

WHITE LAKE CHARTER TOWNSHIP ENGINEERING DESIGN STANDARDS

A. GENERAL

1. The plans and specifications shall be prepared under the supervision of an Engineer registered in the State of Michigan and each sheet of the plans, excepting standard detail sheets provided by the Township, shall have imprinted thereon the seal and signature of that Engineer. Alternatively, the cover sheet only may be sealed and signed by the Engineer if the sheet index is contained thereon.
2. Plans may consist of: (a) a cover sheet showing a plan view of the complete project, (b) plan and profile sheets, and (c) detail sheets. Sheet size shall be 24" X 36". Plan and profile sheets shall be drawn to a minimum scale of 1" = 50' horizontally and a minimum of 1" = 5' vertically. Plan sets of 20 sheets or less shall be folded to 9"x12" with the title block out prior to submittal to the Township.
3. Elevations shall be based on NAD 88 with two permanent bench marks established at least every 1200' and shown on the plans.
4. All easements, lengths and sizes of sewers and water mains shall be shown.
5. Location (relative to property lines) of proposed streets and sanitary, storm and water lines shall be shown on the plans.
6. Design of public streets shall be in accordance with either Road Commission for Oakland County or MDOT standards, as applicable. Private roads serving site condominiums shall meet RCOC standards for residential subdivisions unless open ditches are requested for imperative environmental reasons in which case pavement width shall be not less than 22 feet. All private roads shall also meet the requirements of the Private Easement Roads section of the Township Zoning Ordinance.
7. Proposed site grading shall be shown on the plans by the use of contours at one or two foot intervals and/or spot elevations and flow arrows to realistically demonstrate the proposed route of flow of surface drainage.
8. Place notes on the plans as follows:
 - a. All construction shall be in accordance with the Township's current standards and specifications.
 - b. The Contractor shall notify the Township Engineer and/or the authority having jurisdiction, 48 hours prior to the beginning of construction.

- c. Contractor shall contact MISS DIG at 800-482-7171, 72 hours in advance of construction, for existing underground utility locations.
 - d. In order to verify compliance with approved plans, full-time construction observation will generally be required during all phases of underground site construction including installation of sanitary sewer, storm sewers, drains, watermains and appurtenances as well as private street curbing and paving construction. Intermittent observations will be made for site grading, parking lot curbing and paving, retaining wall construction and other surface activity.
9. Where it is necessary to extend off site improvements and/or utilities in order to meet the current requirements of the Township ordinances, these improvements shall be the sole responsibility of the developer. However, once these improvements become public property the entity having jurisdiction shall have all rights and responsibilities to the improvements or utilities, subject to maintenance and guarantee bonds and agreements.
 10. There shall be ten feet of horizontal separation between large trees and sanitary sewers, watermains and public storm sewers except as otherwise provided herein.
 11. All projects requiring site plan review are required to submit electronic record copy drawings (as-builts) at the end of the project, prior to final certificate of occupancy. Drawing requirements are appended to these standards for reference. Similarly, a certificate of compliance will be required regarding construction of any storm water sedimentation or storage basin, copy of the form is appended for reference.
 12. Topography shall be provided extending to at least 50 feet off-site and shall extend to the opposite right of way line of abutting streets. Elevation contours at one foot vertical intervals shall be provided in areas of construction except in areas of terrain steeper than 1v:3h where the contours may be extended to two foot intervals. Ground measured elevations shall be provided at the site perimeter.

B. GRADING AND PAVING

1. Any earth disruption of more than one acre or within 500 feet of a lake or stream or adjacent to any protected wetland will require a soil erosion control permit from White Lake Township. Any site with 5 acres or more of disturbed land will require a notice of coverage for the storm water discharge under the NPDES program as administered by the MDEQ.
2. Minimum and maximum grades shall be as follows unless approved by the Township Engineer:

	<u>Minimum</u>	<u>Maximum</u>
Grass Areas	1%	1 v to 3 h
Asphalt	1%	4% (8% in driveways)
Concrete	0.5%	4% (8% in driveways)

3. The limits of earth disruption shall be shown on the site plan.

4. All disturbed areas shall be revegetated prior to issuance of the final certificate of occupancy. Topsoil in a quantity to cover disturbed areas to a depth of 3" must be retained on site. Vegetation coverage shall be acceptable to the Township erosion control specialist prior to acceptance.
5. All grading shall meet the adjacent property grades unless a grading easement is obtained from the adjacent property owner.
6. Any grade changes which, in the opinion of the Township Engineer require a soil retaining system shall be designed by a qualified structural or geotechnical engineer. A detail of the retaining structure, with calculations shall be submitted to the Township Engineer for review. Any portion of a retaining wall more than 30" high shall have provided at the top of said wall a decorative railing not less than 42" high (non-residential uses) meeting the requirements of Section 1012.3 of the Michigan Building Code. The fence or railing for residential uses shall not be less than 36" high.
7. No filling or structures shall be placed in any floodplain unless compensatory volume is provided. All buildings shall comply with Michigan Building Code, F.E.M.A., and Township codes and ordinances regarding floodplain elevations.
8. Minimum standards for the construction of all asphalt parking areas and drives shall be 1.5" of inches of MDOT 36-A bituminous mix wearing course over 1.5" of bituminous mix MDOT 13-A leveling course on 6 inches of compacted MDOT 21AA stone or 8 inches of compacted 22A gravel. Construction of private roads shall meet the current requirements of the Road Commission for Oakland County.
9. All concrete areas shall be constructed in accordance with M.D.O.T. standards.
10. When paved areas are excavated, asphalt areas shall be saw-cut and removed to a distance equal to the depth of excavation (i.e. within a 1:1 slope from the bottom of excavation). Concrete shall be removed to the first joint past the distance equal to the depth of excavation. Granular backfill compacted in layers to a minimum of 95% of maximum unit weight is required in all excavations within a 1:1 slope of existing or proposed pavement.

C. STORM DRAINAGE SYSTEMS & RETENTION/DETENTION STANDARDS

1. General

- a. When concentrated storm water is proposed to be discharged over, onto or across private property other than that owned by the developer, an agreement between the owners must be executed relieving the Township of any responsibility for damage that might occur. Both the form and content of said agreement shall be subject to the approval of the Township's legal counsel. Such an agreement shall be submitted to (and approved by) the Township prior to construction.

- b. One copy of a plan shall be submitted to the Township Engineer on which is delineated the limits and acreage of the area(s) contributing surface drainage to:
 - (1) Each catch basin and inlet structure,
 - (2) Each proposed crossroad culvert, and
 - (3) Each existing crossroad culvert affected.
 - c. All notes, details and specifications found on the "Storm Sewer Standard Details Sheet" shall apply.
2. Manholes, catch basins and inlets.
- a. Generally, manholes shall be placed not more than 400' apart for sewers less than 30" diameter and 600' apart for larger sewers.
 - b. The minimum inside diameter of all manholes, catch basins and inlet structures shall be 48", with the following exception:

Inlet structures from which water will be discharged directly into a catch basin, may be 24" inside diameter. The depth of such inlets shall be no greater than 5.0' and no less than 3.5' from top of frame and cover to invert and shall allow no entrance pipes other than sub-drains. The exit pipe shall be no larger than 12".
 - c. Manholes and inlet structures may be constructed of brick, manhole block, precast concrete (ASTM C478), or cast-in-place concrete.
 - d. All manhole block or brick structures shall be plastered on the outside with 1 to 2.5 mix of portland cement mortar, 1/2" thick. No lime shall be added.
 - e. The type of covers and grates for catch basins and inlets shall be shown on the plans.
 - f. Horizontal separation from buildings shall be a minimum of 10 feet or a distance which will allow a 1:1 slope to the base of the foundation whichever is greater.
 - g. Where different sized pipes come together in a manhole the 8/10 ths flow lines shall match.
 - h. In commercial or industrial districts the 1st manhole upstream from an outlet which is released to a wetland or open watercourse, even through a detention basin, shall have a 3 ft. deep sump and a trapped outlet designed to retain 12" of floating solids or liquids. Proprietary storm water treatment systems will be considered on a case-by-case basis as an alternative to trapped sumps and sediment forebays.
 - i. Storm sewers which discharge to any wetland or natural water course shall be treated for sedimentation by use of a detention basin, leaching/sedimentation basin or a long, flat, broad swale. Proprietary storm water treatment systems will be considered on a

case-by-case basis as an alternative to trapped sumps and sediment forebays.

- j. Residential developments with high water tables or heavy soils in which frequent sump pump use is expected, shall provide underground storm sewer taps to each lot stubbed at the property line with a 3" diameter schedule 40 PVC pipe and temporarily marked with a 4" x 4" timber.
- k. Any storm sewer carrying off-site water and/or surface drainage other than from roof conductors or sump pump leads shall be at least 12" in size.

3. Storm Sewer Capacity, Design and Velocity.

- a. The following are permissible slopes for each pipe size for concrete pipe:

Pipe Size	Minimum. % of Grade <u>2.5 ft/sec</u>	Maximum % of Grade <u>10 ft/sec</u>
8"	0.60	8.35
10"	0.40	6.20
12"	0.32	4.88
15"	0.24	3.62
18"	0.20	2.84
21"	0.16	2.30
24"	0.14	1.94
27"	0.12	1.66
30"	0.10	1.44
36"	0.08	1.12
42"	0.06	0.92
48"	0.05	0.76
54"	0.04	0.60

- b. Sewer design capacity shall be determined by the rational method, ($Q = A.C.I.$), based on a 10 year storm with a 15 minute initial time of concentration. Single family areas may use an initial time of concentration of 20 minutes. Rainfall intensity shall be calculated using the formula $I=175/(t+25)$ where t is the time of concentration. Velocities, capacity and friction losses shall be based on Manning's formula generally with $n = 0.013$ for concrete pipe and 0.021 for corrugated metal pipe. 0.010 may be used for smooth bore plastic pipe.
- c. Hydraulic gradient (HGL) shall be shown, to scale, on the profile if the pipe is surcharged or a note provided on the plan that the hydraulic grade line is contained within the pipe. Pipe design shall be such that the HGL shall generally be held at least one foot below the rim of all structures; exceptions may be made at the discretion of the Township Engineer for depressed truck docks and rear yard swales which are well below adjacent building grades.

- d. Inlet structures in the public street right-of-way shall be spaced a maximum of 400' apart or a maximum of 400' each way from high points. The spacing and/or number of inlet structures required to accommodate the design flows in streets and in private drives and parking areas, shall be based on a maximum of 1 cfs per 90 square inches of opening in an inlet or catch basin cover.
- e. Generally, drops of over 2.0' at manholes, from invert of higher pipe to lower pipe, shall be avoided. Drops of over 2.0' require a two foot sump in the manhole to act as a water cushion.

4. Storm Water Retention/Detention.

Storm water management in the form of detention, or retention shall be required and maintained for all new developments, whenever the design engineer is unable to substantiate the adequacy of the receiving body of water or storm drainage facility.

In general, detention is defined as storm systems utilizing a controlled release rate, thereby detaining the stormwater. Detention basins have a positive outlet. Retention basins are defined as those systems that do not have a positive outlet, except through percolation and/or evapo-transpiration.

Wherever possible detention shall be preferred over retention or leaching basins. Leaching basins should only be used in a very specific set of circumstances as outlined herein and then only when other storm water management systems are not possible.

- a. Release rates for storm water detention facilities shall comply with the requirements of the governmental unit having jurisdiction of the receiving facility.
- b. In general, the release rate shall not exceed 0.2 cubic feet per second (cfs) per acre of that land currently draining to the proposed outlet.
- c. Detention volume, in cubic feet, shall be calculated by the O.C.D.C. simplified detention basin design method utilizing the 100 year design frequency rainfall of $275/(t+25)$ where t is the time in minutes.
- d. In general, the following runoff factors shall be used, either the given weighted value or an alternate calculated value based on actual mix of area types. An alternate green space C factor may apply (natural forest/porous soils could be lower, steep grass slopes on heavy soil could be higher).

<u>SURFACE</u>	<u>C FACTOR</u>
Green space	0.20
Pavement	0.80
Roof	0.90

Connected open water (wet basin)	1.00
SF developments (weighted)	0.35
Multiple Developments (weighted)	0.60
Commercial (weighted)	0.75

- e. For retention or detention basins a minimum 12" free board shall be provided between the design high water level and the secondary overflow.
- f. The top berm of a retention or detention basin shall be a minimum of 6" above the overflow spillway. Armored overflow spillways of bermed basins shall be provided to prevent destruction of the basin in the case of overtopping. Armoring shall be commensurate with the risk to downstream areas in the event of a major overtopping. Sod or other soft armoring may be acceptable in low risk situations; rip-rap, gabion or concrete may be required in higher risk situations.
- g. Generally, side slopes shall be no steeper than 1v to 3h if fenced with chain link 5' high, or 1v to 6h if unfenced. An 8' (minimum) gated access opening shall be provided for all fenced basins. Alternative slopes may be considered if proper engineering data and maintenance provisions are clearly provided for evaluation. Innovative slope designs are encouraged if significant aesthetic benefit is gained by using materials such as boulder walls. Pedestrian and vehicular safety must be maintained in all cases. Side slopes of 1v to 4h will be considered for unfenced dry detention basins.
- h. Slope bottom of detention basin to outlet, to provide for total dewatering for dry basins. Minimum slope for dry basins shall be 1.00 percent. Permanent wet basins are encouraged where the water table allows in order to provide for additional sediment removal. Wet basins shall provide for a minimum two foot water depth.
- i. Specify method(s) to be used for sealing the bottom and sides of the basin, where elevated groundwater or seepage would adversely affect nearby properties.
- j. The detention basin shall provide a permanent outlet filter set to overflow at the 1 year frequency storm, and a primary overflow structure at the 100 year frequency level. The filter shall be equal to the Oakland County Drain Commissioner Detention Basin Outlet Filter (CMP) Detail SO-2.
- k. Provide 12' wide easements for access when a basin maintenance agreement is required.
- l. Limits of detention (outline of the water at the 100 year design level) must be clearly shown on the site plan.
- m. If detention is provided in an area which has permanent standing water, detention volume will be calculated above the permanent water line

- n. Where it is not possible to provide a positive outlet for storm water management a retention basin (i.e. no outlet) may be used. This basin shall be designed to accommodate storm water from two consecutive 100 yr. storms and soils and water table information shall be provided to substantiate that water levels will return to pre-existing conditions at least once per year. The formula for retention volume in cubic feet shall be $33,000AC$ where A is the drainage area under proposed conditions and C is the weighted runoff factor.
- o. There shall be no retention (i.e. no positive outlet) in parking areas.
- p. All retention/detention basin areas shall be re-vegetated prior to issuance of a certificate of occupancy. All soil erosion control measures shall remain in place until vegetation is re-established sufficiently to control erosion. A cash bond shall be placed with the Township to guarantee that when the development is fully stabilized, any basin relying on infiltration will be drained and any accumulated sediment will be removed and that the bottom and sides of the basin deeply scarified to allow infiltration and the basin will be revegetated.
- q. An agreement for operation and/or maintenance of all detention and/or retention basin facilities shall be required by the Township. The agreement, both as to form and content, shall be subject to the approval of the Township Attorney.
- r. No more than 50% of the total required detention storage volume shall be provided above the surface in the parking lot or drive access areas. The remaining storage may be incorporated in the connecting storm pipes, in open graded stone storm sewer trench backfill, in the risers of the storm sewer structures, in underground storage tanks and in open detention basins.

By limiting parking lot detention to 50% of the total, the frequent heavier storm will be contained completely underground. Light rainfalls will generally be conveyed through the restrictive outlet pipe or orifice without the need for detention.
- s. Maximum detention depth over any catch basin in parking or access aisles shall be 8" (0.67 feet). The maximum depth in any non-handicapper accessible parking space shall be 6" (0.50 feet). Barrier free parking and access routes shall not be used for stormwater storage nor shall sidewalks connecting the parking area to the building.
- t. All parts of the building shall be protected from flooding due to storage levels 12" (1.00 feet) above the 100 year design level of the parking lot storage. If at all possible, an overland flow route shall be provided which is below the flood level of the building.
- u. To provide additional storage beyond the parking lot, the following alternates (in any combination) are allowable:
 - 1) Over sizing of the storm sewer connecting pipes utilizing normally accepted

pipe materials while maintaining minimum cover requirements and a free draining pipe invert.

- 2) Utilizing a "French Drain" trench with open graded pipe backfill completely contained in a geotextile filter fabric. The stone voids may be assumed to be no more than 40% of the backfill volume. The pipe shall be hydraulically connected to the stone backfill utilizing perforated smooth bore corrugated polyethylene pipe (N-12 or Hi-Q). Only storage volume above a free draining invert will be allowed unless exceptionally granular native soils and a deep water table can be demonstrated.
 - 3) Underground tanks constructed of concrete, fiberglass, polyethylene or corrugated metal. All tanks not in a green space protected from vehicular traffic by curbing or a substantial natural barrier shall be designed for H-20 heavy duty traffic loading. CMP tanks shall meet MDOT standard gauge requirements, but in any case shall not be less than 10 gauge and shall be galvanized and bituminous coated on the exterior or shall be aluminized. All tanks shall have manhole access utilizing a cast iron frame and lid and manhole rungs meeting the requirements of MIOSHA.
 - 4) Open basins meeting existing detention basin requirements.
 - 5) Proprietary underground storage devices will be evaluated on a case by case basis.
- v. Open detention or retention basins shall be constructed and stabilized and be provided with the outlet, filter and overflow devices prior to commencing mass grading of the balance of the site. During site construction, the detention basin outlet will be temporarily restricted to no greater than a 3" outlet.

5. Engineered Infiltration Systems

Engineered Infiltration Systems may be utilized when all the following conditions exist:

- a. No adequate storm sewer, open ditch, or road drain is available for storm water disposal and an open retention pond is not prudent or feasible.
- b. Soil composition is optimum and ground water table is suitable for percolation. Optimum soil conditions defines soil composed entirely of coarse sand, gravel, or a coarse sand gravel mixture. A soils report by a licensed engineer with borings to 20 10 feet below the bottom of the infiltration system with groundwater level data and in situ or laboratory determined permeability rates and recommending the advisability of an Engineered Infiltration System shall be provided.
- c. Leaching basins shall be sized as a combination storage and groundwater discharge

detention basin with storage volume determined the same as open detention basins. The discharge rate shall not exceed a perc rate of 6" per hour for the bottom and sides of the soil/stone interface (sides of the trenches). Stone voids ratio may be assumed as 0.40.

One of two standard basins based on the designs shown on the Township Standard Storm Sewer Detail Sheet or proprietary underground storage/infiltration systems or other engineered systems if approved by the Township Engineer may be used.

6. Sedimentation Forebays/Pretreatment

- a. Open detention/retention basins shall be provided with a sediment forebay constructed in accordance with the standards of the Oakland County Drain Commissioner, Engineering Design Standards for Storm Water Facilities. In general, the capacity shall be adequate to contain a one-year storm and release it over a period of 48 hours.
- b. The volume, above any permanent water level, may be considered in calculation total detention volume of the basin system.
- c. Proprietary water treatment devices, such as the StormCeptor or Aqua Swirl will be considered on a case by case basis as a substitute for a sediment forebay. Those devices may also be considered as a pretreatment device prior to discharging to an underground detention/recharge system or an open water course.
- d. Surface water discharge of commercial areas to an engineered infiltration system shall require pretreatment to remove oil, grease, floating trash and approximately 80% of the Total Suspended Solids (TSS) in order to protect the water table aquifer.

D. WATER SUPPLY AND DISTRIBUTION SYSTEMS.

1. Water mains shall be installed with a minimum of 6'-0" of cover except at gate wells where they shall be installed with a 5' depth of cover, so that a standard valve key can be used to operate the valve.
2. Watermains shall generally be installed on the north or east side of the street at 7.5' off the property line.
3. If street trees are required, they shall be placed as far from the main as possible, but in no case less than 3' from the watermain.
4. Watermains not located within a public street right-of-way shall be within either a 60' wide utility/ingress-egress easement dedicated to White Lake Township in the case of private streets or in a 20' wide easement if it is not in juxtaposition with a public street or in an easement extending to 10' beyond the watermain in the case of the easement being in juxtaposition with a public street. Variances from this requirement may be considered on a case by case basis by the Township Engineer. In the case of 20' easements not in juxtaposition with a public road, no structures or trees, other than small ornamental trees or shrubs will be allowed in the easement.

5. Refer to Ordinance 22, for design requirements of significant off-site watermains. In general off-site watermains shall be designed by the Township Engineer at the developer's expense unless the design engineer can demonstrate recent and substantial experience in public sector municipal utility design. In either case, the watermain may be constructed by the developer's contractor, under inspection by the Township Engineer.
6. Plans and specifications shall be prepared in accordance with the White Lake Township Standards and shall include profiles for watermains 16" in diameter and larger. Special profiles or cross sections may be required in some instances.
7. In general, all water systems in developments requiring more than 600 feet of watermain shall be looped, i.e. there shall be two or more sources of supply. It shall be the decision of the Township Engineer whether a water system must be looped.
8. A barrel to barrel separation of 10 feet shall be maintained between watermain and sanitary sewers, sewer leads or storm sewers. A minimum of 18" of vertical separation is required. Watermains below sanitary sewers are to be avoided, if it must occur, the crossing shall be perpendicular and no watermain joint shall be closer than 8 feet from the sewer.
9. All watermains installed on private property must be centered in 20-foot wide exclusive easements. If watermains are installed in private roads, easements, which are the full width of the road, are required.
10. Distribution systems shall be designed to be capable of delivering a minimum of 1,000 gallons per minute at 20 pounds per square inch pressure at each hydrant.
11. In general, all watermains shall be Ductile Iron Class 54 with push on joints including bends and tees. Watermains installed by directional boring methods may be ductile iron with special joints or HDPE DR 9 meeting AWWA C906 and ANSI-NSF-61 standards.
12. Domestic water services with line sizes and material shall be shown for all buildings other than single family detached dwellings.

The minimum acceptable size shall be 1". The basis of size for all others shall be determined by the developer's engineer and submitted for approval by the municipality prior to submittal of final plans.

Domestic services may tap into fire lines within easement. Separate shutoffs are required for both the fire line and domestic line.
13. Watermain profiles, where required by these standards must include the pipe diameter, slope, pipe material and class, control center line elevations, existing and proposed ground profile at centerline of construction and locations where sand backfill is required.
14. All utility crossings must be shown in the profile view.

15. All dead end watermains except those in cul-de-sacs, terminate with a gate valve and hydrant. A blow-off may be substituted with Water Department and Fire Chief approval.
16. The watermain shall be extended across the entire frontage of the site. Size and location shall be as required by the Township Engineer.
17. Maximum 6" hydrant lead length shall be 40 feet.
18. Water mains shall be a minimum of 8" diameter except for hydrant leads under 40' long, which may be 6" diameter.
19. Valves and gate wells shall be so located that no more than four valves must be closed to isolate a section of water main.
20. Valves shall be located so that no more than 800 feet of watermain will out of service.
21. All connections to an existing watermain shall be accomplished utilizing tapping sleeves valves and wells unless other methods are specifically authorized by the Township Engineer.
22. Hydrant spacing along roads and streets shall be 500 feet maximum in single family residential areas and 300 feet maximum in commercial, multiple family or industrial areas.
23. Hydrant spacing around commercial buildings and manufacturing establishments is variable and will be determined on a case by case basis.
24. In general, hydrants in high density residential developments shall be located so that the most remote part of every building can be reached from a minimum of two hydrants, utilizing a maximum unobstructed hose length of 300' from any hydrant.
25. Hydrants shall be located so that they are at least 50' distant from any building or trash enclosure.
26. Whenever practical hydrants shall be located at street intersections.
27. All mainline gate valves are to be within gate wells. The valves must be the same size as is the watermain.
28. Both hydrants and the related auxiliary valves are to be located so that they are readily accessible by fire fighting equipment. An improved all-weather-surfaced road or drive, at least extending to within 15' of each hydrant, shall be provided. Temporary hydrants may be exempted from this requirement.
29. Standard White Lake Township detail sheets for watermains are required to be included in all final construction plans where watermains are being proposed.

30. Hydrants must be located such that the centerline is 6 feet behind the back of curb or in the backside of ditches. Ditch enclosures must be provided for hydrants located behind the ditch line and must be sized to convey the normal 10 year design flow of all upstream tributary areas.
31. Watermains around cul-de-sacs shall extend far enough around them to serve all contiguous lots. The associated fire hydrant at the terminus is to be located in the cul-de-sac island in a position most prominent to incoming traffic.
32. Horizontal separation from buildings shall be a minimum of 10 feet or a distance which will allow a 1:1 slope to the base of the foundation whichever is greater.
33. Prior to acceptance of the watermain by the Township, the following shall be submitted, reviewed and approved by the Township:
 - a. Waiver of lien and sworn statement from the contractor/developer.
 - b. Maintenance Bond - 50% of the value of the water system for two (2) years from the date of acceptance, wording shall be as required by Ordinance 22.
 - c. Bill of Sale or Dedication for the water distribution system
 - e. Executed watermain easements.
 - e. Adobe PDF compatible electronic file and 2 full size sealed paper copies of the approved as-built plan.

E. SANITARY SEWER SYSTEMS.

1. Generally, no sewer shall be less than 8' in depth to the invert below crown of road, and in no case shall have less than 4' of cover.
 - a. Sewers shall generally be installed on the south or west side of the street at 7.5' off the property line.
 - b. If street trees are required, they shall be placed as far from the sewer as possible, but in no case less than 3' from the sewer.
 - c. Sewers not located within a public street right-of-way shall be within either a 60' wide utility/ingress-egress easement dedicated to White Lake Township in the case of private streets or in a 20' wide easement if it is not in juxtaposition with a public street or in an easement extending to 10' beyond the sewer in the case of the easement being in juxtaposition with a public street. Variances from this requirement may be considered on a case by case basis by the Township Engineer. In the case of 20' easements not in juxtaposition with a public road, no structures or trees, other than small ornamental trees or shrubs will be allowed in the easement.
 - d. Pipe materials and joints as well as standard construction details for manholes, drop connections, sumps, house lead and risers and low pressure sewers shall be in accordance with the current standards of White Lake Township and the

Oakland County Department of Public Works.

6. A listing of the current Oakland County Department of Public Works "Sanitary Sewer Construction Notes" shall be incorporated in the plans and all requirements and all regulations contained in these notes shall be followed.
7. The "Standard Bedding" details of the Oakland County Department of Public Works shall apply for type of pipe utilized.
8. Service leads to commercial buildings shall be a minimum 6" diameter and a maximum length of 150'. Approved cleanouts shall be located at intervals of no more than 75', and at all changes in direction. A 4' diameter sampling manhole located near the building shall be provided in the building lead for all commercial and industrial uses or residential uses involving food service. The manhole cover of the sampling manhole shall be marked sanitary sewer but shall not reference White Lake Township or Oakland County.
9. Service leads shall be installed at a minimum one percent (1%) grade
10. Any sewer serving more than one building shall be a minimum 8" sewer with manholes. Any sewer serving more than one property shall be a public sewer.
11. No sanitary sewer shall be installed closer than 10' distant from any building, swimming pool or other structure or a distance which will allow a 1:1 slope to the base of the foundation whichever is greater.
12. There shall be a temporary 1 ft. sump in the furthest downstream manhole for construction and testing purposes.
13. The last run (furthest upstream run) shall have a minimum grade of 1%, unless approved by the Township Engineer.
14. All leads to commercial or institutional food service operations shall have a 1000 gallon grease interceptor. The kitchen facilities only shall be connected to this interceptor.
15. Downspouts, foundation drains, weep tiles or any conduit that carries stormwater or groundwater will not be permitted to discharge into the sanitary sewer system. Floor drains shall connect to the sanitary sewer. Uncovered truck docks shall be connected to the storm sewer system and shall be trapped.
16. Extension of the sanitary sewer across the entire frontage of the site and/or as required by the Township to service upstream properties is required. The size and location shall be as required by the Township Engineer.
17. Sanitary sewer will be located so as to provide unrestricted access for maintenance and inspection. Wherever possible the sanitary sewer should be located within 15 feet of a paved road or parking area.

18. Both existing and proposed ground elevations shall be shown on profiles.
19. Utility crossings (sanitary, storm, water, houselead and water services), with elevations, shall be shown on all profiles. Generally, a minimum of 18" clearance, vertically shall be provided between utilities. Watermain should be above sanitary sewer.
20. Lengths of run between structures, pipe size and class, percentage of grade, and elevation of tops of frame and cover, and dimensions to all leads from the nearest down-stream manhole shall be indicated on the profiles of storm and sanitary.
21. External drop connections shall be used for all manhole locations with 18 inches or more difference between inverts of pipes unless otherwise approved. Current Oakland County standards shall be utilized.
22. Where pipes of differing sizes join in a manhole the 8/10ths flow lines shall match.
23. Where an angle of less than 135 degrees is created by two pipes in a manhole, the outflowing invert shall be a minimum of 0.1 ft. lower than the inflowing invert.
24. Additional items pertaining to sanitary sewer capacities and depths of cover for pipe materials, etc., can be found in the "Sanitary Sewer Standard Details" sheet(s). All notes, standards and specifications found on the "Sanitary Sewer Details" sheet shall apply.
25. A completed Part 41 of Act 451 permit application shall be provided for review with the sanitary sewer plans. A sample form is available from the Township Engineer.
26. Prior to acceptance of the sewer by the Township, the following shall be submitted, reviewed and approved by the Township:
 - a. Waiver of lien and sworn statement from the contractor/developer.
 - b. Maintenance Bond - 50% of the value of the sewer system for two (2) years from the date of acceptance.
 - c. Bill of Sale or Dedication for sewer.
 - d. Executed sewer easements.
 - e. Adobe PDF compatible electronic file and 2 full size sealed paper copies of the approved as-built plan.

END

Charter Township of White Lake
Checklist of As-Built Drawing Requirements

- A. Grading
 - 1. Rear yard swale elevations and enough on site elevations to clearly indicate drainage patterns and confirm that the site was built in substantial conformance with the construction drawings.
 - 2. Finish floor elevation of all buildings.
 - 3. Location and height and type of retaining walls.

- B. Storm Sewer
 - 1. Pipe lengths, sizes and slopes.
 - 2. Rim elevations of drainage structures.
 - 3. Pipe inverts.
 - 4. Pipe material and class.
 - 5. Joint type
 - 6. Two dimensional ties to manholes, not required for CB=s or inlets in pavement. Back of curb is sufficient for one tie, property corners are not acceptable, existing building corners, trees, other utility structures and hydrants are acceptable, preferably at a distance of less than 100 feet.
 - 7. Structure numbers.
 - 8. Pipe manufacturer and structure manufacturer.
 - 9. Casting types by manufacturer catalog number.
 - 10. Verification of special features such as trapped catch basins or leaching basins.

- C. Detention/Retention Basins
 - 1. As-built volume with calculations.
 - 2. Elevations of primary and secondary overflows.
 - 3. Elevations of inlet and outlet pipe.
 - 4. Berm and spillway weir elevations.
 - 5. Outlet restrictor location and size.
 - 6. Certification must be provided and sealed by an engineer licensed in the State of Michigan to verify that the detention or retention basin volume and restrictor size is in substantial conformance with the construction documents.
 - 7. Bottom and top of slope elevations to determine that side slopes meet plan slopes.
 - 8. As-built basin contours at one foot intervals

- D. Sanitary Sewer (if requested by Township sewer engineer)
 - 1. Length between manholes, pipe sizes and slopes.
 - 2. Rim elevations of manholes.
 - 3. Casing size, length, thickness and filling material and location along sewer run.
 - 4. Two dimensional ties to manholes and cleanouts and leads. Back of curb is sufficient for one tie, property corners are not acceptable, existing building corners, trees, other utility structures and hydrants are acceptable, preferably at a distance of less than 100 feet.
 - 5. Pipe material and joint type.
 - 6. Pipe manufacturer and manhole manufacturer and casting make and model no.
 - 7. Pipe inverts at structures.
 - 8. Manhole numbers.
 - 9. Wye locations.

10. Special detail for force main structure, including part manufacturer and model nos.
11. All start-up data and O. & M. manuals for pump station

E. Watermain

1. Length between valves and wells, tees, bends, other fittings
2. Size of pipe.
3. Pipe material class and joint type.
4. Manufacturer of pipe, gate wells, valves, hydrants, fittings.
5. At least two dimensional ties to gate valves and wells. Back of curb is sufficient for one tie, property corners are not acceptable, existing building corners, trees, other utility structures and hydrants are acceptable, preferably at a distance of less than 100 feet.
6. Finish grade of hydrants, rim elevation of gate wells.
7. Special details for utility crossings showing location of vertical bends, pipe clearances, type of restraints.
8. Casing size, length, thickness and filling material.
9. Hydrant and gate valve numbers.
10. Verification that the watermain is no closer than 6 feet to the edge of and is within the easement or public right-of-way line

Information must be placed on a copy of the construction plans with design information crossed out, not erased. Provide two blueprints for review prior to providing digital copy.

It is not necessary to provide duplicate information in both the plan view and profile view however, the location of all as-built information must be clearly referenced.

A legend to identify as-built information must be provided.

Redraw profiles if pipe elevations vary by more than 2.0 feet or pipe lengths change by more than 20 feet.

All as-built information must be presented in a clear and concise manner.

When approved, an Adobe PDF compatible digital file shall be submitted to the Township Engineer. If that is not possible, a clean paper copy supplied by the design engineer will be scanned by the Township Engineer. In either case, two sealed sets of prints are required. All site plan sheets except standard details and including the cover sheet shall be provided.

**CERTIFICATION OF STORM WATER BASIN CONSTRUCTION
FOR THE CHARTER TOWNSHIP OF WHITE LAKE
OAKLAND COUNTY, MICHIGAN**

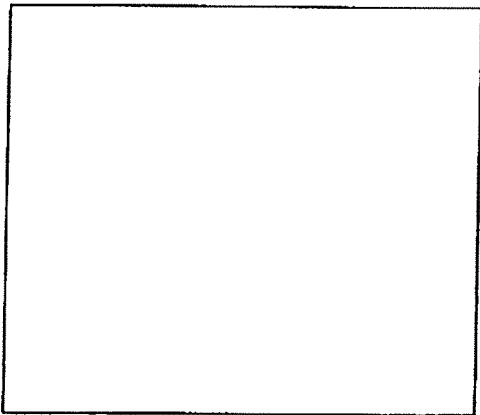
PROJECT NAME

ADDRESS OR LOCATION DESCRIPTION

TOWNSHIP FILE # _____ SECTION _____

BASIN(S) LOCATION OR DESCRIPTION:

In accordance with the requirements of the Charter Township of White Lake, I hereby certify to the Charter Township of White Lake that as of this date the storm water sedimentation, detention or retention basin(s), for all intents and purposes, was (were) constructed according to the plans approved by the Charter Township of White Lake, and that the basin(s) will detain the volume as shown on the approved construction plans with the required one foot of freeboard and that in the case of detention basins, the outlet restrictor and all overflow devices have been built per plan.



By: _____

Michigan Licensed Surveyor or Engineer

Date: _____

Firm Name: _____

Address: _____

SEAL