints shall be modified grooved tongue with rubber gaskets as described in C, Materials, Part 2.
  - d. Manhole steps shall be reinforced polypropylene plastic, PS2-PFS, manufactured by M.A. Industries, Inc., or approved equal or E.J.I.W. #8500 or approved equal.
  - e. Manhole covers and frame shall be East Jordan Iron Works #1040 with Type "A" cover or approved equal. Covers shall be cast with the words "SANITARY SEWER" in raised letters spaced in from the periphery of the cover.

## **C. Construction Methods**

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### Septic Systems

- a. Construction of septic systems shall meet the requirements of the State of Michigan and the Oakland County Health Department.

### Sanitary Sewer Systems

#### 1. General

##### a. Construction Progress

Unless otherwise permitted by the Township Engineer, construction of sanitary sewers shall begin at the outlet end of the sewer and precede upgrade.

##### b. Certification and Inspection

Certification papers showing that pipe and fittings have been tested in accordance with the applicable specifications and that pipe and fittings meet the specifications for this project shall accompany all pipe and fittings delivered to the job. All pipe and fittings will be inspected upon delivery to the job site. No cracked, broken or damaged pipe or fitting will be allowed in this work. Rejected pipe and fittings will be immediately removed from the job site by the proprietor at his expense.

No pipe or fittings known to be defective shall be laid in the work. Any piece found to be defective after it has been laid shall be removed by the proprietor and replaced

with a sound piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut shall be square and ground smooth. Cut surfaces of ductile iron pipe shall be painted with two coats of approved asphaltum metal protective paint where required by the Township Engineer.

c. Excavation

Excavation, bedding, and backfill for open cut pipe installations and structures shall be accomplished in accordance with requirements in the Grading and Earthwork Section.

2. Laying Pipe

a. Handling Pipe and Fittings

All pipes and castings shall be unloaded and distributed along the line of work in such manner and with such care as will effectually avoid damage to any pipe or fitting. Dropping pipe or fittings directly from the truck will not be permitted. Care must also be taken to prevent abrasion of the pipe coating. Wherever the coating may have been rubbed off, the part shall be recoated as may be required by the nature of the pipe coating.

b. Placement of Pipe

Each pipe shall be inspected for defects prior to being lowered into the trench. The inside of the pipe and the outside of the spigot shall be cleaned of any dirt or foreign matter.

Construction shall begin at the outlet end and precede upgrade with spigot ends pointing in the direction of flow. Pipes shall be laid on a minimum 4" MDOT 2NS natural sand cushion. A 6" MDOT 2NS natural sand cushion shall be provided if called for on the plan details. If the subgrade has been disturbed so that refilling is necessary to bring the pipe to grade, such refilling shall be done with MDOT 6A coarse aggregate thoroughly tamped in place. Bell holes shall be excavated so that the full length of the pipe barrel will bear uniformly on the sand cushion.

Pipes shall be centered in bells or grooves and pushed tight together to form a smooth and continuous invert. After laying pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be re-laid properly.

c. Line and Grade

Pipe shall be carefully laid to line and grade and shall have bearing over its entire length except at joints where the joint hole shall be of such size as to give adequate room for working. Pipe shall be laid with a minimum cover as shown on the standard details.

d. Excavation Below Bottom of Pipe

As a result of construction procedures or where excavation has not uncovered a stable foundation subgrade at a depth of 6" below the bottom of the proposed pipe, excavation shall continue downward below the bottom of the proposed pipe to reach stable foundation soil. The space resulting from such excavation and the pipe bedding shall be filled and constructed with MDOT 6A coarse aggregate and bedding as specified in the Grading and Earthwork section.

e. Laying and Bedding of Pipe

Pipe installation shall be made in accordance with the published installation guide of the pipe manufacturer except as otherwise specified herein. Whenever instructions

given by the manufacturer are at variance with the provisions specified herein, the laying standards provided herein shall govern.

Proper tools, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gauges, etc. shall be provided at the site of the work for installation of the pipe.

Immediately before laying each section of pipe or fitting, it shall be thoroughly cleaned of all debris, dirt or other accumulated foreign material. It shall be inspected for damage to the coating or pipe material and repairs shall be made where required. If deemed irreparable by the Township Engineer, then it shall be removed from the job site. Care shall be taken to keep the interior of previously laid pipe clean and free from dirt and other foreign material. Bulkheads or other means shall be used at the open end of the previously laid pipe for this purpose.

After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe, the pipe shoved into proper position in the collar or bell and brought into true alignment. The pipe shall then be secured with MDOT 2NS natural sand that is carefully tamped under and on each side of the pipe.

f. Concrete Cradle for Pipe

Where required, pipe shall be installed with a cradle of MDOT Grade S3 concrete.

Each pipe shall rest on a 6" minimum thickness bed of dry mix concrete that is shaped to fit the bottom of the pipe. The dry mix concrete shall be MDOT Grade S3.

After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be filled to a level equal to a point 1' above the top of the pipe with MDOT Grade S3. The concrete shall have a 5" slump and be mechanically vibrated to insure complete filling of the annular space between the excavated face of the original ground and the outside face of the pipe.

g. Pipe Placed in Casings:

Pipes will be placed in casing pipe in the locations shown on the drawings. Under this work the contractor will place the carrier pipe, fill the annular space between the casing and carrier pipe, place bulkheads, and complete all backfilling.

For road crossings, all void spaces between the casing pipe and the carrier pipe will be filled with sand meeting the requirements of MDOT 2NS natural sand. Sand will be placed by flushing or other methods approved by the engineer. The applicant will furnish the Township Engineer with information on the quantity of sand placed.

The annular space at the ends of the casing pipe will be bulkheaded with a minimum of 8" thick solid masonry with a ½" fiberboard cushion between the masonry and carrier pipe.

All necessary skidding materials required to protect the carrier pipe will be furnished.

h. Jointing

i. Gravity Pipe

Where pipe is laid in wet trenches, trenches with running sand, or in trench conditions where manual means will not allow pushing the pipe home, the applicant shall provide and use mechanical means for pulling the pipe home and holding the pipe joints tight until completion of the line. Mechanical means shall consist of a cable placed inside the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position.

ii. Pressure Pipe

Refer to the Water Supply System Section for acceptable construction methods and approved materials for joints and joint restraint of ductile iron pressure pipe.

i. Backfill

Backfill shall be placed in accordance with the Grading and Earthwork section.

3. Structures and Appurtenances

a. General

Construction methods for sanitary structures shall conform to sections 403.03.A.1, 4, and 7 of the 2003 MDOT Standard Specifications for Construction, except as herein provided.

All precast sections shall bear the stamp of an approved laboratory as having been tested and delivered from tested stock of the manufacturer.

Precast sections shall be constructed so that no more than 50% of the circumference, measured on the inside face, is deleted on any horizontal plane for sewer pipe openings. There shall be no less than 12" of residual concrete measured on any horizontal plane between pipe openings.

Excavation shall be carried to the depth required to permit the construction of the base in accordance with the requirements of the Standard Details. The excavation shall be sufficiently wide to allow for shoring, bracing, or formwork, should any or all be necessary. The excavation shall allow for accessibility in plastering the exterior of all brick masonry. The bottom of the excavation shall be trimmed to a uniform horizontal bed to receive the concrete base. The excavated section shall be completely dewatered before any concrete is placed therein.

With the exception of sanitary structures having sumps, the bottom of the structures shall be channeled to provide for smooth flow through the manhole. Channels shall be formed using MDOT Grade S3 concrete.

Connections to manholes shall be properly supported and braced where not resting on original ground so that any settlement will not disturb the connection.

i. Drop Manholes

Exterior drop manhole connections shall be constructed on sanitary manholes in conformance with the standard details whenever a sewer enters a manhole at an elevation of 18" or more above the invert of the outlet sewer pipe.

ii. Test Manholes

The first manhole upstream from the point of connection to the existing sanitary sewer system shall have a 1' deep sump that shall be filled with concrete and channeled upon successful completion of infiltration testing.

The outlet pipe from this manhole shall be plugged with a watertight stopper to prevent discharge to the existing system until acceptance of the new system. The requirement to provide a sump may be waived by the Township Engineer where testing is to be done by either low pressure air testing or by exfiltration testing.

iii. Final Grade Adjustments

Where sanitary manholes are located outside of pavements and sidewalks, final grade adjustments shall be made with precast concrete grade rings. Brick construction will not be allowed except where located in paved surfaces and approved by the Township Engineer. The manhole casting frame and concrete

adjustment rings shall be secured to precast cone section with a minimum of 4<sup>5</sup>/<sub>8</sub>" diameter cadmium coated threaded studs or bolts. All joints in the assembly shall be sealed with either rubber "O" ring gaskets or butyl rope. The maximum allowable grade adjustment using grade rings shall be 15". Final grade adjustment for manholes located in pavements and sidewalks shall be made with brick and mortar. A minimum of three (3) or maximum of six (6) courses of brick shall be placed on top of the precast cone section.

A rubber wrap, elastomeric seal, or approved equal shall be provided for watertightness around the chimney.

4. Stubs, Connections, and Bulkheads

Existing sanitary sewers shall be connected in where called for on the plans. Bulkheads shall be placed or removed where called for on plans.

Unless otherwise noted on the plans, stubs shall consist of one length of sewer pipe with watertight stopper bulkhead or, where approved by the Township Engineer, a brick and mortar bulkhead. Pipe stubs shall be of the same material as the sewer to which they connect unless specified otherwise.

5. Service Connections

a. Wyes and Risers

Wye branches, tees, or stubs fitted with suitable stoppers shall be set for each lot shown, and at such other points as called for on the plans.

Risers shall be 6" pipe and shall be constructed where shown on the plans. They shall connect to wye branches and shall be constructed as shown on the Oakland County standard detail sheet. The applicant is responsible for sealing the riser in such a fashion as to not permit the infiltration of ground water into the system. Fittings and stoppers shall be equipped with the allowable type of joint used on the sewer. Backfill at all risers shall be carefully placed and tamped sufficiently to insure against damage from backfill settlement. The termination point of any lead shall be marked with a decay resistant marker. The marker shall be located not more than 12" below grade.

b. Building Connections

Building connections shall be constructed as shown on the plans. A watertight pipe stopper shall be placed in the end of the connection. Pipe and stopper shall be equipped with the allowable type of joint used on the sewer.

The invert of the building connections at the point of terminus shall be a minimum of 10' below grade at the property line (for basement service) except where otherwise directed by the Township Engineer.

6. Cleaning

All sewers shall be thoroughly cleaned before final acceptance.

7. Testing

a. General

All sanitary sewers shall be subjected to infiltration, exfiltration or low-pressure air tests, or a combination thereof prior to final acceptance. In addition, all PVC and ABS plastic sewers shall be subjected to deflection testing by means of a nine-point deflection test mandrel.

The Township Engineer shall be present for all testing operations. If testing is to be done by the proprietor, only properly trained personnel shall be allowed to perform the testing work. If testing is to be done by municipal agency work forces, then the proprietor shall be responsible for coordinating with the inspector in order to schedule the testing.

In the event that the sanitary sewer pipe fails any of the required tests, the proprietor shall be responsible for repairing the pipe and repeating the test until acceptable results are achieved.

The Township Engineer shall approve the method of testing and measurement. The proprietor shall provide all necessary equipment and labor for making the tests.

b. Infiltration Test

All sanitary sewers that are over 24" in diameter shall be subjected to an infiltration test. Also, all sanitary sewers that are 24" in diameter and smaller and where the ground water level is more than 7' above the top of the sewer shall be subjected to an infiltration test.

The infiltration rate for all sanitary sewers shall not exceed a maximum of 200 gal./in. diameter per mile of sewer per 24 hours.

c. Low Pressure Air Test

All sanitary sewers that are 24" in diameter or smaller and where the ground water level is 7' or less above the top of the sewer shall be subjected to a low pressure air test.

The procedure for air testing of sanitary sewers shall be as follows:

The sanitary sewer line shall be tested in increments between manholes. The line shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide an airtight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be connected to the orifice. The supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3½" and a range of 0 – 10 psig. The gauge shall have minimum divisions of 0-10 psig and accuracy of plus or minus (+/-) 0.04 psig.

The sanitary sewer shall be pressurized to 4 psig greater than the greatest back pressure caused by ground water over the top of the sanitary sewer pipe. At least 2 minutes shall be allowed for the air pressure to stabilize between 3½ and 4 psig. If necessary, air shall be added to the sewer to maintain a pressure of 3½ psig or greater.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sanitary sewer. The sanitary sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3½ psig, or such other pressure as is necessary to compensate for ground water level.

The time required for the air pressure to decrease 1.0 psig during the test shall not be less than the time shown in the following Air Test Tables. The proprietor shall use the appropriate test table based upon the sanitary sewer pipe material.

d. Videotaping (Sanitary Sewers)

As a means of insuring that pipe laid was properly installed and that all joints are in a "home" position, the applicant shall provide for videotaping of 100% of the pipe footage laid. The Township Engineer shall review and approve which pipe runs are to be videotaped. The videotaping shall be done no sooner than thirty (30) days after

sewer installation is complete. The applicant shall provide 48 hours notice to the Township Engineer prior to videotaping so that a representative may be present. A satisfactory review of the videotape by the Township Engineer shall be a condition for sewer acceptance. Typical items to be reviewed on the videotape will include pipe deflection, pipe settlement, connections, joints and pipe cleanliness. If the videotape review reveals unsatisfactory conditions, all deficiencies shall be corrected and the affected pipe sections redelivered for review by the Township Engineer.

### Air Test Table

Specification Time (min:sec) Required for Pressure Drop from 3-1/2 to 2-1/2 PSIG																
When Testing One Pipe Diameter Only																
Pipe Diameter, Inches																
		4	6	8	10	12	15	18	21	24	27	30	33	36	39	42
Length of Line, Feet	25	0:04	0:10	0:18	0:22	0:27	0:32	0:36	0:45	0:54	1:03	1:12	1:21	1:30	1:39	1:50
	50	0:09	0:21	0:36	0:45	0:54	1:03	1:12	1:30	1:48	2:06	2:24	2:42	3:00	3:18	3:39
	75	0:14	0:32	0:54	1:08	1:21	1:34	1:48	2:15	2:42	3:09	3:36	4:03	4:30	4:57	5:29
	100	0:18	0:42	1:12	1:30	1:48	2:06	2:24	3:00	3:36	4:12	4:48	5:24	6:00	6:36	7:18
	125	0:22	0:52	1:30	1:52	2:15	2:38	3:00	3:45	4:30	5:15	6:00	6:45	7:30	8:15	9:08
	150	0:27	1:03	1:48	2:15	2:42	3:09	3:36	4:30	5:24	6:18	7:12	8:06	9:00	9:54	10:57
	175	0:32	1:14	2:06	2:38	3:09	3:40	4:12	5:15	6:18	7:21	8:24	9:27	10:30	11:33	12:47
	200	0:36	1:24	2:24	3:00	3:36	4:12	4:48	6:00	7:12	8:24	9:36	10:48	12:00	13:12	14:36
	225	0:40	1:34	2:42	3:22	4:03	4:44	5:24	6:45	8:06	9:27	10:48	12:09	13:30	14:51	16:26
	250	0:45	1:45	3:00	3:45	4:30	5:15	6:00	7:30	9:00	10:30	12:00	13:30	15:00	16:30	18:16
	275	0:50	1:56	3:18	4:08	4:57	5:46	6:36	8:15	9:54	11:33	13:12	14:51	16:30	18:09	20:06
	300	0:54	2:06	3:36	4:30	5:24	6:18	7:12	9:00	10:48	12:36	14:24	16:12	18:00	19:48	21:54
	350	1:03	2:27	4:12	5:15	6:18	7:21	8:24	10:30	12:36	14:42	16:48	18:54	21:00	23:06	25:33
	400	1:12	2:48	4:48	6:00	7:12	8:24	9:36	12:00	14:24	16:48	19:12	21:36	24:00	26:24	29:12
	450	1:21	3:09	5:24	6:45	8:06	9:27	10:48	13:30	16:12	18:54	21:36	24:18	27:00	29:42	32:51
500	1:30	3:30	6:00	7:30	9:00	10:30	12:00	15:00	18:00	21:00	24:00	27:00	30:00	33:00	36:30	

Note: Table SA-1 is taken from the National Clay Pipe Institute (NCPI) tables which are based upon ASTM C828 “Test Method for Low Pressure Air Test for Vitrified Clay Pipe Lines” and ASTM C924 “Standard Practice for Testing Concrete Pipe Sewer Lines by Low Pressure Air Test Method”.

## V. Storm Water Management Systems

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### A. General

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1. Storm water management systems shall be designed in accordance with the Rules of the Oakland County Drain Commissioner's Office (OCDC) Procedures and Design Criteria for Storm Water Management Systems, latest revision. The basis of detention pond sizing shall be the 100-year storm event. The basis of retention pond sizing shall be two back-to-back 100-year storm events.
2. Restricted discharge rates and/or improvements to downstream drainage courses may be required as prescribed. Any discharge points into wetland areas are required to be reviewed and approved by the Michigan Department of Environmental Quality.
3. Where an approved point of discharge is not available on the site, the applicant shall make such offsite drainage improvements as are necessary to provide positive drainage to an approved outlet, as determined by the Township Engineer and/or the OCDC. Such improvements shall be located in an easement secured by the applicant. The easement form and width of the easement shall be subject to Township approval.
4. Plan and profile views shall be provided for all proposed storm water management system improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically oriented.
  - a. Design calculations for all components of storm water management systems, including but not necessarily limited to storm sewers, channels and detention facilities, shall be provided on the plans.
  - b. A drainage area map shall be included on the plans. The map shall define the areas tributary to catch basins and inlets (including upstream and offsite areas). The design calculations shall include the determination of the weighted runoff coefficients for the areas tributary to each specific inlet or outlet. The design calculations shall also include justification for the initial time of concentration used for the storm sewer design calculations.
  - c. The following information must be shown in the plan view of the proposed storm sewer system improvements:
    - i. Size, material and type of pipe;
    - ii. Length between structures;
    - iii. Slope of sewer between structures;
    - iv. Where required, a dedicated storm water easement must be shown on the plans. The easement width shall be in accordance with the following:
      1. A minimum of 20' for enclosed storm drains.
      2. A minimum of 24' plus the top width of the channel for open swales
    - v. Top of casting and all invert elevations at each structure;
    - vi. Progressive numbering system on structures.
  - d. The following information must be shown in the profile view of the proposed storm sewer system improvements:
    - i. Existing and proposed ground elevations;

- ii. Size, material and type of pipe;
  - iii. Length between structures;
  - iv. Slope of sewer between structures;
  - v. Hydraulic gradient between structures;
  - vi. Top of casting and all invert elevations at each structure;
  - vii. All utility crossings;
  - viii. Special backfill areas, i.e. sand;
  - ix. Progressive numbering system;
  - x. Adjacent existing or proposed utilities plotted where parallel.
- e. Where public sewer construction is proposed, the OCDC standard storm sewer detail sheets must accompany the plans.

## **B. Design Criteria**

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Components of storm water management systems shall be designed in accordance with the requirements of the OCDC, as noted previously. The OCDC design criteria shall apply to all storm water management system components, regardless of whether the facilities will be publicly dedicated or privately maintained at the completion of the project.

1. Storm water discharge rates shall be determined as prescribed in items 1 and 2 of Part A of this section.
2. Surface runoff “c” factors shall be determined as outlined by the OCDC.
3. Storm water conveyance systems shall be designed per the requirements prescribed by the OCDC. The following are acceptable forms of storm water conveyance:
  - a. Natural Streams and Channels
  - b. Vegetated Swales and Open Ditches
  - c. Storm Sewers. Enclosed storm sewer systems are generally comprised of the following elements:
    - i. Pipe
    - ii. Manholes
    - iii. Catch Basins
    - iv. Inlets
  - d. Culverts
4. Detention/Retention facilities shall be designed per OCDC guidelines.

## **C. Materials**

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1. Vegetative cover for natural streams and channels, open ditches and swales, as well as detention/retention facilities shall be in accordance with the requirements of the OCDC.

2. Sewer Pipe
  - a. Storm sewer pipe shall conform to the current American Society for Testing Materials “Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”, ASTM C-76 for circular pipe, or ASTM C-507 for horizontal elliptical pipe, latest revision.
  - b. If other materials are proposed for use, the applicant shall furnish the load carrying design analysis for the pipe for the proposed depth conditions.
  - c. Minimum pipe size shall be 12” diameter. In-line restriction is permissible, if acceptable by OCDC.
  - d. Concrete pipe shall be utilized in areas under the influence of a roadway. Corrugated Metal Pipe (C.M.P.) may be utilized as driveway culverts, if acceptable by the RCOC.
3. Pipe Joints
  - a. Pipe joints shall conform to the following requirements:
    - i. Modified Grooved Tongue (M.G.T.) pipe shall have a rubber gasket snapped into a groove cast into the tongue.
    - ii. The modified groove or bell end of the pipe shall be made smooth and shall have not over a  $3\frac{1}{2}^{\circ}$  slope for sizes 12” – 24”, or a  $2^{\circ}$  slope for sizes 27” – 108”, tapered to fit the rubber gasket to tolerances as determined by the gasket manufacturer.
    - iii. Rubber gasket joints shall be in accordance with the Specification for “Joints for Concrete Pipe and Manholes, using Rubber Gaskets,” ASTM Designation: C-443, latest revision.
    - iv. Rubber gasket joints shall be lubricated and coupled in accordance with pipe manufacturer’s printed instructions.
    - v. Joint seal wrap shall be utilized on all joints on metallic pipe.
4. Manholes
  - a. Manholes shall be precast reinforced concrete sections in accordance with OCDC standard details.
    - i. Precast reinforced concrete manhole sections shall conform to the requirements of the American Society for Testing and Materials, “Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, latest revision.
    - ii. Wall thickness shall depend on depth and shall be subject to the approval of the Township’s Engineer.
    - iii. Brick for casting adjustment or concrete block for manhole, inlet, and catch basin construction shall conform to the requirements of the Michigan Department of Transportation “Standard Specifications for Construction,” latest revision. Wall thicknesses shall depend on depth and shall be subject to the approval of the Township’s Engineer.
    - iv. Pre-cast manhole joints shall be as described in Section C.3.
    - v. A minimum of two to a maximum of six adjustment courses shall be placed above the top of the cone section on all precast or block manholes.

- vi. Manhole covers and frames shall be East Jordan Iron Works #1040 with Type “B” cover, or approved equal.
  - vii. The entire outside surface of all concrete block and brick masonry portion of drainage structures shall be plaster coated with ½” thick mortar.
  - viii. All manholes on storm sewers 18” in diameter and smaller shall have 2’ deep sumps unless otherwise called for on the plans.
5. Catch Basins
- a. Catch basins shall be constructed of brick, precast manhole blocks, or precast reinforced concrete manhole sections, as described in OCDC Standard Details.
  - b. Catch basins, inlets and grates, within the influence of a roadway, shall be in accordance with the requirements of the Road Commission for Oakland County.
  - c. Lawn catch basin and inlet frames and grates shall be East Jordan Iron Works #1000, with Type “N” grate, or approved equal.
  - d. Ditch catch basin frames and grates shall be East Jordan Iron Works #1000, with Type 01 Beehive grate, or approved equal.
  - e. Parking lot catch basin frames and grates shall be selected at the discretion of the applicant’s engineer, but shall be capable of carrying the anticipated traffic loads, and shall have sufficient opening area to receive the design runoff.

#### **D. Construction Methods**

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1. Construction Progress

Unless otherwise permitted by the Township Engineer and/or the OCDC, construction of storm sewers shall begin at the outlet end of the sewer and proceed upgrade.

2. Certification and Inspection

All pipe and fittings delivered to the job shall be accompanied by certification papers showing that pipe and fittings have been tested in accordance with the applicable specifications and that pipe and fittings meet the specifications for this project. All pipe and fittings will be inspected upon delivery to the job site. No cracked, broken or damaged pipe or fitting will be allowed in this work. Rejected pipe and fittings will be immediately removed from the job site.

No pipe or fittings known to be defective shall be laid in the work. Any piece found to be defective after it has been laid shall be removed and replaced with a sound piece. If the major part of a defective pipe is sound, the good end may be cut off and used. Every such cut shall be square and ground smooth. Cut surfaces of ductile iron pipe shall be painted with two coats of approved asphaltum metal protective paint.

3. Excavation

Excavation, bedding, and backfill for open cut pipe installations structures shall be accomplished in accordance with requirements in the Grading and Earthwork Section.

4. Laying Pipe

a. Handling Pipe and Fittings

All pipes and castings shall be unloaded and distributed along the line of work in such manner and with such care as will effectually avoid damage to any pipe or fitting. Dropping pipe or fittings directly from the truck will not be permitted. Care must also

be taken to prevent abrasion of the pipe coating. Wherever the coating may have been rubbed off, the part shall be recoated as may be required by the nature of the pipe coating.

b. Placement of Pipe

Each pipe shall be inspected for defects prior to being lowered into the trench. The inside of the pipe and the outside of the spigot shall be cleaned of any dirt or foreign matter.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in the direction of flow. Pipes shall be laid on a minimum 4" MDOT 2NS natural sand cushion. A 6" MDOT 2NS natural sand cushion shall be provided if called for on the plan details. If the subgrade has been disturbed so that refilling is necessary to bring the pipe to grade, such refilling shall be done with MDOT 6A coarse aggregate thoroughly tamped in place. Bell holes shall be excavated so that the full length of the pipe barrel will bear uniformly on the sand/aggregate cushion.

Pipes shall be centered in bells or grooves and pushed tight together to form a smooth and continuous invert. After laying pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be re-laid properly.

c. Line and Grade

Pipe shall be carefully laid to line and grade and shall have bearing over its entire length except at joints where the joint hole shall be of such size as to give adequate room for working. Pipe shall be laid with a minimum cover as shown on the standard details.

d. Excavation Below Bottom of Pipe

As a result of construction procedures or where excavation has not uncovered a stable foundation subgrade at a depth of 6" below the bottom of the proposed pipe, excavation shall continue downward below the bottom of the proposed pipe to reach stable foundation soil. The space resulting from such excavation and the pipe bedding shall be filled and constructed with MDOT 6A coarse aggregate and bedding as specified in the Grading and Earthwork section.

e. Laying and Bedding of Pipe

Pipe installation shall be made in accordance with the published installation guide of the pipe manufacturer except as otherwise specified herein. Whenever instructions given by the manufacturer are at variance with the provisions specified herein, the laying standards provided herein shall govern.

Proper tools, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gauges, etc. shall be provided at the site of the work for installation of the pipe.

Immediately before laying each section of pipe or fitting, it shall be thoroughly cleaned of all debris; dirt or other accumulated foreign material. It shall be inspected for damage to the coating or pipe material and repairs shall be made where required. If deemed irreparable by the Township Engineer, then it shall be removed from the job site. Care shall be taken to keep the interior of previously laid pipe clean and free from dirt and other foreign material. Bulkheads or other means shall be used at the open end of the previously laid pipe for this purpose.

After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe, the pipe shoved into proper position in the collar or bell and brought

into true alignment. The pipe shall then be secured with MDOT 2NS natural sand that is carefully tamped under and on each side of the pipe.

f. Concrete Cradle for Pipe

Where required, pipe shall be installed with a cradle of MDOT Grade S3 concrete.

Each pipe shall rest on a 6" minimum thickness bed of dry mix concrete that is shaped to fit the bottom of the pipe. The dry mix concrete shall be MDOT Grade S3.

After setting the pipe, the space between the outside of the pipe and the undisturbed trench bank shall be filled to a level equal to a point 1 foot above the top of the pipe with MDOT Grade S3. The concrete shall have a 5" slump and be mechanically vibrated to insure complete filling of the annular space between the excavated face of the original ground and the outside face of the pipe.

g. Pipe Placed in Casings:

Pipes will be placed in casing pipe in the locations shown on the drawings. Under this work the contractor will place the carrier pipe, fill the annular space between the casing and carrier pipe, place bulkheads, and complete all backfilling.

For road crossings, all void spaces between the casing pipe and the carrier pipe will be filled in accordance with Road Commission for Oakland County (RCOC) current standards and methods.

The annular space at the ends of the casing pipe will be bulkheaded with a minimum of 8" thick solid masonry with a ½" fiberboard cushion between the masonry and carrier pipe.

All necessary skidding materials required to protect the carrier pipe will be furnished.

h. Jointing

Where pipe is laid in wet trenches, trenches with running sand, or in trench conditions where manual means will not allow pushing the pipe home, mechanical means shall be utilized for pulling the pipe home and holding the pipe joints tight until completion of the line. Mechanical means shall consist of a cable placed inside the pipe with a suitable winch, jack, or come-along for pulling the pipe home and holding the pipe in position.

All joints on pipe measuring 42" in diameter or greater and elliptical concrete pipe (42" equivalent diameter and larger) shall be cement mortar pointed on the inside.

i. Backfill

Backfill shall be placed in accordance with the Grading and Earthwork section.

5. Structures and Appurtenances

Construction methods for drainage structures shall conform to section 403.03 of the 2003 Michigan Department of Transportation Standard Specifications for Construction except as herein provided.

All precast sections shall bear the stamp of an approved laboratory as having been tested and delivered from tested stock of the manufacturer.

Precast sections shall be constructed so that no more than 50% of the circumference, measured on the inside face, is deleted on any horizontal plane for sewer pipe openings. There shall be no less than 12" of residual concrete measured on any horizontal plane between pipe openings.

Excavation shall be carried to the depth required to permit the construction of the base in accordance with the requirements of the OCDC Standard Details. The excavation shall be sufficiently wide to allow for shoring, bracing, or formwork, should any or all be necessary. Also, the excavation shall allow for accessibility in plastering the exterior of all brick masonry. The bottom of the excavation shall be trimmed to a uniform horizontal bed to receive the concrete base. The excavated section shall be completely dewatered before any concrete is placed therein.

With the exception of drainage structures having sumps, the bottom of the structures shall be channeled to provide for smooth flow through the manhole. Channels shall be formed using MDOT Grade S3 concrete.

Connections to manholes shall be properly supported and braced. Where not resting on original ground so that any settlement will not disturb the connection.

6. Stubs, Connections, and Bulkheads

Existing sewers shall be connected in where called for on the plans. Bulkheads shall be placed or removed where called for on plans.

Unless otherwise noted on the plans, stubs shall consist of one length of sewer pipe with watertight stopper bulkhead or, where approved by the Township Engineer, a brick and mortar bulkhead. Pipe stubs shall be of the same material as the sewer to which they connect unless specified otherwise.

7. Cleaning

All sewers shall be thoroughly cleaned before final acceptance.

8. Testing

a. General

The applicant shall be responsible for providing all necessary equipment and labor for making the tests.

b. Deflection Test for Plastic Pipe

The allowable maximum deflection shall be 5% of internal pipe diameter. A Deflection Test Gauge (Go, No-Go) as manufactured by Hurco Technologies, Cherne Industries, or approved equal shall be used to verify that the maximum allowable deflection standard is met. Pipe with deflections greater than 5% will be considered unacceptable and shall be replaced.

c. Videotaping (Public Storm Sewers)

As a means of insuring that pipe laid was properly installed and that all joints are in a "home" position, the applicant shall provide for videotaping of 25% of the pipe footage laid (pipe 36" diameter and smaller), with no less than one manhole run being televised on each project. The Township Engineer shall review and approve which pipe runs are to be videotaped. The videotaping shall be done no sooner than thirty (30) days after sewer installation is complete. The applicant shall provide 48 hours notice to the Township Engineer prior to videotaping so that a representative may be present. A satisfactory review of the videotape by the Township Engineer shall be a condition for sewer acceptance. Typical items to be reviewed on the videotape will include pipe deflection, pipe settlement, connections, joints and pipe cleanliness. If the videotape review reveals unsatisfactory conditions, all deficiencies shall be corrected and the affected pipe sections retelevised for review by the Township Engineer.

## **VI. Paving Improvements**

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### **A. General**

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1. All roads proposed for construction in Groveland Township shall be public roads under the jurisdiction of the Road Commission for Oakland County (RCOC) unless otherwise permitted by Township Ordinance. Plans for such roads and/or accompanying sidewalks/bikepaths shall be prepared in accordance with RCOC “Procedures and Guidelines For Developing Public Roads”, latest revision. In addition to any submittals required for RCOC approval, plans shall also be submitted to Groveland Township for review of the proposed road improvements in relation to other existing and proposed facilities. The applicant shall submit three sets of RCOC approved paving plans to the Township upon County approval. Private roads, when permitted, shall conform to the requirements of the Groveland Township Zoning Ordinance Sec 54-893 (Private Streets).
2. Paving improvements for parking lots, internal roads and pedestrian facilities on private sites shall be designed in accordance with the requirements prescribed herein.
3. Concrete curb and gutter will be required for all private roadway construction and parking lot construction with the following exceptions:
  - a. Large lots of two and one half (2 ½) acres or more for residential detached housing.
  - b. Industrial storage yards not used for regular road vehicle parking
  - c. Bituminous curb may be substituted for concrete curb and gutter in commercial parking lot construction.
4. Underground storm sewers, including edge drains for parking lots and roads, shall be designed and installed with all paving improvements which require concrete curb and gutter or asphalt curb. Where pavements are to be constructed over clay soils or other poorly drained soils and a granular subbase is used, an approved subdrainage system shall be installed. Edge drain shall extend a minimum of 50-feet, in each direction, under the curb line from any installed catch basin or inlet located in the curb line.
5. Plan and profile views shall be provided for all proposed paving improvements. The plan and profile shall be presented on the same plan sheet and shall be vertically aligned. If possible, storm water management improvements shall be shown on the same plan sheet as the paving improvements.
  - a. The plans shall include typical cross section(s) showing dimensions, materials, type and thickness of the proposed paving improvements.
  - b. The following information shall be shown in the plan view of the proposed paving improvements.
    - i. Centerline alignment, including curve data, stationing, edge of pavement and/or curb. Centerline and stationing are not required for parking lots.
    - ii. Location of existing and proposed topographic features, including utilities;
    - iii. Location of existing and proposed traffic control devices;
    - iv. Location of existing and proposed street-light poles;
    - v. Location of all proposed pedestrian facilities.

- c. The following information shall be shown in the profile view of the proposed paving improvements. Profiles are not required for proposed parking lots.
  - i. Existing and proposed ground at the centerline (for rural roads) or top of curb (for urban roads).
  - ii. Percent of grade and vertical curve data.

## **B. Design Criteria**

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- 1. Cross Sections
  - a. Dimensional widths and thickness of materials and associated road features shall be designed in accordance with the typical road cross sections prescribed by the RCOC. For public roads, the cross section requirements will be based on the functional class of the road as designated by the RCOC.
  - b. For parking lots and internal roads at nonresidential sites, the cross section requirements will be based on the functional class of the public road serving the property. The minimum width for an internal drive shall be 26' measured from the back-of-curb to back-of-curb or edge of pavement to edge of pavement for non-curbed internal roads.
  - c. Driveways will be defined as the paved area adjacent to a public or internal road serving no more than one residence, commercial or industrial establishment.
    - i. Single family residential driveways shall be designed according to the following criteria.
      - 1. Concrete driveways shall be a minimum of 6" thick between the back of curb or edge of pavement and the right-of-way or easement line. Concrete driveways outside the right-of-way or easement shall be a minimum of 4" thick.
      - 2. Pads utilized to rest garbage dumpsters on shall be a minimum of 8" thick concrete.
      - 3. Bituminous pavement driveways shall be a minimum of 3" thick (minimum 333 pounds per square yard) over a 21AA aggregate base course having a minimum compacted thickness of 6".
      - 4. Aggregate surface course driveways will only be permitted where the adjacent public or internal road does not have a paved surface. The aggregate surface course shall be a minimum of 6" thick within the right-of-way or easement and a minimum of 4" thick outside the right-of-way or easement.
    - ii. Driveways to serve multi-family residences, commercial or industrial establishments shall be designed so that thickness of the surface and the base to be used shall be sufficient to provide the bearing capacity needed to carry the proposed traffic loads. Minimum RCOC requirements are a three inch (333 pounds per square yard) bituminous asphalt mix on eight inches of compacted gravel 21AA, nine inches asphalt on existing suitable soils, nine inches of unreinforced concrete on compacted sand or equivalent surfacing material which meets current Michigan Department of Transportation Specifications for Construction may be considered acceptable for normal driveway traffic loads over stable, well-drained soil.
    - iii. Parking lot pavement shall be designed as to sustain the loading that will be

applied to the parking lots and delivery routes. The following is a list of the minimum acceptable cross-sections for parking lots. The design engineers shall fully investigate the impacts of various loading scenarios upon the proposed paving cross-sections.

1. Light Duty Pavement is to be utilized in areas utilized for short-term vehicle parking. The cross-section shall be a minimum of 1 ½” of MDOT 4C HMA Wearing Course on 1 ½” of MDOT 3C HMA Leveling Course on 3” of MDOT 2C Base Course on 8” of 21AA aggregate base or equal cross-section. An MDOT approved asphalt binder material shall be placed between each asphalt layer. All materials shall be placed on suitable, stable, well-drained soil.
  2. Heavy Duty Pavement is to be utilized in areas utilized for loading zones, ingress/egress of delivery vehicles and or refuse pick-up trucks. The cross-section shall be a minimum of 1 ½” of MDOT 4C HMA Wearing Course on 1 ½” of MDOT 3C Leveling Course on 3 ½” of MDOT 2C Base on 10” of 21AA aggregate base or equal cross-section. An MDOT approved asphalt binder material shall be placed between each asphalt layer. All materials shall be placed on suitable, stable, well-drained soil.
- d. Pedestrian facilities shall be designed in accordance with the requirements prescribed by the RCOC.
2. Horizontal Alignment
- a. Horizontal alignment of pavement and associated road features shall be designed in accordance with the requirements prescribed by the RCOC.
  - b. Internal roads shall be designed to accommodate the typical vehicles anticipated to use the site, including but not necessarily being limited to, delivery vans and trucks, fire department traffic, trash collection vehicles and school buses.
  - c. Parking lots and off street loading and unloading areas shall be designed in accordance with the requirements prescribed by Article VIII. Off-Street Parking, Loading and Unloading of Chapter 54 – Zoning of the Groveland Township Code of Ordinances. If the proposed parking abuts a proposed sidewalk that will be 7 feet wide adjacent to a building the parking space length may be reduced by 18 inches to allow for 2 foot of overlaying by a parked vehicle.
  - d. Driveways
    - i. Single family residential driveways shall be a minimum of 10’ wide.
    - ii. Driveways to serve multi-family residences, commercial or industrial establishments shall be a minimum of 30’ wide.
    - iii. Offset parking areas adjacent to driveways shall be configured with a 25’ radius.
  - e. Pedestrian facilities shall generally be located outside the right-of-way in a dedicated easement. Pedestrian facilities will be located within the right-of-way with the permission of the RCOC. The horizontal alignment of pedestrian facilities shall be as close to parallel as practical to the right-of-way or easement.
    - i. Concrete sidewalk shall be a minimum of 5’ wide.
    - ii. Bituminous pavement bikepaths shall be a minimum of 10’ wide.
3. Vertical Alignment
- a. The vertical alignment of all public roads, internal roads and parking lots shall be designed in accordance with the requirements prescribed by the RCOC.

- b. Vertical alignment of driveways shall be designed in accordance with the requirements prescribed by the RCOC.
  - c. Pedestrian facilities shall be designed to meet the requirements of the American with Disabilities Act, as amended.
4. Storm Sewer
- a. Storm sewer located within the influence of a roadway shall be made of concrete material. All storm sewer shall be in compliance with the provisions and standards of Section V. Storm Water Management Systems, of this manual.

### **C. Materials**

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- 1. Subgrade
  - a. Subgrade material shall consist of clay, sand, gravel or other similar material.
  - b. The finished subgrade surface shall be free of all topsoil, stones, stumps, organic matter, muck, peat and frost heave material.
- 2. Underdrainage
  - a. Underdrain pipe shall be smooth plastic pipe or corrugated plastic tubing meeting current Michigan Department of Transportation (MDOT) requirements.
  - b. Underdrain outlets shall be constructed of polyvinyl chloride (PVC) plastic pipe or corrugated steel pipe conforming to MDOT requirements.
  - c. Underdrain pipe shall extend a minimum of 50-feet, in each direction, from a catch basin or inlet located in the curb line.
  - d. Underdrain shall be installed in accordance with current MDOT details. Reference MDOT detail R-80-C for additional information.
- 3. Subbase materials shall conform to the requirements of MDOT Class II granular material, compacted in place.
- 4. Aggregate Base Course
  - a. Dense graded aggregate conforming to the requirements for MDOT Specifications 21A or 21AA, compacted in place.
  - b. The use of slag material will not be permitted.
  - c. The use of stabilized base course will be permitted. The type, thickness and mix must conform to MDOT requirements and must be approved by the Township Engineer.
- 5. Bituminous pavement materials shall be in accordance with MDOT requirements as specified on the typical cross sections prescribed by the RCOC.
- 6. Concrete pavement materials shall be in accordance with MDOT requirements as specified on the typical cross sections prescribed by the RCOC.

### **D. Construction Methods**

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- 1. Construction methods shall be in accordance with the plan details and the most recent edition of the MDOT Standard Specifications for Construction.
- 2. Pavement Cuts

Where a trench must be cut through pavement, driveway, or sidewalk, particular care shall

be taken to avoid unnecessary damage to adjoining areas of the pavement, driveway or sidewalk. All cuts through existing surfaces shall be made full-depth with a concrete saw. Cuts in concrete pavement shall be made parallel with longitudinal and transverse construction or contraction joints.

Saw cuts in concrete pavement shall not be nearer than 5' to a transverse joint, to the centerline of pavement, or to the edge of pavement or curb. No existing or replacement pavement shall be less than 5' to a joint or centerline of pavement, or to edge of pavement, surfacing or curb, removal and replacement shall be extended to said joint, centerline, edge of pavement, surfacing, or curb. These same requirements shall apply to the saw cutting and replacement of concrete driveways.

If a square of block of sidewalk is cut, broken, or cracked, the entire square or block shall be removed and replaced.

### 3. Pavement Replacement, Temporary

All pavement removed in crossing and/or paralleling paved streets, alleys, drives and parking areas shall be temporarily replaced immediately following completion of backfilling operations. Temporary pavements for streets and alleys shall conform to the Oakland County Road Commission specifications for underground construction. Temporary pavement for driveways, including approaches and parking areas, shall consist of a minimum of 3" of compacted cold patch asphalt over a minimum of 7" of compacted MDOT 22A aggregate base. All temporary pavements, including those constructed for streets, alleys, drives and parking areas, shall be maintained in good condition until the final pavement replacement is made.

## **VII. Grading and Earthwork**

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### **A. General**

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1. The standards outlined in this section shall not be applicable to operational sand and gravel mining facilities. Standards regulating these operations are listed in the Groveland Township Code of Ordinances Chapter 14 – Environment.
2. All proposed developments should be graded such that water runoff will be intercepted within the boundaries of the site and conducted through a storm sewer system to an approved point of discharge.
3. Easements for surface drainage shall be dedicated and recorded.
4. For newly formed perimeter lots, the drainage easement width shall be 25' minimum, and for newly formed abutting lots with a common rear yard lot line, the easement width shall be at least 10' on each lot.
5. The following information must be shown in the plan view of the proposed grading:
  - a. Grading plans shall be drawn to a scale of 1" = 50' or larger.
  - b. The grading plans shall show the existing elevation topography either by contour method or grade point grid method.
  - c. High and low street grade points, slope direction (by arrow) and the location of all catch basins, inlets and drainage ditches shall be shown on the grading plan.
  - d. A detail of the typical lot drainage pattern shall be shown on the grading plan with all grade control points identified. All grade point elevations shall be shown for each lot. This will include the first floor (F.F.), or the foundation grade (F.G.) elevations, high point (grade break), drainage arrows and additional spot elevations to clarify site grading.
6. Plot plans shall be provided in accordance with the current Groveland Township requirements

### **B. Design Criteria**

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1. General
  - a. Grading plans shall take into account the desirable natural features and the character of the land, which must be preserved where possible, as recommended by the Township Planner and Township Engineer.
  - b. No filling will be allowed in any areas of land which lie either wholly or in part within the flood plain of a river, stream, creek, lake or wetland. Only a variance in the form of a permit from the Michigan Department of Environmental Quality may override this restriction.
  - c. Filling and grading shall not create a barrier causing entrapment of water on the adjacent lands of others.
2. Drainage Pattern
  - a. Generally, all single-family lots shall be graded for front to rear drainage.
  - b. Rear to front drainage will be allowed by the Township only where, due to existing topography, front to rear drainage would be very difficult to achieve or is not feasible.

- c. Drainage patterns other than those listed in 2a or 2b may be used. All non-conforming lots with drainage patterns other than those in 2a or 2b shall be noted on the grading plan. Each will be reviewed and approved on a case-by-case basis.
  - d. Large acreage parcels, outside of approved subdivisions/site condominiums, will be reviewed on an individual basis.
3. Slopes
- a. To minimize the impact of grading operations on the existing topography of a site the incorporation of the natural existing topography is strongly encouraged. Grading operations are typically anticipated to occur within a 50' radius of a buildings footprint or as approved by the Township Engineer.
  - b. All areas within 10' of buildings shall slope away from the building at a minimum slope of 5%. The minimum slope for any other part of the site shall be 1%.
  - c. A maximum slope of 3' horizontal to 1' vertical shall be utilized without terracing. A maximum slope of 4' horizontal to 1' vertical shall not be exceeded for terracing. The toe of slope shall be located outside of the rear and/or side lot line drainage easements.
  - d. Swales:
    - i. Each single-family lot shall be graded to drain away from the house to swales constructed along the lot lines.
    - ii. Swales shall discharge to a catch basin, roadway gutter, or other approved drainage course.
    - iii. The longitudinal slope along a rear or side yard drainage swale shall be not less than 1.5% or more than 6.0%.
  - e. Grading for side slopes of detention/retention facilities shall conform with current Oakland County Drain Commission standards.
  - f. For streets with ditches and no curbs, where the lot elevations is higher than the roadway, the elevation of the front ROW line shall be at least 6" above the centerline of the road.
  - g. For streets with ditches and no curbs, where the lot elevations is lower than the roadway, grading shall occur to ensure that the site is not adversely impacted by potential runoff.
  - h. Driveway slope gradients shall not exceed 8%. Sidewalk slopes shall not exceed 5%.
4. Retaining Walls and Structures
- a. All retaining wall, sheeting, bracing and shoring operation designs shall be accompanied by a signed and sealed letter from the engineer of record certifying that structures have been designed in accordance with all applicable structural design codes (with the codes identified), and that all applicable safety factors, standards and codes (identifying safety factors) have been met or exceeded. A qualified geotechnical engineer shall review the soil conditions. Submitted designs are subject to the review and recommendation for approval by the Township Engineer.
  - b. Concrete Walls and Structures
    - i. Clearly identify location of the structure in plan view
    - ii. Indicate the top of wall and bottom of wall elevation
    - iii. Finished grades adjacent to structure at a maximum of 25' intervals
    - iv. Minimum and maximum heights of wall presented in a cross-section view

- v. Notes identifying or referencing material types and specifications
  - vi. Design loads including vehicular impact and surcharge loadings where applicable. Loads due to attached structures (fences, guardrails, guards, etc) shall be considered in the design of the wall
  - vii. Structural dimensions and footing depth
  - viii. Wall and footing thickness
  - ix. Reinforcing steel grade, cover and spacing
  - x. Bearing pressures (noted or referenced) and soil bearing capacities
  - xi. Geo-grid length shall be provided, dimensioned and labeled. Any changes in layout shall be shown on the plans
  - xii. Openings in the wall
  - xiii. Location of protective guardrail and/or fencing. The necessity for guardrail will be reviewed on a case-by-case basis. Typically a guard, fence or guardrail s required on structures greater than 30” in height. The typical guard, fence or guardrail is 42” high with openings less than 4” in diameter.
  - xiv. Fence, guard, guardrail posts footings or connections to walls shall be detailed. Installation of the post or post footing shall be specified so as not to damage any geo-grid, if applicable
  - xv. Subgrade drainage system
  - xvi. Locations of filter wrapped drain tile and outlets
  - xvii. Location of utility crossings
  - xviii. Soil boring information and geotechnical analysis
- c. Block and Timber Walls and Structures
- i. Clearly identify location of the structure in plan view
  - ii. Indicate the top of wall and bottom of wall elevation
  - iii. Finished grades adjacent to structure at a maximum of 25’ intervals
  - iv. Minimum and maximum heights of wall presented in a cross-section view
  - v. Notes identifying or referencing material types and specifications
  - vi. Segmental wall dimensions and soil reinforcing (if applicable)
  - vii. Design loads including vehicular impact and surcharge loadings where applicable. Loads due to attached structures (fences, guardrails, guards, etc) shall be considered in the design of the wall
  - viii. Structural dimensions and footing depth
  - ix. Geo-grid length shall be provided, dimensioned and labeled. Any changes in layout shall be shown on the plans
  - x. Embedment depth
  - xi. Wall and footing thickness
  - xii. Bearing pressures (noted or referenced) and soil bearing capacities
  - xiii. Openings in the wall
  - xiv. Location of protective guardrail and/or fencing. The necessity for guardrail will be reviewed on a case-by-case basis. Typically a guard, fence or guardrail s required on structures greater than 30” in height. The typical guard, fence or guardrail is 42” high with openings less than 4” in diameter.

- xv. Fence, guard, guardrail posts footings or connections to walls shall be detailed. Installation of the post or post footing shall be specified so as not to damage any geo-grid, if applicable
- xvi. Subgrade drainage system
- xvii. Locations of filter wrapped drain tile and outlets
- xviii. Location of utility crossings
- xix. Soil boring information and geotechnical analysis
- xx. Manufacture specifications are required for any block walls.
- xxi. Boulder walls shall not exceed four feet in height.

### **C. Materials**

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- 1. Materials used in earth excavations and/or embankment construction shall be in accordance with the plans and the 2003 Michigan Department of Transportation (MDOT) Standard Specifications for Construction.
- 2. Material placed in future building sites, roadways or other areas that may support structures shall be free of trees, stumps, topsoil or any other surplus or unsuitable materials.

### **D. Construction Methods**

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- 1. All construction methods shall conform with MIOSHA Construction Safety Standard, Part 9, Excavation, Trenching, and Shoring.
- 2. Methods of Excavation in Earth

All excavation shall be by open cut from the surface, except in special cases where boring/jacking under pavement or structures may be required, or where boring/jacking under the root system will be required for tree root protection. All excavation shall be made in such a manner and dimensions as will give ample room for building the structures, bracing, sheeting and supporting the sides of the excavation, pumping and drainage of ground water and sewage which may be encountered, and removal of all materials excavated. Special care shall be taken so that the soil below the bottom of structures to be built shall be left undisturbed so that a firm bed will be provided for construction. Any voids shall be backfilled with suitable granular material and shall be properly compacted.

- 3. Trench Excavation
  - a. General

Excavation shall be of sufficient width and depth to provide adequate room for construction and installation of the work to the lines, grades and dimensions called for on the plans. The bottom trench width shall such that it allows for the safe installation of pipe material while minimizing the amount of natural material excavated to install the pipe.

Where trench excavation is in granular material, the last 6” of trench depth shall be carefully excavated and trimmed to the exact elevation and contour of pipe. Where trench excavation is in rock or clay soil, the trench bottom shall be undercut a minimum of 4” below the final elevation of pipe. The bedding material as hereinafter specified shall be placed and compacted to the underside of the pipe.

Excavation for structures shall be made to the outside lines and surfaces of such structures wherever it is practicable to build directly against the sides and bottoms of excavations. In such cases, care shall be taken not to disturb the original foundation or backing. Final trimming shall be done just before construction of the structure. If

excess excavation is made, or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be refilled with bedding, as specified hereinafter, and solidly machine tamped into place to 95% of maximum unit weight before the construction work proceeds.

Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for form construction and other construction methods to be followed, wherever necessary.

b. Bedding

Where the subgrade below the bottom of the pipe is disturbed during the construction, the space shall be refilled with sand or pea gravel bedding material solidly tamped to form a firm foundation for the pipe. Sand or pea gravel bedding material shall be extended to 1' above the pipe, except that the bedding shall be exclusively pea gravel to the springline for pipe 36" and greater in diameter.

c. Amount of Trench Opening

Not more than 50' of trench shall be open at one time in advance of the pipe unless permitted by the Township Engineer. The length of street that may be occupied by the construction work at any one time shall be subject to the direction of the RCOC and will be based on requirements of the use of the street by the public. No more than 600' of street length shall be occupied at one time, and vehicle traffic through the street shall not be entirely stopped without permission of the RCOC and the Township Engineer.

After placement of the utility line the trench shall be promptly backfilled in order to minimize the length of open trench and avoid any unsafe conditions.

4. Stone Refill

In locations where soil at the bottom of trench is unstable the trench shall be excavated (undercut) below the trench bottom and refilled with MDOT 6A crushed aggregate.

5. Excavation & Trench Dewatering

Any excavation or trench shall be maintained free of water during construction of any structures and/or pipelines.

Adequate precautions shall be taken to control the discharge of dewatering pumps so as to prevent soil erosion or sedimentation of drainage ditches, structures, storm sewers, culverts, natural drainage courses, ponds, lakes or wetlands. Any pumping operations that impact any natural drainage courses, ponds, lakes or wetlands will require the review and permitting by the MDEQ.

Discharge from any dewatering operations shall have a suitable outlet and that it will not cause any damage to adjacent dwellings or property. Water and discharge hoses shall be placed and/or controlled so as to prevent a hazard to pedestrians or motor vehicles passing in the vicinity of the construction site.

Electric pumps shall have suitable power supply appurtenances meeting NEC requirements and properly fused and grounded to prevent electrical shock hazards to on-site personnel.

Internal combustion engine driven pumps, if operated 24 hours per day, shall have adequate exhaust silencers in good repair to muffle engine noise to an acceptable level for the area where located. Noise generated from pumping operations shall comply with current Township noise ordinances.

6. Diverting Existing Sewers

Where existing sewers or drains are encountered during construction operations, adequate provision shall be made for diverting flow in the existing sewers so that the excavation will be kept dry during the progress of the construction work. Upon completion of the construction work, the existing sewers shall be restored or otherwise provided with an adequate outlet as approved or directed by the Township Engineer and/or the sewer's controlling agency.

7. Sheeting, Bracing & Shoring

Sheeting, bracing and shoring shall be provided where required to properly support the surfaces of excavations and protect the construction work, adjacent work, or workers. In removing the sheeting and bracing after the construction has been completed, special care shall be taken to prevent any caving of the sides of the excavation and injury to the completed work or to the adjacent property.

8. Crossing Existing Structures/Pipes

During construction, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits and other underground structures. Every effort shall be made to prevent damage to such structures. Wherever such structures are disturbed or broken, they shall be restored to good condition. Specified granular backfill shall be placed as described in item 9, Backfilling. MDOT Grade 3S concrete can be utilized where approved by the Township Engineer. Either granular backfill or concrete shall be brought to the spring line of the higher utility.

9. Trees

Every effort shall be made to preserve trees 8" in diameter or more. The Township Engineer shall approve methods of tree preservation.

10. Backfilling

a. General

Backfilling shall include all work required as hereinafter specified. The placement of various pipe, including bedding and building of structures, shall be completed prior to backfilling.

Trenches and/or other excavations can be backfilled with suitable on-site excavated material (not including gray or blue clay) replaced into the trench or excavation and compacted to not less than 95% of maximum unit weight as determined at existing moisture content during backfilling. Compaction shall be provided by means of suitable mechanical compaction equipment.

If the moisture content of cohesive backfill material exceeds the optimum moisture content for maximum density by more than 3%, the material shall be dried to meet the foregoing moisture content limitation or MDOT Class II Granular Material shall be provided. No sloppy or wet backfill will be allowed.

Maximum unit weight will be determined by current methods of Test for Compaction and Density of Soil, AASHTO Designation T-180 or by the Cone Density Method developed by MDOT, as the material may require.

Compaction tests shall be conducted at all locations requiring granular backfill. Such tests shall be the responsibility of the applicant. Tests shall be sufficiently spaced to verify acceptable compaction.

Any depression resulting from settlement of any backfill shall be brought to the proper grade and surface and made to match the adjacent surface.

b. Compaction

Backfill material shall be placed in layers not to exceed 12”in thickness unless approved by the Township Engineer.

Specified compaction shall be obtained with the use of a bulldozer, sheepsfoot roller, mechanical tamper or other similar and effective equipment. Specified compaction means not less than 95% (not average 95%) of maximum unit weight when tested in accordance with current MDOT Specifications.

If excavated material is not suitable to obtain 95% minimum compaction, unsuitable materials shall be removed or granular materials shall be added, or both, to obtain 95% minimum compaction as specified.

c. Backfilling Trenches

i. Bedding

The type of bedding is required to be shown on the detail drawings.

Bedding shall be worked under the haunches of the pipe to provide firm continuous support.

Bedding placed on the sides of and above the pipe shall be compacted by machine tamping to not less than 95% of maximum unit weight in layers not exceeding 12”in depth.

ii. Trench or Excavated Area

All trenches in paved streets, shoulders, traveled roadways, parking areas and driveways shall be backfilled with suitable excavated backfill or granular backfill, as shown on the drawings from 1’ above top of pipe up to the required subgrade elevation which will allow for placement of the required gravel base and/or pavement surface. The approved excavated backfill or granular backfill shall be placed and thoroughly and uniformly compacted by machine tamping to the specified compaction. With the approval of the Township Engineer, water jetting may be accepted in lieu of tamping for granular backfill only.

Specified compaction shall be required of the entire trench when the edge of trench is within 3’ of edge of pavement. On road crossings, specified compaction shall extend 10’ beyond the edge of pavement for paved roadways with gravel shoulders or shall extend 3’ beyond the back of curb for roadways with curb.

Trenches under concrete sidewalks and bike paths shall be backfilled from one foot above top of pipe to a level 4” below finished grade of the sidewalk with approved suitable excavated backfill or granular backfill and compacted to 95% maximum density.

Trenches not in paved streets, shoulders, traveled roadways, parking areas, driveways or under sidewalks, shall be backfilled from 1’ above the top of the pipe up to the ground surface with suitable excavated backfill and shall require compaction equal to adjacent undisturbed earth.

Wherever gas mains, water mains, sewers, or other utilities are located in the trench area, granular backfill shall be used for backfill from bottom of the trench up to the springline of the pipes. Granular backfill shall be placed across the full trench width and extend far enough either side of the existing pipe to allow specified compaction so as to thoroughly support the pipe within the trench area.

d. Backfilling Around Structures

As soon as practicable after concrete structures have set, forms and debris shall be removed and the surface of the concrete pointed. After the structure has been inspected and approved, the excavated area around the structure shall be backfilled up to specified subgrade with granular material or suitable excavated material as called for on the drawings for the adjacent trench. The fill shall be thoroughly compacted by machine tamping. No large boulders or masonry shall be placed in backfill. No backfill will be placed against manhole walls within 48 hours after the plaster coat has been applied to the outside of the walls nor shall backfill be placed about concrete structures until concrete has attained at least 75% of its design strength and approval of the Township has been obtained.

#### 11. Disposal of Excavated Material

After all suitable excavated material has been used on site, all excess material shall be removed and disposed of properly.

All other excavated materials that are unsuitable for use as fill or backfill shall be disposed of properly. Unsuitable materials may include, but are not limited to, broken concrete, asphalt, rock, stone, and other related debris. The applicant shall be required to obtain proper disposal areas and permits.

Any agreements that the applicant makes with local residents concerning the placement of fill on private property shall be the sole responsibility of the applicant. Copies of such agreements shall be provided to the Township. Placement of fill on private property within the Township may require special review and permit by the Township. It is the applicant's responsibility to obtain these reviews and permits.

Placement of fill on private property may require that the property owner and/or the applicant obtain a grading permit or fill permit from the Township.

#### 12. Contractor Safety Requirements

All construction operations shall be performed in accordance with OSHA and MIOSHA requirements.

The excavation and trenching operations shall be conducted in a manner that will provide safe working conditions for all persons on the site who may be affected by the construction operations. All construction operations shall be conducted in a manner that will protect adjacent property from damage.

Trench sides shall be either cut back to the slope as required by soil and ground water conditions which will provide stable sides, or supporting systems shall be installed with a sufficient strength to provide a safe work environment. Design and installation of trench supporting systems shall be the responsibility of the applicant.

A competent or qualified person who will be responsible for the safety of both the work and workmen, and who will make all the decisions relevant to the stability of trenches, the adequacy of any and all protective devices, proper operation of equipment, and all other matters related to safety, shall be employed at all times at the site of the work.

Excavated material, heavy equipment, backfill materials, sewer pipe, or other construction materials shall not be stored closer than 2' along or adjacent to the trench where they may impose too great a load on the earth and cause displacement or caving of the earth. A safe means of emergency exit shall be provided, at all times, within 25' of any worker in any excavation.

## **VIII. Soil Erosion and Sedimentation Control**

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### **A. General**

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1. Soil erosion and sedimentation control measures shall be incorporated into the design and construction of all projects, as specified by the OCDC requirements.
2. All proposed temporary and permanent soil erosion and sedimentation control measures shall be shown on the plans. All soil erosion control measures shall be identified in accordance with the Michigan Unified Keying System.
3. Cleaning and maintenance schedule listing annual budget and frequency of maintenance operations shall be indicated on the plans.

### **B. Design Criteria**

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1. Temporary soil erosion and sedimentation control measures shall be designed in accordance with the requirements of the OCDC requirements.
2. Permanent soil erosion and sedimentation control measures shall be designed in accordance with the requirements outlined in other sections of these standards.

### **C. Materials**

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1. Temporary soil erosion and sedimentation control measures shall be fabricated of the materials specified in the latest edition of the Best Management Practices (BMP) guidelines published by the Michigan Department of Environmental Quality (MDEQ).
2. Permanent soil erosion and sedimentation control measures shall be in accordance with the material requirements specified in other sections of these standards.

### **D. Construction Methods**

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1. Temporary soil erosion and sedimentation control measures shall be installed and maintained as outlined in the latest edition of the BMP guidelines published by the MDEQ.
2. Permanent soil erosion and sedimentation control measures shall be constructed and maintained as specified in other sections of these standards and in accordance with the cleaning and maintenance schedule shown on the approved soil erosion and sedimentation control plan.
3. All lots within approved residential subdivision/site condominiums shall have the disturbed ground stabilized with sod, seed, or other acceptable permanent soil erosion control measures within 30 days after the final certificate of occupancy has been issued. Inclement weather exceptions will be made from November 15<sup>th</sup> through June 15<sup>th</sup> as determined by the OCDC.



## **Appendix A.**

### **Record Plan Requirements**

# Appendix A: Record Plan Requirements



ORCHARD, HILTZ & McCLIMENT, INC.  
34000 Plymouth Road  
Livonia, MI 48150  
ph: 734-522-6711  
fax: 734-466-4557

## RECORD DRAWING REQUIREMENT CHECKLIST

JOB NAME: \_\_\_\_\_ REVIEWED BY: \_\_\_\_\_

JOB NUMBER: \_\_\_\_\_ DATE REVIEWED: \_\_\_\_\_

**This checklist should be completed, signed and sealed by the design engineer and submitted along with the Record Drawings.**

**The Orchard, Hiltz & McCliment, Inc project number must be printed in the lower right hand corner of all plan sheets.**

### SANITARY SEWER

### COMMENTS

#### I. PLAN VIEW

##### *OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between manholes
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Lengths of casing pipe
- D. [NEED] [O.K.] Ties to manholes
- E. [NEED] [O.K.] Type & class of pipe & joint ("O" ring, slip, solvent weld, etc.)
- F. [NEED] [O.K.] T/casting grades
- G. [NEED] [O.K.] Wye locations
- H. [NEED] [O.K.] Permit numbers (County & MDEQ)
- I. [NEED] [O.K.] Manufacturer of pipe
- J. [NEED] [O.K.] Manufacturer of manhole
- K. [NEED] [O.K.] Manhole numbering (sequential)
- L. [NEED] [O.K.] Show all sanitary sewer easements on plans
- M. [NEED] [O.K.] Provide sketch and legal description of sanitary sewer easements

#### II. PROFILE VIEW

##### *OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between manholes
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Lengths of casing pipe
- D. [NEED] [O.K.] Depth of wye & riser
- E. [NEED] [O.K.] Invert grades
- F. [NEED] [O.K.] Type & class of pipe & joint ("O" ring, slip, solvent weld, etc.)
- G. [NEED] [O.K.] T/casting grades
- H. [NEED] [O.K.] Wye locations
- I. [NEED] [O.K.] Percent slope between manholes (as-built)
- J. [NEED] [O.K.] Manhole numbering (sequential)

**STORM SEWER****COMMENTS**

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**I. PLAN VIEW***OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between manholes/catch basins/inlets
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Ties to manholes/catch basins/inlets
- D. [NEED] [O.K.] Type & class of pipe & joint
- E. [NEED] [O.K.] T/casting grades
- F. [NEED] [O.K.] Structure numbering (sequential)
- G. [NEED] [O.K.] Special structures (low head, 5' dia., 6' dia., 2' sump, etc.)
- H. [NEED] [O.K.] Show all easements for storm sewer
- I. [NEED] [O.K.] Provide sketch and legal description of storm sewer easements

**II. PROFILE VIEW (REQUIRED FOR PIPE 12" & LARGER)***OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between manholes
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Type & class of pipe & joint
- D. [NEED] [O.K.] Invert grades
- E. [NEED] [O.K.] T/casting grades
- F. [NEED] [O.K.] Structure numbering (sequential)
- G. [NEED] [O.K.] Percent slope between manholes (as-built)

**WATER MAIN****COMMENTS****I. PLAN VIEW***OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between gate valve & wells, hydrants and fittings
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Ties to gate valve & wells, hydrants and fittings
- D. [NEED] [O.K.] Ties to hydrants
- E. [NEED] [O.K.] Ties to stop boxes
- F. [NEED] [O.K.] Ties to building or offsets to pipe
- G. [NEED] [O.K.] Type and class of pipe w/or without Polywrap
- H. [NEED] [O.K.] Finish grade of hydrants
- I. [NEED] [O.K.] T/Casting grades
- J. [NEED] [O.K.] Horizontal bend locations
- K. [NEED] [O.K.] Location of thrust blocks & types of restraints
- L. [NEED] [O.K.] Sequentially numbered G.V. & wells
- M. [NEED] [O.K.] Permit numbers (County & MDEQ)
- N. [NEED] [O.K.] Manufacturer of pipe
- O. [NEED] [O.K.] Manufacturer of hydrant
- P. [NEED] [O.K.] Show all water main easements on plan
- Q. [NEED] [O.K.] Provide sketch and legal description of water main easements

**II. PROFILE VIEW (REQUIRED FOR PIPE 12" & LARGER)****COMMENTS***OHM USE ONLY*

- A. [NEED] [O.K.] Lengths between grade changes
- B. [NEED] [O.K.] Size of pipe
- C. [NEED] [O.K.] Type and class of pipe
- D. [NEED] [O.K.] G.V.. & well location
- E. [NEED] [O.K.] Hydrant location (identify special structures such as blow off)
- F. [NEED] [O.K.] Air relief valves/blow off valve locations
- G. [NEED] [O.K.] Vertical bend locations
- H. [NEED] [O.K.] T/Casting grades

**PAVEMENT**

**COMMENTS**

I. Width and station of pavement (measured from centerline)

*OHM USE ONLY*

- A. [NEED] [O.K.] At end of radius at intersection
- B. [NEED] [O.K.] At beginning of taper
- C. [NEED] [O.K.] At end of taper
- D. [NEED] [O.K.] Any changes in alignment
- E. [NEED] [O.K.] Radius @ intersection
- F. [NEED] [O.K.] Right-of-way survey data

II. Drives

*OHM USE ONLY*

- A. [NEED] [O.K.] location
- B. [NEED] [O.K.] Width
- C. [NEED] [O.K.] Radius, if any

III. Sidewalk

*OHM USE ONLY*

- A. [NEED] [O.K.] Location
- B. [NEED] [O.K.] Width
- C. [NEED] [O.K.] Changes in alignment
- D. [NEED] [O.K.] Ramps
- E. [NEED] [O.K.] Provide sketch and legal description for safety path & sidewalk easements

Reviewer: Please check whether "MAJOR" or "MINOR" changes are required.

MAJOR

MINOR

NONE

GRADING

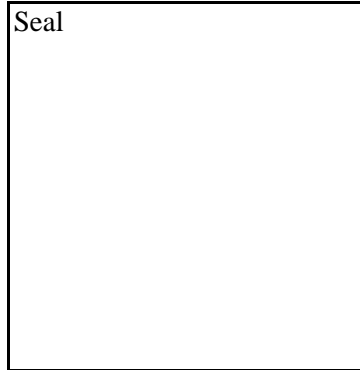
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Submit a sealed grading certificate attesting that finish elevations are in compliance with approved grading plan along with the as-built grading plan(s) showing any changes that were made in the field.

These record drawing documents were prepared by:

            
Print Name \_\_\_\_\_

            
Signed \_\_\_\_\_



## **Appendix B.**

### **Digital Plan Requirements**

## **Appendix B. Digital Plan Requirements**

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The following digital submission specifications are being provided as minimum requirements and guidelines for consultants and developers reference. Should you have any questions or comments please contact your community representative.

### **A. Digital format of CAD files**

The acceptable digital format for as-built drawing files shall be in AutoCAD format according to the following specifications:

- AutoCAD version 12.0 or later
- DWG or DXF formats as defined in AutoCAD
- Layer naming (shown in Table A) is to remain unaltered
- All polygons must be closed
- Lines shall not be unnecessarily segmented
- Intersecting lines segments must have common end points

### **B. Layering scheme**

Key mapping features shall be stored on unique CAD layers. Related text shall be included with each layer (i.e., storm pipes on a single layer and storm pipe annotation on a separate single layer). See “Table A” for layer names and descriptions. Submitted drawings will go through a quality check and the layers will be verified. Drawings found not to comply will be required to be modified by the applicant or applicant’s representative by the request of the Township, or the Township Engineer until they are compliant. Any submittals requiring modification will result in an additional fee to the consultant/developer. Submittals needing substantial modifications will result in the rejection of the digital file.

### **C. Coordinate System**

All drawings shall contain adequate geodetic reference to Michigan South State Plane NAD 83. Units must be described as either being US survey feet or international feet.

Drawings will conform to having one of the following references:

- (a) A drawing will reference a section corner/quarter-corner with distance and bearing data relating this point to the site plan.
- (b) A minimum of two (2) drawing locations will be identified with NAD83 coordinates established by field survey techniques (i.e., GPS or total station). Geographic coordinates shall appear in the drawing as text of a readable size and shall be in either Michigan South State Plane NAD83 or Geographic coordinates of sufficient resolution to derive state-plane coordinates within 1/10 of a foot.

### **D. Media for delivery**

File transfer media shall be one of three options:

- CDROM or CD-R
- Electronic (Internet) file transfer
- 3.5 floppy disk with PKZIP file compression (least preferred)



## CADD/GIS Standard Naming Convention

<b>Description</b>	<b>Layer name</b>
<b>Annotations</b>	
all chart lines and text*	a_chart
day stamp	a_daystamp
all legend lines*	a_legend
all location map lines and text*	a_locmap
match line	a_matchline
match line text	a_matchline_txt
north arrow	a_north
drawing notes in layout	a_note
graphic scale	a_scale
street name (major)	a_street_maj
street name (minor)	a_street_min
all titleblock lines*	a_tblk
*The colors and linetypes for these layers are set by property	

**Description****Layer name****Utilities**

cable lines	e_cable
cable point	e_cable_pt
cable symbol	e_cable_sym
cable text	e_cable_txt
electric utility lines	e_elec
point layer for electric symbols	e_elec_pt
electric utility symbols	e_elec_sym
electric utility text	e_elec_txt
existing force main lines	e_fm
existing force main point	e_fm_pt
existing force main symbol	e_fm_sym
existing force main text	e_fm_txt
gas utility lines	e_gas
point layer for gas symbols	e_gas_pt
gas utility symbols	e_gas_sym
gas utility text	e_gas_txt
sanitary utility lines	e_san
point layer for sanitary symbols	e_san_pt
sanitary symbols	e_san_sym
sanitary utility text	e_san_txt
storm utility lines	e_stm
point layer for storm symbols	e_stm_pt
storm symbols	e_stm_sym
storm utility text	e_stm_txt
telephone lines	e_tel
point layer for telephone symbols	e_tel_pt
telephone symbols	e_tel_sym
telephone utility text	e_tel_txt
misc. utility lines	e_util
point layer for misc. utility symbols	e_util_pt
misc. utility symbols	e_util_sym
misc. utility text	e_util_txt
water main utility lines	e_wm
point layer for water main structure symbols	e_wm_pt
water main structure symbols	e_wm_sym
water main text	e_wm_txt
proposed cable lines	p_cable
proposed cable symbol	p_cable_sym
proposed cable text	p_cable_txt
proposed electric lines	p_elec
proposed electric symbol	p_elec_sym
proposed electric text	p_elec_txt
proposed force main	p_fm

proposed force main text	p_fm_txt
proposed gas lines	p_gas
proposed gas symbol	p_gas_sym
proposed gas text	p_gas_txt
proposed jack & bore	p_jbore
proposed jack & bore text	p_jbore_txt
proposed sanitary	p_san
proposed sanitary symbol	p_san_sym
proposed sanitary text	p_san_txt
proposed storm	p_stm
proposed storm text	p_stm_txt
proposed storm symbol	p_stm_sym
proposed structure text	p_*str_txt
proposed telephone lines	p_tel
proposed telephone symbol	p_tel_sym
proposed telephone text	p_tel_txt
proposed underdrain	p_udrain
proposed underdrain text	p_udrain_txt
proposed water main	p_wm
proposed water main symbol	p_wm_sym
proposed water main text	p_wm_txt
*insert the utility name here (stm, san, wm etc)	

## Miscellaneous

existing dimensions	e_dim
layers to be frozen	freeze
hatch boundaries	hatch_bound
proposed building dimension	p_bldg_dim
proposed building	p_bldg
proposed building hatch	p_bldg_hatch
proposed building text	p_bldg_txt
proposed major contours	p_conmaj
proposed minor contours	p_conmin
proposed contour text	p_cont_txt
proposed dimensions	p_dim
point layer for proposed grades	p_grade_pt
proposed elevations	p_grade_txt
proposed grading limit line	p_gradlmt
proposed grading limit dimension	p_gradlmt_dim
proposed grading limit text	p_gradlmt_txt
proposed guardrail	p_grail
proposed parking lot text	p_park_txt
proposed signs	p_sign_sym
proposed tree symbol	p_tree_sym
proposed wall	p_wall
soil boring symbol	sb_sym
soil boring text	sb_txt
viewports	vp

**Description****Layer name****Drainage**

drainage arrows

p\_drain\_sym

proposed ditch

p\_ditch

proposed ditch text

p\_ditch\_txt

proposed drainage area text

p\_drainage\_txt

erosion control structures (inlet filter)

p\_eroctrl\_sym

erosion control text

p\_eroctrl\_txt

proposed silt fence

p\_silt

drainage area boundaries

p\_drainage

**Description****Layer name****Profiles**

existing centerline of structures	e_prf_cl
existing ground center	e_prf_grndc
existing ground center elevations	e_prf_grndc_txt
existing ground left	e_prf_grndl
existing ground left elevations	e_prf_grndl_txt
existing ground right	e_prf_grndr
existing ground right elevations	e_prf_grndr_txt
existing sanitary	e_prf_san
existing sanitary structure	e_prf_san_sym
existing sanitary text	e_prf_san_txt
existing storm	e_prf_stm
existing storm structure	e_prf_stm_sym
existing storm text	e_prf_stm_txt
existing text	e_prf_txt
existing water main	e_prf_wm
existing water main structures	e_prf_wm_sym
existing water main text	e_prf_wm_txt
proposed centerline of structures	p_prf_cl
proposed ditch text	p_prf_ditch_txt
proposed ditch, left	p_prf_ditchl
proposed ditch, right	p_prf_ditchr
proposed ground center	p_prf_grndc
proposed ground center text	p_prf_grndc_txt
proposed ground left	p_prf_grndl
proposed ground left text	p_prf_grndl_txt
proposed ground right	p_prf_grndr
proposed ground right text	p_prf_grndr_txt
proposed sanitary	p_prf_san
proposed sanitary structure	p_prf_san_sym
proposed sanitary text	p_prf_san_txt
proposed storm	p_prf_stm
proposed storm structure	p_prf_stm_sym
proposed storm text	p_prf_stm_txt
proposed structure labels	p_prf_str_txt
proposed text	p_prf_txt
proposed water main	p_prf_wm
proposed water main structure	p_prf_wm_sym
proposed water main text	p_prf_wm_txt
grid base	prf_base
grid elevations	prf_elev
profile grid lines	prf_grid
grid stations	prf_sta

**Description****Layer name****Existing topography**

building lines	e_bld
building hatch	e_bld_hatch
existing building point	e_bld_pt
building text	e_bld_txt
existing building dimension	e_bld_dim
road centerline	e_cl
existing centerline point	e_cl_pt
existing contours (major)	e_conmaj
existing contours (minor)	e_conmin
point layer for cultural symbols	e_cult_pt
cultural symbols (e.g. mailboxes)	e_cult_sym
auto offset text	e_cult_txt
existing culvert	e_culv
existing culvert point	e_culv_pt
existing culvert symbol	e_culv_sym
curb	e_curb
existing curb point	e_curb_pt
ditch centerline	e_ditch
existing ditch point	e_ditch_pt
driveways	e_dw
existing driveway point	e_dw_pt
edge of asphalt	e_eoa
existing asphalt hatch	e_eoa_hatch
existing edge of asphalt point	e_eoa_pt
existing edge of brick	e_eobr
existing edge of brick point	e_eobr_pt
existing brick hatch	e_eobr_hatch
edge of concrete	e_eoc
existing concrete hatch	e_eoc_hatch
existing edge of concrete point	e_eoc_pt
edge of gravel	e_eog
existing gravel hatch	e_eog_hatch
existing edge of gravel point	e_eog_pt
existing edge of other	e_eoo
existing edge of other hatch	e_eoo_hatch
existing edge of other point	e_eoo_pt
fence lines	e_fence
existing fence point	e_fence_pt
fence symbols	e_fence_sym
existing face of curb	e_foc
guardrail lines	e_grail
existing guardrail point	e_grail_pt
guardrail symbol	e_grail_sym
existing pavement marking	e_pm

point layer for rock symbols	e_rock_pt
rock symbol	e_rock_sym
existing railroad line	e_rr
existing railroad point	e_rr_pt
existing railroad symbol	e_rr_sym
road shoulder	e_shldr
road shoulder point	e_shldr_pt
shrub line	e_shrub
point layer for shrub symbols	e_shrub_pt
shrub symbols	e_shrub_sym
point layer for sign symbols	e_sign_pt
sign symbols	e_sign_sym
top and bottom of banks or slopes	e_topo
point layer for e_topo	e_topo_pt
annotations (e.g. conc., edge/asph. Etc.)	e_topo_txt
tree lines	e_tree
point layer for tree symbols	e_tree_pt
tree symbols	e_tree_sym
existing landscaping or planted areas	e_veg
existing vegetation point	e_veg_pt
sidewalk	e_walk
existing sidewalk hatch	e_walk_hatch
existing sidewalk point	e_walk_pt
wall	e_wall
existing wall text	e_wall_pt
existing wetland	e_wtln
existing wetland hatch	e_wtln_hatch
existing wetland point	e_wtln_pt
edge of water	e_wtr
existing water hatch	e_wtr_hatch
existing edge of water point	e_wtr_pt

**Description****Layer name****Proposed design**

proposed asphalt

p\_eoa

proposed back of curb

p\_boc

proposed road centerline

p\_cl

proposed concrete

p\_eoc

proposed face of curb

p\_foc

proposed shoulder

p\_eos

proposed walk

p\_walk

**Description****Layer name****Staging**

proposed stage lines

p\_stage

proposed staging dimensions

p\_stage\_dim

proposed staging hatch

p\_stage\_hatch

stage symbols (signs, arrows, barrels etc.)

p\_stage\_sym

proposed staging text

p\_stage\_txt

Note: for multiple stages add 1, 1a, 2, 2a etc

I.e. p\_stage1a p\_stage2 etc.

**Description****Layer name****PMS**

proposed pavement markings  
proposed pavement marking dimensions  
proposed pavement marking symbols  
proposed pavement marking text  
proposed sign symbol  
proposed sign text

p\_pm  
p\_pm\_dim  
p\_pm\_sym  
p\_pm\_txt  
p\_sign\_sym  
p\_sign\_txt

**Description****Layer name****Removal**

proposed removal lines  
proposed removal hatch  
proposed removal symbols  
proposed removal text

p\_rem  
p\_rem\_hatch  
p\_rem\_sym  
p\_rem\_txt

**Description****Layer name****Details**

existing or lightweight object lines	d_det_1
interior medium weight object lines	d_det_3
heavy object lines	d_det_5
detail center lines	d_det_cen
existing detail dimensions	d_det_edim
existing detail text	d_det_etxt
hidden object lines	d_det_hid
detail notes	d_det_notes
proposed detail dimensions	d_det_pdim
proposed detail text	d_det_ptxt
detail subtitle	d_det_sub
detail title	d_det_title
detail hatch	d_det_hatch
detail section lines	d_det_sec

## Description

### Survey

aerial control points  
aerial control text  
point layer for benchmarks  
benchmark symbols  
benchmark text  
existing boundary line  
existing boundary dimension  
existing boundary point  
existing boundary symbol  
existing boundary text  
existing bridge line  
existing bridge hatch  
existing bridge point  
control:traverse & benchmark lines  
control:traverse & benchmark points  
control:traverse & benchmarks symbols  
control:traverse & benchmarks text  
existing easement  
existing easement dimensions  
existing easement text  
existing road easement  
existing road easement dimension  
existing road easement text  
existing sanitary easement  
existing sanitary easement dimension  
existing sanitary easement text  
existing storm easement  
existing storm easement dimension  
existing storm easement text  
existing water easement  
existing water easement dimension  
existing water easement text  
existing lots  
existing lot dimension  
existing lot text  
point layer for monument symbols  
monument symbols  
monument text  
existing property iron symbol  
existing property iron text  
section lines  
existing row dimension  
existing row text

### Layer name

e\_actrl  
e\_ctrl\_txt  
e\_bm\_pt  
e\_bm\_sym  
e\_bm\_txt  
e\_bndy  
e\_bndy\_dim  
e\_bndy\_pt  
e\_bndy\_sym  
e\_bndy\_txt  
e\_brg  
e\_brg\_hatch  
e\_brg\_pt  
e\_ctrl  
e\_ctrl\_pt  
e\_ctrl\_sym  
e\_ctrl\_txt  
e\_esmt  
e\_esmt\_dim  
e\_esmt\_txt  
e\_esmtrd  
e\_esmtrd\_dim  
e\_esmtrd\_txt  
e\_esmts  
e\_esmts\_dim  
e\_esmts\_txt  
e\_esmtstm  
e\_esmtstm\_dim  
e\_esmtstm\_txt  
e\_esmtwm  
e\_esmtwm\_dim  
e\_esmtwm\_txt  
e\_lot  
e\_lot\_dim  
e\_lot\_txt  
e\_mon\_pt  
e\_mon\_sym  
e\_mon\_txt  
e\_prir\_sym  
e\_prir\_txt  
e\_secline  
e\_row\_dim  
e\_row\_txt  
e\_secline\_txt

section line text	e_row
existing row	e_setbk
existing setback line	e_setbk_dim
existing setback dimension	e_setbk_txt
existing setbk text	p_bndy
proposed boundary line	p_bndy_dim
proposed boundary dimension	p_bndy_txt
proposed boundary text	p_esmt
proposed easement	p_esmt_txt
proposed easement text	p_esmtgrad
proposed grading easement	p_esmtgrad_dim
proposed grading easement dimension	p_esmtgrad_txt
proposed grading easement text	p_esmtrd
proposed road easement	p_esmtrd_txt
proposed road easement text	p_esmtsan
proposed sanitary easement	p_esmtsan_txt
proposed sanitary easement text	p_esmtstm
proposed storm easement	p_esmtstm_txt
proposed storm easement text	p_esmttemgrad
proposed temporary grading easement	p_esmttemgrad_dim
proposed temp grading easement dimension	p_esmttemgrad_txt
proposed temp grading easement text	p_esmtwm
proposed water easement	p_esmtwm_txt
proposed water easement text	p_lot
proposed lot line	p_lot_dim
proposed lot dimension	p_lot_txt
proposed lot text	p_prir_sym
proposed property iron	p_prir_txt
proposed property iron text	p_row
proposed row	p_row_dim
proposed row dimension	p_row_txt
proposed row text	p_setbk
proposed setback	p_setbk_dim
proposed setback dimension	p_setbk_txt
proposed setback text	

