

ENGINEERING DESIGN & CONSTRUCTION STANDARDS

City of Howell



Adopted by City Council

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City of Howell Engineering Design Standards

These Engineering Design Standards are intended to provide a reasonable basis for design of public and private improvements in the City of Howell. They are not intended as a substitute for sound engineering judgment. The Standards may not apply to all conditions, and alternate solutions shall be permitted as approved by the City's Administration and/or Engineer.

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City of Howell

Engineering Design Standards

1. GENERAL

- 1.1 Complete improvement plans bearing the seal of a licensed Professional Engineer, Surveyor or Architect licensed to practice in the State of Michigan.
- 1.2 A certified boundary survey of the site, prepared and sealed by a licensed Professional Engineer, Surveyor licensed to practice in the State of Michigan, or a copy of the completed plat shall be submitted with the engineering drawings.
- 1.3 Plans submitted shall be on 24" x 36" white prints having black lines and shall be neatly and accurately prepared.
- 1.4 All plans shall contain the date of the last revision on each sheet.
- 1.5 For projects or subdivisions having more than 1 sheet of plans, a general plan having a scale of 1" = 100' shall be provided showing the overall project and indicating the size and general location of all improvements shown in the detailed plans.
- 1.6 Street names, street and easement widths, lot lines, lot dimensions, lot numbers and ownership shall be shown on all plans.
- 1.7 Elevations shall be on U.S.G.S. Datum. 2 permanent bench marks for the work shall be indicated on the plans.
- 1.8 Any areas of potential "wetlands" as defined by the Michigan Department of Environmental Quality (MDEQ) shall be indicated on the plans. No improvements will be allowed in wetlands unless the MDEQ issues a permit, or a letter of "No Authority", for such improvements.
- 1.9 Finished grade shall be indicated for all structures.
- 1.10 The developer or their engineer shall be responsible for forwarding plans for approval to any private utility company (gas, electric, phone, cable, etc.) and any Federal, State or County (Drain Commission, Road Commission, etc.) agency whose facilities or rights-of-way may be affected by the proposed construction.
- 1.11 It shall be the owner's engineer and contractor's responsibility to verify the existence and location of all underground utilities.
- 1.12 All engineering construction plans shall contain the latest version of the applicable City of Howell Standard Detail Sheets.
- 1.13 The developer's/owner's company, contact name(s), address, phone number and fax number shall be shown on the plans.

- 1.14 An Engineer's Opinion of Construction Cost must be supplied with the Site Plan submittal. This estimate will be used by the City to establish review fees, observation escrow accounts and performance bonds for the improvements in accordance with the City's Ordinance.
- 1.15 All utility trenches under the 45 degree zone of influence line of existing or proposed pavements, bike paths, sidewalks or drive approaches shall be backfilled with Class II sand compacted to at least 95% of maximum unit weight.
- 1.16 Utility crossings of paved roadways will be required to be bored. Open cutting of paved roadways will not be permitted.
- 1.17 An itemized quantity list will be required for all proposed utility improvements (water main, sanitary sewer, storm sewer).

1.18 Pre-Construction Meeting

Once the engineering plans have been approved by the City, a pre-construction meeting with the Applicant and/or their representative is required prior to the start of any site work. This meeting will verify that all relevant permits have been applied for, that the proper insurance is provided and to schedule construction observation. The owner's representative and underground contractor are required to attend this meeting.

1.19 Insurance

Prior to commencement of the work, the Contractor shall purchase and maintain during the term of the project such insurance as will protect him, the Owner, and the Engineer from claims arising out of the work described in this contract and performed by the Contractor, Subcontractor(s) or Sub-Subcontractor(s) consisting of: Worker's Compensation Insurance, Comprehensive General Liability, Comprehensive Automobile Liability, Owner's Protective Liability Policy, Umbrella or Excess Liability. A sample form is attached for reference. This form may change or be updated from time to time.

The required limits of liability for insurance coverage shall be **not less than** the following:

Workers' Compensation

Coverage A - Compensation..... Statutory
 Coverage B - Employer's Liability..... \$500,000

Comprehensive General Liability

Bodily Injury and Property Damage	\$1,000,000	Each Occurrence
Combined Single Limit	\$2,000,000	Per Job Aggregate
.....	\$1,000,000	Completed Operations
		Aggregate

Comprehensive Automobile Liability

Bodily Injury and Property Damage \$1,000,000 Each Accident
Combined Single Limit

Owner's Protective

Bodily Injury and Property Damage \$1,000,000 Per Occurrence
Combined Single Limit \$1,000,000 Aggregate

Umbrella or Excess Liability \$2,000,000 Per Occurrence
\$2,000,000 Aggregate

Notice of Cancellations or Intent Not to Renew – Policies will be endorsed to provide that at least 30 days written notice shall be given to the City and to the Engineer of cancellation of, or intent not to renew.

The policies shall include the following additional insured on all policies other than Worker’s Compensation:

- City of Howell, their Council members, elected officials, officers, consultants, agents, and employees.
- The City of Howell’s Engineer, their owners, officers, consultants, agents, and employees.

1.20 Performance Guarantee

The Contractor is required to provide a Performance Guarantee in conformance with City of Howell Code of Ordinances. Projects not 100% complete will require an escrow deposit with the City in the amount of the unfinished improvements, and signed off by all City Departments and agencies, prior to issuance of a temporary certificate of occupancy.

2. WATER MAIN

2.1 *General*

- 2.1.1 If the proposed improvements include the construction of public water main, the developer shall submit 6 sets of water main only plans with a completed MDEQ permit application. This information will be forwarded by the City to the MDEQ for permitting.
- 2.1.2 All water system improvements shall be designed in accordance with the current edition of "Recommended Standards for Water Works" (a/k/a Ten State Standards).
- 2.1.3 All testing of new water mains (Bac-T, pressure, etc.) shall comply with the latest requirements of the American Water Works Association (AWWA).
- 2.1.4 Water mains in new developments shall be installed from boundary to boundary in abutting road rights-of-way, on roads the project fronts, on interior streets and at other locations as may be deemed necessary by the City for future extensions.
- 2.1.5 The City of Howell has adopted a Wellhead Protection Plan which all projects are required to adhere to. A copy of the plan is available at www.cityofhowell.org

2.2 *Design Requirements*

- 2.2.1 8" minimum diameter mains will be installed in single family residential areas.
- 2.2.2 12' mains are considered to be the minimum size in commercial, office, industrial, and multiple family residential areas except in a looped system of 1,500' or less where 8" mains may be permitted.
- 2.2.3 Dead end mains are not recommended. However, if they are approved by the City, the maximum length of a dead end main shall be 600' in single family and 500' in multi-family.
- 2.2.4 Water mains are to be looped whenever possible. Interconnection to existing public water supply systems is encouraged.
- 2.2.5 Hydrant leads longer than 75' must be 8'.
- 2.2.6 No service leads are allowed to connect to a hydrant lead.
- 2.2.7 Profile view is required for 16" and larger water mains, and for other smaller sizes when determined necessary by the City.

- 2.2.8 Water mains shall be kept on one side of the street for the entire length of the street. Water mains shall not be located under pavement or under cul-de-sacs unless approved by the City and/or their Engineer.
- 2.2.9 Gate valves shall be spaced at a maximum of 800' intervals on distribution lines. They shall be spaced such that not more than four valves need to be turned off to isolate any section of the water main.
- 2.2.10 Sufficient valves shall be placed such that not more than 24 single family homes, 30 multiple family units or 2 hydrants shall be out of service within a section of isolated water main.
- 2.2.11 Dead-end mains must end with a hydrant and a gate valve and box.
- 2.2.12 Gate valves should not be located under roadway pavement, bike paths, sidewalks or driveway approaches when possible, unless approved by the City and/or their Engineer.
- 2.2.13 In single family residential areas, hydrants shall be spaced along the water main a maximum of 500'. Commercial, industrial and multiple family spacing shall be a maximum of 250'.
- 2.2.14 Hydrants shall be located a minimum of 3', or a maximum of 8', behind the back of curb, unless approved by the City and/or their Engineer.
- 2.2.15 Buildings shall be covered by a 250' radius of a hydrant. Hydrants shall be no closer than 2 times the height of the tallest part of the structure. There shall be a fire hydrant located within 100' of any building fire department connection.
- 2.2.16 Hydrants located in parking areas shall be protected with a 6" (minimum) concrete curb or standard guard posts. A 3' minimum clear space shall be maintained around the circumference of the hydrant.
- 2.2.17 When connecting to an existing water main, a tapping sleeve, gate valve and box will be required unless connection to the existing main can be made without interrupting service on the main.
- 2.2.18 The plans shall indicate the finish grades of all hydrants and valve boxes.
- 2.2.19 Water mains shall be located so as to provide a minimum of 10' horizontal clearance between the nearest edge of the water main and the nearest edge of any sanitary or storm sewer.
- 2.2.20 A minimum vertical clearance of 18" shall be maintained between the top or bottom of any water main and the top or bottom of any sewer or utility line. Vertical clearance of less than 18" will require concrete encasement of the sewer and/or utility line.

2.2.21 Restrained joints shall be used at all bends, tees, hydrant shoes, plugs and caps where necessary to prevent lateral movement of the water main as outlined in the Restrained Joint Schedule found in the Water Main Standard Detail Sheet.

2.2.22 All public water main not contained in a public right-of-way shall be centered within a minimum 20' wide easement, dedicated to the City of Howell. The City has standard easement forms that can be used. These forms have been reviewed and approved by the City's legal counsel. The developer/applicant can propose to utilize alternate forms, however they will need to be reviewed and approved by the City's attorney.

2.3 *Materials*

Item	Material	Manufacturer
Pipe	Ductile iron class 52	various
	- 2 brass wedges per joint	
Gate valve	Flow Master	EJ
	A2360	Mueller
	- left hand open	
	- resilient seated	
Hydrant	Water Master 5BR 250	EJ
	Centurion 200	Mueller
	- with 1 - 5" Storz nozzle	
	- with 2 - 2.5" hose fittings	
	- 5.5' bury	
Restrained joints	Mega-Lug	EBAA Iron
	Field-Lok gasket	US Pipe
Corporation stop	Compression - H15008	Mueller
Curb stop	Compression - H15209	Mueller
Curb box	Arch pattern H10314	Mueller
	- with extension rod	
Valve box	6860 Series 5-1/4" adjustable	Tyler
Tapping sleeve	Stainless steel	various
Gate well cover	1040 Type A w/ Howell cover	EJ
Service lead pipe	Type K copper	various

2.4 *Installation*

- 2.4.1 Copies of the water service permit applications and meter requests can be found at www.cityofhowell.org/permits
- 2.4.2 All water main shall be installed with a minimum cover of 5.5' below finish grade. The maximum cover shall be 8.5' unless approved by the City or its Engineer. When water mains must dip to pass under another utility, the sections which are deeper than normal shall be kept to a minimum length by the use of vertical bends, properly restrained.
- 2.4.3 The contractor will fill, disinfect and pressure test all new water main construction under the supervision of the City of Howell and/or its agent.
- 2.4.4 Before any water main will be accepted by the City, it must pass bacteriological and pressure testing complying with the current specifications and procedures of the City.
- 2.4.5 Water main shall not be placed closer than 20' (measured horizontally) from any building footing.
- 2.4.6 All water service taps shall be installed by the developer/contractor under the City's supervision.
- 2.4.7 Water/sewer meters shall be purchased from, and installed by, the City.
- 2.4.8 For Capital charges and Meter Fees, please refer to the Fee Schedule located on the Water/Sewer Application. This application is made available at the City's Department of Public Works, Building Department and online at www.cityofhowell.org/permits.

SECTION 3 SANITARY SEWER

3.1 General

- 3.1.1 All non-domestic facilities (i.e. commercial, industrial, etc.) will be required to fill out and submit a *Sanitary Determination of Use* application. A copy can be found at www.cityofhowell.org/permits
- 3.1.2 If the proposed improvements include the construction of public sanitary sewer, the developer shall submit sufficient sets of sanitary sewer only plans, with a completed Part 41 MDEQ permit application. This information will be forwarded by the City's Engineer to the MDEQ for permitting.
- 3.1.3 All sanitary sewer improvements shall be design in accordance with the current edition of "Recommended Standards for Wastewater Facilities" (a/k/a Ten State Standards).
- 3.1.4 A fats/oils/grease interceptor will be required for all food service operations in accordance with City Ordinance Chapter 1043. No connections for domestic waste will be allowed to the interceptor.
- 3.1.5 Downspouts, weep tile, footing drains, sump pump discharges, or any conduit, that carries storm or ground water shall not be allowed to discharge into a sanitary sewer.
- 3.1.6 Sanitary sewers must be placed in standard minimum 20' easements. The easement width may be increased depending on the proposed sewer depth, soil conditions or adjacent facilities.
- 3.1.7 It shall be the responsibility of the applicant to field check and verify the utility information provided by the City.

3.2 Design Requirements

- 3.2.1 At all connections to the City 's sanitary system or extension thereto, in the first manhole upstream from the connection, provide a water-tight bulkhead with a 1" diameter pipe through the bulkhead for measuring infiltration immediately upstream. Also a 1' sump at the base of the manhole shall be provided.
- 3.2.2 The minimum allowable size of a public sanitary sewer is 10" diameter.

3.2.3 The following table of minimum slopes for sanitary sewers shall be adhered to:

Size (inch)	Standard grade (%)	Minimum grade (%)	Maximum grade (%)
10	0.60	0.30	6.2
12	0.40	0.22	6.0
15	0.24	0.16	3.6
18	0.18	0.12	2.8
21	0.14	0.1	2.2

3.2.4 The last upstream run of sewer must be at a grade of 1.00% or greater.

3.2.5 The minimum slope for building leads is 1.00%.

3.2.6 A monitoring manhole is required on the sanitary lead for all non-residential connections to the sanitary sewer system. The monitoring manhole can only have 1 lead running through it. It must be located on a straight run of lead and cannot be a manhole on the public sewer main.

3.2.7 Each building structure shall have a separate individual sanitary service lead connected to a public sanitary sewer.

3.2.8 There shall be no distance greater than 400' between manholes regardless of pipe size.

3.2.9 Generally, sanitary sewers will not be approved in a rear lot easement.

3.2.10 The following information shall be indicated on the sanitary sewer profile:

- a. Length of run between manholes
- b. Type, class, size and slope of pipe and leads
- c. Class of bedding
- d. Rim elevation of all manholes
- e. Existing and proposed ground elevation line above the route of the sewer
- f. A logical numbering system for manholes
- g. Invert elevations of all sewer at manholes
- h. Location and limits of sand backfill (where required)
- i. Location and elevations of crossings with other utilities

3.2.11 Provide a minimum depth from top of curb (or road centerline if uncurbed) to the top of any sanitary sewer of 9' at locations where the sewer grade is parallel to the road grade. Under any design the sewer shall be deep enough to reasonably serve, by gravity, a standard depth basement.

- 3.2.12 Sanitary sewer shall be placed on the opposite side of the street from the water main, and shall have a horizontal separation of at least 10' from any water main or service.
- 3.2.13 External drop connections are required at manholes where the invert of the outlet pipe is 18" or more below the invert of the inlet pipe. The external drop connection piping must be cast with the manhole. Internal drop connections will not be allowed.
- 3.2.14 Where the applicant must extend the sanitary sewer from off-site, the applicant shall extend sanitary sewer leads to the property line of all adjacent property on both sides of the right-of-way the entire length of the off-site sanitary sewer installation.
- 3.2.15 In new subdivisions, all service leads shall be sand backfilled and extended a minimum of 10' past the property line or to the easement line.
- 3.2.16 The plan and profile view of the proposed sanitary sewer shall generally be shown on the same sheet.
- 3.2.17 Maximum flow velocity for pipe flowing full shall be maintained by matching the 8/10ths point of the diameter depth above invert for pipe size increases.
- 3.2.18 Provide a drop of 0.10' in the downstream sewer invert for a direction change of 30 degrees or greater to compensate for velocity head loss of the incoming flow.

3.3 Materials

Item	Material	Manufacturer
Truss pipe	PVC	various
Concrete pipe	RCP C76 - Class III, IV, V	various
Solid wall pipe	Main line - PVC Sched 40 or SDR 26	various
	Leads - PVC Sched 40 or SDR 23.5	various
Manhole cover	1040 Type A cover w/ a gasketed bolt down lid w/ Howell cover	EJ

3.3 Installation

- 3.3.1 No sanitary sewer installation, or portion thereof, shall have infiltration exceeding the MDEQ requirements as contained in their permit.
- 3.3.2 The end of each a service lead shall be marked by setting a 2"x4", 8' long, wooden stake vertically above the end of the lead.
- 3.3.3 The end of a service lead shall have an airtight stopper of compatible joint material and shall be adequately braced to withstand exfiltration and/or air test pressure.
- 3.3.4 When existing manholes are to be tapped, a hole of the appropriate diameter shall be core drilled through the wall of the manhole. A watertight fitting shall be used to connect the pipe into the manhole.
- 3.3.5 All sewers shall be subjected to infiltration, air or exfiltration tests, or a combination thereof, in accordance with the following requirements, prior to acceptance of the system by the City, and prior to removal of the bulkhead.
 - a. All sewers over 24" diameter shall be subjected to infiltration tests. All sewers of 24" diameter or smaller, where ground water level above the top of sewer is over 7', shall be subjected to an infiltration test.
 - b. All sewers of 24" diameter or less, where the ground water level above the top of the sewer is 7' or less, shall be subjected to air tests or exfiltration tests.
- 3.3.6 A minimum of 30 days after installation, and prior to the acceptance of new mainline sanitary sewer systems, a televised inspection of each section of the mainline shall be conducted from manhole to manhole. A DVD and log of this inspection shall be submitted to the City, for review by the City's Engineer, to document the current condition of the sanitary system at the time of the utility acceptance. The DVD and log shall be consistent with the Standards of the City of Howell.

3.4 Pump Stations

- 3.4.1 While pump stations are not encouraged, in special instances where a station is required, the City will provide complete pump station standards for use by the developer's engineer in preparing the plans. The minimum number of pumps in a pumping station shall be 2 and minimum size of discharge lines shall provide adequate cleaning velocities and shall conform to MDEQs requirements. All pumping station plans will be considered separately. Provisions must be included

for auxiliary power source, bypass capability and must include telemetered alarm system.

- 3.4.2 Force mains shall be designed to withstand both internal pressures and external trench and live loads. Design computations shall be submitted by the proprietor's engineer for review and approval. Pipe materials shall be ductile iron or HDPE. Ductile iron pipe shall be cement lined. Joints and fittings shall be equal to the requirements for pressure pipe used in the domestic water distribution system. Force mains shall be pressure tested for water tightness to a test pressure equal to twice the total system head but no less than 50 psi held for a minimum 1 hour. The amount of leakage shall be limited to not more than 25 gallon per inch diameter per mile of pipe per 24 hours at required test pressure.

3.5 *Building Sewers*

- 3.5.1 Unless otherwise approved due to exceptional circumstances, construction of the building sewer, from public sewer main to property line for each fronting parcel which the sewer is designed to serve, shall be included with construction of each sanitary sewer.
- 3.5.2 Whenever possible, the Building sewer shall be brought to the building at an elevation below the basement floor. No building sewer shall be laid parallel to or within 3' of any bearing wall, which might thereby be weakened. The depth shall be sufficient to afford protection from frost. The building sewer shall be laid at uniform grade. The line shall be straight or laid with properly curved pipe and fittings. Changes in direction greater than forty-five degrees, or lengths over 10', shall be provided with clean-outs accessible for cleaning.
- 3.5.3 Where cover over sanitary sewer to finished grade is more than 10', risers shall be installed from wyes or tees to an elevation 10' below finished grade. Location of the wye or tee shall be marked from the downstream manhole on the record sewer plans prepared. Where the water table is high, the riser shall end at a depth of 1' above the water table.
- 3.5.4 When house leads are to be cut into an existing sanitary sewer, tap shall be made with the use of an approved saddle.
- 3.5.5 Ordinary house connections shall be 6" diameter and shall be constructed of PVC solid wall Schedule 40 plastic pipe. Larger building sewers may be constructed of materials permitted for sanitary sewers under the same conditions of depth.
- 3.5.6 Minimum grade of building sewers shall be 1%.

- 3.5.7 Downspouts, weep tile, footing drains, sump pump discharges or any other conduit that carries storm, surface or ground water shall not be allowed to discharge into the building sewer or lateral sewer.
- 3.5.8 The City representative will review each new or repurposed development for compliance with the Industrial Wastewater Pretreatment Regulations, Chapter 1043 of the City Code.

4. STORM SEWER

4.1 *Design Requirements*

- 4.1.1 In no event will maximum design rate or volume of discharge exceed the maximum capacity of the downstream land, channel, pipe or watercourse. It is the applicant's obligation to meet this standard. Should a storm water system, as built, fail to comply, it is the applicant's responsibility to redesign, reconstruct, or make modifications at his/her expense to storm water management facilities. Such modifications or additional facilities will be subject to the City's review and approval.
- 4.1.2 Storm drainage systems shall be designed for 10 year rainfall intensity. The Rational Method for arriving at storm sewer runoff shall be used. An "n" value of 0.013 shall be used for concrete pipe and 0.009 for High Density Polyethylene (HDPE) pipe.
- 4.1.3 The formula for a 10 year rainfall intensity shall be equivalent to $I = 175/(T+25)$ in which T is the time of concentration in minutes, and I is the rainfall intensity in inches per hour.
- 4.1.4 The initial T is generally 20 minutes for residential areas and 15 minutes for high runoff areas.
- 4.1.5 The consulting engineer shall use the following minimum values for "C", the runoff coefficient, in the "Rational Formula" of computing storm water flows ($Q = CIA$).
- | | |
|--------------------------|----------|
| Impervious Hard Surfaces | C = 0.90 |
| Gravel Surface | C = 0.50 |
| Vegetated/Turf Surface | C = 0.20 |
- Other values of the runoff coefficient may be used or required at the discretion of the City and/or their Engineer for such areas as parks, open-spaces or unusual sites.
- 4.1.6 Sufficient capacity shall be provided in the storm sewer system to take fully developed upstream drainage into the system. When a storm sewer is designed to provide capacity for upstream areas, the hydraulic gradient shall remain in the pipe.
- 4.1.7 Storm sewer design calculations, including a drainage area map shall be submitted with the design plans. The storm district map shall show all on-site and off-site drainage districts. The district limits must be overlaid on a proposed grading plan for the site.

- 4.1.8 All public storm sewers must be located in the public right-of-way or an easement. The minimum storm sewer easement shall be 12' wide. The easement size will vary as required for maintenance and access. Any storm sewer that accepts runoff from abutting property or public right-of-way must be placed in a minimum 12' storm sewer easement.
- 4.1.9 If a storm sewer is designed to take on-site drainage only, the hydraulic gradient must be no higher than 1' below ground. When the hydraulic gradient is above the top of the sewer pipe, the design elevation of the hydraulic gradient shall be indicated on the profile at each manhole.
- 4.1.10 Storm water detention is necessary for all developments in the City of Howell. See Section 5, Detention / Retention Facilities, for details.
- 4.1.11 Manholes shall be located as follows:
 - a. All changes in alignment
 - b. Points where the size of the sewer changes
 - c. Points where the grade of the sewer changes
 - d. The junction of sewer lines
 - e. Street intersections or other points where catch basins or inlets are to be connected.

4.1.12 Manhole spacing for storm sewers shall be as follows:

<u>Diameter of Sewer (in)</u>	<u>Maximum Manhole Spacing (ft)</u>
12 - 15	330
18 - 30	350
36 & larger	400

- 4.1.13 The minimum size of a public storm sewer is 12" diameter. 10" diameter pipe will be allowed for sewer lines that pick up only footing drain or roof conductor drainage. No open covers will be permitted for a 10" diameter storm sewer.
- 4.1.14 Connections must be made at manholes. Blind taps are not allowed.
- 4.1.15 The following information shall be indicated on the storm sewer profile:
 - a. Length of run between manholes.
 - b. Type, class, size and slope of pipe and leads.
 - c. Class of bedding.
 - d. Rim elevations of all manholes.
 - e. Existing and proposed ground elevations above the route of the sewer.
 - f. A logical numbering system for manholes.

- g. Invert elevations of all sewers at manholes.
- h. Locations and limits of sand backfill, where required.
- i. Locations and elevations of crossing with other utilities.

4.1.16 The following table of minimum slopes for storm sewers shall be adhered to:

Pipe diameter & Minimum Slope

10" @ 0.45%	30" @ 0.09%
12" @ 0.32%	36" @ 0.07%
15" @ 0.24%	42" @ 0.06%
18" @ 0.18%	48" @ 0.05%
21" @ 0.14%	54" @ 0.04%
24" @ 0.12%	60" @ 0.036%
27" @ 0.10%	

4.1.17 The minimum velocity may not be less than 2.5' per second in a pipe flowing full. The maximum velocity in storm sewers shall be 10' per second. The contents of a larger pipe will never be discharged into a smaller line even though the slope may be steeper for the smaller line. This principle does not apply, however, to a restricted opening or discharge.

4.1.18 Where possible provide a minimum of 3' of cover from the top of curb (or road centerline) to the top of any storm sewer.

4.1.19 For subdivisions, storm sewers shall be located in the public road right-of-way or in easements adjacent to the public road right-of-way and shall be public sewer. Storm sewers shall not be located in rear yards except to pick up rear yard drainage or for sump pump discharge lines. The rear yard storm sewers shall be privately owned and maintained.

4.1.20 At all pavement catch basins and inlets, a minimum of 100 lineal feet (50 lineal feet in each direction) of 6" diameter edge drain shall be constructed at the back of curb line in each direction. Additional edge drain may be required based on site soil conditions as determined by the City or its Engineer.

4.1.21 No more than 1.0 acre of area shall be tributary to 1 standard catch basin. Catch basins may be placed side by side in order to provide for additional capacity.

4.1.22 A maximum of 900' of drainage is allowed from 2 directions.

4.1.23 Where lateral sewers are proposed, all new homes must be constructed with a sump pump discharge lead to an underground

pipe connected to an underground storm sewer or an approved alternate storm drain. Sump pump discharge lines shall not discharge directly to street gutters. The sump pump discharge lead shall be a minimum of 4" diameter. The lead shall be constructed at a minimum 1.0% grade.

4.1.24 The minimum grade for swales shall be 1%.

4.1.25 The City encourages the use of Best Management Practices (BMPs). The use of such will be reviewed and approved on a site by site basis by the City and/or their Engineer.

4.2 *Materials*

Item	Material	Manufacturer
Pipe	RCP C76- Class III, IV, V	various
	HDPE - Smooth interior with corrugated exterior	various
Leads	PVC Sched 40 or SDR 26	various
Catch basin cover	in pavement - 5100 w/ M1 grate	EJ
	in straight back curb - 7045 w/ M1 grate	EJ
	in mountable curb - 7300 w/ M grate	EJ
	in grass area - 1040 w/ N or M1 grate	EJ
	- use ADA cover in pedestrian crossings	
Manhole cover	1040 w/ Type B cover w/ Howell cover	EJ

4.3 *Installation*

4.3.1 All RCP storm sewers shall be installed on Class II sand compacted to 95% of its maximum unit weight or better.

4.3.2 A pre-fabricated bar screen shall be installed on all storm sewers end sections 18" in diameter and larger.

5. DETENTION / RETENTION FACILITIES

- 5.1 The City of Howell follows the current version of the LCDC Detention/Retention Design Standards except where modified below.
- 5.2 Commercial and industrial developments using an underground detention system as their means of storm water detention must provide a storm water pre-treatment unit to minimize the potential of contaminants entering the detention system. These pre-treatment units will be reviewed on a site by site basis.
- 5.3 A Detention Basin Maintenance Agreement on the City's standard form is required for all types of storm water detention / retention. This document is required at the time of as-built plan review.
- 5.4 Maintenance Agreements, per the MDEQ permit, should be required for ALL vegetative and structural BMPs (i.e. detention/retention basins, oil/water separators and stormceptors, bioswales, green roofs, etc.) – see permit requirements below.
- 5.5 Additional Permit Requirements:

Storm water Management Criteria	Description
A. Water Quality (WQ)	Treat the runoff volume generated from the proposed site equivalent to 1.0" depth of precipitation. The WQ Volume is determined by the Livingston County Drain Commissioners guidelines and site applicability. Design for a minimum removal of 80% of TSS as compared to uncontrolled runoff or a discharge concentration not to exceed 80 mg/L Total Suspended Solids (TSS). This criteria is assumed to be met if extended detention of the CP Volume is provided.
B. Channel Protection (CP)	The Channel Protection (CP) Criteria was developed to prevent or minimize the channel enlargement process in streams and rivers. The CP Volume for a 2-yr storm must be stored and released over a period of at least 24 hours.

- 5.6 MDEQ MS4 Permit & Post Construction Control Guidelines released in 2014 States:
- 5.6.1 Applicability:
- a. 1 acre or more of development or re-development that discharge to an MS4;

- b. less than 1 acre but is part of a larger common plan of development or sale, and is in the Urbanized Area as defined by MDEQ based on the 2010 or most current census data.

5.6.2 Regulatory Mechanism or Ordinance must meet the following: Water Quality:

- a. Treat the first 1" of runoff from the contributing area of the site; or treat runoff generated from 90% of all runoff-producing storms.
- b. BMPs must be designed on a site-specific basis to reduce post-development total suspended solids (TSS) by 80%; or achieve a discharge concentration of TSS not to exceed 80 mg/L. NOTE: These requirements do not require monitoring of project sites to determine compliance with this TSS removal requirement. Instead, the expected reduction of suspended solids by BMPs is obtained from the literature and built into the design of the project.

5.6.3 Channel Protection – This criteria is to be used to meet water quality standards and provide protection when the MS4 discharges into waters of the state. The post-construction runoff rate and volume of discharges not to exceed the pre-development rate and runoff for all storms up to the 2 year, 24 hour storm at the entire site. At a minimum, pre-development is the last land use prior to the planned new development or re-development.

5.6.4 Infiltration BMPs - Redevelopment of previously degraded sites offers benefits for minimizing land disturbance and impervious cover, as well as economic benefits, these sites must be evaluated for designs that allow infiltration. If there is any questions regarding groundwater contamination refer to MDEQ document on Post Construction Controls and the section of Soil and/or Groundwater Contamination.

5.6.5 Long-Term O&M – Long-Term Operation & Maintenance plans/agreements are required for all structural and vegetative BMPs installed and implemented on a city site or commercial/industrial or residential projects meeting development criteria. These plans/agreements must meet the performance standards in perpetuity, or until land use changes in a manner that warrants changes in the BMP or its removal. The owner or developer must annually provide the City with documentation that they have completed their site inspections as outlined in the O&M procedure for the site.

5.6.6 O&M should allow the City, if controls are neglected to:

- a. Enter the property and inspect all structural or vegetative BMPs;
- b. Provide written documentation to the owner to correct any

deficiencies noted, or lacking action within 7 business days, or in the event of a health hazard or pending neighboring property damage; perform maintenance or corrective actions neglected by the BMP owner or operator. All funds expended in maintenance or corrective actions will be paid for by the BMP owner or operator; and

- c. Track the transfer of O&M responsibility of the BMP to new ownership.

6. STORM WATER QUALITY MANAGEMENT

6.1 *General Guidance for Storm Water Reviews*

- 6.1.1 The City of Howell will perform site plan review on all development and re-development projects within the defined urbanized area and within the jurisdictional boundaries of the City that exceed 1 acre or less than 1 acre but part of a larger common plan of development or sale that would disturb 1 acre or more.
- 6.1.2 The design standards and guidelines of the Livingston County Drain Commissioner are to be used for calculations determining allowable discharge rates and detention/retention volumes for water quality on development and re-development projects within the City of Howell and will be referenced in the review process.
- 6.1.3 If a site will be discharging into a MS4 under jurisdiction of the Michigan Department of Transportation, the site must provide the City of Howell with the MDOT permit and subsequent calculations and plans for their files.
- 6.1.4 A completed checklist and storm water discharge permit application will accompany each submittal for review.
- 6.1.5 The proposed design will consist of a treatment train of best management practices that will meet the water quality standards outlined in Section 5 above.
- 6.1.6 The City of Howell will complete a short summary of each review for purposes of NPDES-MS4 progress reporting.
- 6.1.7 The review will also include a review of the site's Operation & Maintenance plan and it's signing by the owner / developer, with a copy for the owner/developer for implementation and a copy left with the city for documentation and follow up as needed.
- 6.1.8 All storm water designs will be sealed by a professional civil engineer or architect licensed to practice in the state of Michigan.
- 6.1.9 A site will be inspected by the City of Howell or their designee for compliance with the approved plans for the site, a written copy of the inspection will be kept on file for that site.
- 6.1.10 The City of Howell will utilize water quality standards on its municipal projects including linear projects (e.g. roads and paths) with an area of 1 acre or more. The BMPs used will not put the City into a position that it must purchase property or easements to implement. The standards will

be incorporated to the maximum extent practicable.

- 6.1.11 Roof drains may be connected to a storm sewer system if the flow through the outlet to the City of Howell's MS4 is properly detained or retained. Undetained runoff leaving the site from a roof drain is not acceptable, there are no exemptions.
- 6.1.12 The developer, City Engineer and/or City DPW staff shall make a determination as to whether any or all of the facilities proposed are to become private or part of the City's MS4 or part of any other regulating agencies MS4 (e.g. Drain Commissioner).
- 6.1.13 The City Engineer shall, in the case of a proposed subdivision, make a determination as to those control elevations that shall be entered on the final plat or make a determination as to the necessity for deed restrictions on any particular lot in said subdivision requiring the preservation of mandatory drainage facilities. Where a non-subdivided parcel of land is proposed for development, the City Engineer shall make a determination as to the need for covenants to maintain responsibility for mandatory drainage facilities. All the said facilities shall be located in easements dedicated to the public, and shall be subject to continual inspection during the construction period.

6.2 *Requirements For All Detention/ Retention Areas*

- 6.2.1 Proposed storm water detention facilities shall be designed to detain the 10-year design storm runoff volume from the entire contributing area in excess of the allowable discharge from the site (See Design Calculations, Section IV).
- 6.2.2 The maximum design storage elevation in a detention area must be a minimum of 1' below the lowest ground elevation adjacent to the detention area.
- 6.2.3 The design maximum storage elevation in a detention area must not exceed a depth of 9" above any paved surfaced in non-residential developments. In residential developments the maximum ponding elevation in the detention pond shall not exceed the lowest rim elevation in the development.
- 6.2.4 If parking lot detention is used the owner or lessee must be aware of this detention and sign a letter of understanding that the parking lot will flood during design storms and be flooded for periods of time. The area where detention will be in the parking lot must be marked as to let people using the parking lot understand it will flood during rain events. Also, parking lot detention cannot be for storage of first flush volume.
- 6.2.5 The design maximum storage elevation in a detention area must not be closer than 1' below the minimum finish floor elevation of the proposed

structure(s) or existing facilities.

- 6.2.6 An emergency overflow shall be provided at the detention basin to insure the maximum ponding elevation does not exceed the depths outlined above. This overflow shall be able to allow drainage from the site in the event the 10-year storm is exceeded or the restricted outlet is obstructed.
- 6.2.7 Designs of detention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, and at any attractive nuisances. These features may include, but not be limited to, landscaping, fencing, handrails, lighting, steps, grills, signs, and other protective or warning devices so as to restrict access as required by the City.
- 6.2.8 Side slopes and the bottom of detention basins shall be top soiled, to a minimum of 3", and seeded. Flow through detention basins must be sodded when constructed to decrease sediment transport and provide filtration capacity quickly for the basin.
- 6.2.9 The side slopes and bottom of the basins shall be shaped with maximum slopes of 1 vertical to 4 horizontal to allow mowing of these surfaces. It will be preferred if side slopes are 1 vertical to 6 horizontal.
- 6.2.10 Detention basins with bottom slopes less than 1% shall be underdrained.
- 6.2.11 Detention basins shall be constructed with the top of banks a minimum of 5' from any pedestrian walkway (i.e. public and private sidewalks/ bike paths).
- 6.2.12 If a "wet" detention pond is proposed the bottom of the pond shall be a minimum of 5' below the proposed pond's outlet elevation. 6.2.10 shall not apply to wet detention facilities.
- 6.2.13 Wet detention basins must incorporate BMPs to insure they do not start harboring algae blooms, for example, a fountain to aerate the pond.

6.3 *Rear Lot Drainage Requirements*

- 6.3.1 Rear lot drainage systems are not part of an MS4, they are not owned by the City of Howell, they are to be owned by the homeowners or condo association and must be entered into the covenant for a subdivision or condominium development.
- 6.3.2 Minimum rear lot tile drain sizes and slopes have been determined assuming ponding will occur in rear yards for a duration 4 times the duration of a given 10-year design storm event. This time may range from 4 to 24 hours depending on drainage conditions. The following minimum pipe sizes and slopes apply:
 - 6.3.3 Rear lot tile drains with contributing drainage areas up to 2 acres will

have a minimum diameter of 6” and a minimum slope of 0.5 %.

- 6.3.4 Rear lot tile drains with contributing drainage areas greater than 2 and less than 3 acres shall have a minimum diameter of 8” and a minimum slope of 0.4%.
- 6.3.5 Rear lot tile drains with contributing drainage areas greater than 3 and less than 4 acres shall have a minimum diameter of 10” and a minimum slope of 0.32%.
- 6.3.6 Rear lot tile drains with a contributing area greater than 4 acres shall be considered main line storm sewer and shall be designed according to corresponding storm sewer requirements (See design calculations section of this report). Calculations shall be submitted to verify that rear lot drains have the capacity to pass the 10-year design storm event. Plastic pipe is acceptable for rear lot drainage systems draining more than 4 acres provided it is installed in landscaped/ lawn areas.
- 6.3.7 Rear lot tile drains cannot connect to road underdrains.
- 6.3.8 Rear lot drainage tiles shall have a minimum cover of 2’. A minimum of 4” of sand bedding is required beneath the pipe and a minimum of 6” of sand backfill is required above the pipe.
- 6.3.9 Rear lot catch basins shall have a minimum diameter of 2’. Plastic structures may be used for rear lot drainage systems. Concrete structures are required for storm sewer systems. The catch basins shall not be placed at spacing greater than 300’. Any bends, turns, or dead ends shall require a structure.
- 6.3.10 If pipe is perforated, a manufacturer’s “sock” may be used over the pipe, but is not required.
- 6.3.11 A 20’ easement will be required for all rear lot drainage systems. This easement should be centered along lot lines to allow for a 10’ easement along adjacent lots and to provide access to the rear lot drainage system from either adjacent property owners. Said easements shall be written as to permit neighboring property and/or condominium owners to maintain the rear lot drainage system as it may affect their property.
- 6.3.12 Rear lot drainage shall be large enough to convey all contributing area to the rear lot system, including off site drainage if it is not diverted around the development.
- 6.3.13 Existing rear lot drainage systems abutting a proposed development may be used for the new development provided:
- 6.3.14 The existing rear lot drainage system has the capacity to convey storm water runoff from the proposed rear lot drainage areas.

- 6.3.15 A signed agreement is obtained from property owners located within the existing subdivision allowing the proposed subdivision's rear lot storm water runoff to pass through their existing system.
- 6.3.16 Phased developments owned by the same proprietor may utilize proposed rear lot drainage for a current development phase on future phases of the development provided:
- 6.3.17 Covenants shall be recorded into the deeds of the property owners affected in the current phase allowing for future phases of the development to drain into the current phase's rear lot drainage system.
- 6.3.18 If covenants are not made as outlined above, future phases will require separate rear lot drainage systems or agreements from the current land owners allowing for the use of their rear lot drainage system.
- 6.3.19 The rear lot drainage system shall be constructed to convey rear lot drainage from both the existing and proposed rear lot drainage areas.
- 6.3.20 Easements shall be provided allowing for maintenance by both abutting landowners in current and proposed phases of development.
- 6.3.21 Rear lot drainage shall be shown on the preliminary plat (subdivisions) or site plan (condominiums).
- 6.3.22 All rear lot drains shall connect to an approved storm water drainage system.

7. GRADING

7.1 *General*

- 7.1.1 A grading plan is required for all developments. Rear yard storm drainage systems are required for all residential projects.
- 7.1.2 The grading of the proposed development shall not create drainage problems, or make existing drainage problems worse, on adjacent property. If necessary, storm drains shall be extended to the adjacent property to alleviate drainage problems.

7.2 *Design Requirements*

- 7.2.1 First floor and basement (where applicable) elevations for each proposed structure or building shall be shown on the plans.
- 7.2.2 The grades of existing adjacent houses, buildings, drainage structures and streets shall be shown. The actual surveyed grades of existing adjacent ground and yards shall be shown on a grid pattern up to a minimum of 100' from the property line. The drainage pattern of all adjacent existing land shall be indicated.
- 7.2.3 The grading plan shall be designed to insure that if a failure or overflow occurs within the storm system, water will drain away in overland swales without flooding houses/structures.
- 7.2.4 Finish grade shall be compatible with the grades of surrounding existing houses, yards, buildings and the existing ground at the proposed house/structure.
- 7.2.5 All existing and proposed ground grades are to be in tenths of a foot.
- 7.2.6 Rear yard swales shall be no longer than 400' before being intercepted by a catch basin and shall have a minimum grade of 1.0%.
- 7.2.7 The proposed side yard swale elevation shall be shown between all houses. This elevation must be a minimum of 0.5' below the lower adjacent house grade. The side yard swale must have a minimum slope of 1.0% to the front or rear.
- 7.2.8 General direction of flow of the rear yard drainage and swales must be indicated with arrows.
- 7.2.9 The maximum allowable grade shall be 1 vertical to 4 horizontal.

- 7.2.10 The maximum driveway slope for non-single family sites is 8.0%. All driveway approaches shall not exceed 1.50% for a minimum distance of 25' from the edge of the roadway. The slope of the driveway shall be labeled on the plans.
- 7.2.11 All proposed retaining walls over 3' in height will require design calculation be prepared by a Professional Engineer, licensed in the State of Michigan, and will require review by the City's Engineer. A building permit and/or approval from the City's Building Official may be required as well.

8. PAVING

8.1 *General*

- 8.1.1 Alternative paving designs may be submitted to the City for consideration. They will be reviewed by the City's Engineer and recommendation will be made to the City. Such alternative paving designs shall only be acceptable in those instances where the City finds that the proposed design will provide an equal or better level of serviceability, ease of maintenance and are consistent with other paving in similar areas elsewhere in the City.
- 8.1.2 For roads under the jurisdiction of MDOT or Livingston County Road Commission, all improvements within their jurisdiction shall be designed to meet their requirements.
- 8.1.3 The requirement of acceleration, deceleration and passing lanes will be at the discretion of the City's Engineer.

8.2 *Design Requirements*

- 8.2.1 A boulevard section may be allowed in an enlarged right-of-way. Pavement widths shall be at least 24' for all boulevard streets (back of curb to back of curb). The distance from the property line to the back of curb shall be 16' on boulevards. The minimum island width shall be 10' and maximum 16'. The nose of the boulevard island shall be set back at least 12' from the edge of pavement of the intersecting street.
- 8.2.2 Vertical curves are necessary when a change in grade of 1.0% or more occurs. The minimum length of vertical curve shall be 100'.
- 8.2.3 The maximum cross slope on a cul-de-sac is 3.0%.
- 8.2.4 All proposed roadways shall be profiled. The pavement profile view shall include:
 - a. Elevations at each station for the top of curb, or at centerline if not curbed.
 - b. Existing ground elevations at the center of the right-of-way, and 30' either side of the centerline.

- c. Station and elevations of all high points, low points, grade-breaks and necessary information at vertical curves. Grades for vertical curves must be indicated at 25' intervals.
 - d. The station and top of curb grade of all pavement catch basins and inlets.
- 8.2.5 The design speed and posted speed of the proposed roadway shall be indicated on the plans.
- 8.2.6 The pavement radius at all intersections of all roads shall be a minimum 25'. Industrial developments will require a minimum radius of 35'.
- 8.2.7 Finish grade of all structures shall be indicated in the plan and profile views.
- 8.2.8 Parking lots shall have a minimum slope of 1.0% for bituminous pavement and 0.40% for concrete pavement.
- 8.2.9 All sidewalk and sidewalk ramps shall meet the current MDOT ADA Standards.
- 8.2.10 The minimum sidewalk cross-section is 4" of concrete on 4" of Class II sand. For areas of vehicular crossings, the walk shall be thickened to 6" of concrete.

8.3 *Materials*

Item	Material	Manufacturer
Drainage layer	MDOT CL-II	various
Aggregate base	21AA limestone	various
	21AA crushed concrete	various
Asphalt pavement	major public roads - 2C, 3C, 4C	various
	residential public roads - 13A	various
	parking lots - 1300 L & T	various
ADA tile	ramp rehab - red surface mounted	ADA Solutions Inc.
	new const. - red cast in place	ADA Solutions Inc.

8.4 *Installation*

- 8.4.1 Copies of the City's right-of-way permit application can be found at www.cityofhowell.org/permits
- 8.4.2 The installation of roads and parking areas (on street & parking lots) within the City shall require observation by the City's Engineer at the

following stages:

- a. After the sub grade has been rough cut to the plan elevation.
- b. After the placement of the aggregate base. (confirm at this time that the aggregate base extends under any proposed curb.)
- c. Full-time during the placement of the bituminous pavement.
- d. After all the required vegetation has been established.

8.5 *Specifications for open cut trenching within public rights-of-way*

- 8.5.1 All excavation, backfill, roadbed and surface material removal or replacement for installation or maintenance of utilities and the appurtenances within the public right-of-way (ROW) shall be completed in accordance with these specifications, except when the installation occurs within State or County ROW and is superseded by more restrictive standards.
- 8.5.2 The contractor shall saw-cut the pavement beyond the area to be trenched prior to removal or upon replacement. If the saw-cut is made prior to removal and the edges of the pavement should pull up or break away during construction, then it would be necessary to re-cut those areas, as indicated by the City Engineer or his authorized representative. Alternative methods may be used only with the prior approval of the City Engineer.
- 8.5.3 Excavated trench material such as sand or gravel may be re-used within the roadbed or shoulders as backfill if approved by the City Engineer or his authorized representative. All other material must be hauled away as the trench excavation progresses. In no case shall the excavated material be left within the street roadway overnight, without the prior approval of the City.
- 8.5.4 Backfilling and compaction of trench material shall be maintained to within 5' of the end of the previous section of utility laid in place. All utility valve boxes within the trench area shall be kept plumb as the backfilling progresses, and all top of valve boxes or manhole covers shall be set even with the existing paved surface prior to temporary or permanent pavement patching.
- 8.5.5 All utility trenches crossing a ditch shall be backfilled with select excavated material and vibratory compacted to 95% maximum density, including restoration and permanent erosion control.
- 8.5.6 All utilities laid in an open trench shall rest on a stable base.
- 8.5.7 Open cut trenching through existing paved roadbed or shoulders shall be

sand backfilled, except for the cross-section needed to provide a crushed stone or slag base beneath the replaced pavement surface.

- 8.5.8 Existing unpaved roadbed or shoulders removed within the trench area shall have the top 8" replaced with crushed stone or slag.
- 8.5.9 Any deviations to the type or thickness of backfill must be approved by the City Engineer.
- 8.5.10 All sand and gravel backfill shall be vibratory compacted to 95% maximum density in 12" layers (or less), beginning at a point 12" above top of installed utility.
- 8.5.11 The base course and temporary surface or permanent surface repair for an unpaved or paved roadway shall be placed by one of the following methods, except within State or County right-of-way and is superseded by more restrictive standards.

Method "A" -Temporary Repair

A 10" base course of crushed stone or slag shall be placed and compacted to 95% maximum density within the open cut trench to a point even with existing pavement surface. This type of temporary repair will require maintenance as needed and should be considered only on local streets. The contractor shall be responsible for maintenance of this repair until he installs a permanent surface material.

Method "B" - Temporary Repair

An 8.5" base course of crushed stone or slag shall be placed and compacted to 95% maximum density within the open cut trench to a point 1.5" (local) 2.5" (major) below existing pavement surface. The top 1.5" or 2.5" of pavement trench shall be filled with bituminous cold patch mixture CP-1 and vibratory compacted or rolled to not less than 98% unit weight. This type of temporary pavement repair should be used mainly in the winter and spring months while asphalt plants are closed, but may be used in warm weather when extenuating circumstances prevail which prevent the contractor from making an immediate permanent repair. Cold patch material must be installed in trench cut prior to open to traffic. The contractor shall be responsible for maintenance of this repair until he installs a permanent surface material.

Method "C" - Permanent Pavement Repair to Method "A"

The aggregate base material within the trench shall be removed to the required depth. The pavement surface adjacent to, and parallel to, the trench shall be saw-cut to full depth of existing pavement. If trench was saw-cut prior to excavation and edges were pulled up or broken away during construction, then those edges must be removed by re-saw cutting.

The permanent pavement surface material shall be placed to the thickness of the existing pavement, or the minimum thicknesses designated in these standards. All asphalt surface material shall be vibratory compacted or rolled to not less than 97% unit weight and not in more than 2" layers to a point even with the existing paved surface.

Method "D" - Permanent Pavement Repair to Method "B"

The pavement surface adjacent to, and parallel to, the trench shall be saw-cut to full depth of existing pavement. If trench was saw-cut prior to excavation and edges were pulled up or broken away during construction, then those edges must be removed by re-saw cutting. The existing cold patch material within the trench shall be completely removed and the existing gravel base adjusted to receive the same thickness of bituminous aggregates as the surrounding pavement (minimum of 3"). All asphalt surface material shall be vibratory compacted or rolled to not less than 97% unit weight and not in more than 2" layers to a point even with the existing paved surface.

Method "E" - Permanent Full Depth Asphalt Pavement Repair

For this type of permanent pavement repair it is not necessary to install an aggregate base on sand backfill within the trench area. However, this requires replacement of asphalt immediately after trench compaction and coordination between excavator and paving contractor.

The pavement surface adjacent to, and parallel to, the trench shall be saw-cut to full depth of the existing pavement. If trench was saw-cut prior to excavation and edges were pulled up or broken away during construction then those edges must be removed by re-saw cutting.

The thickness of asphalt required for this patch will be 7" for major streets and 5" thick for local streets. It shall be vibratory compacted or rolled in not more than 2" layers to not less than 97% density of unit weight.

The contractor will be responsible for the permanent repair. The permanent repair must be made the same day unless otherwise approved by the City Engineer or his authorized representative.

- 8.5.12 One lane of traffic must be maintained at all times, unless closing off the road is approved by the City.

9. RECORD DRAWINGS

9.1 *General*

- 9.1.1 All projects within the City which go through site plan review shall be required to submit record drawings. The drawings will need to be reviewed and approved by the City's Engineer prior to final acceptance of the project by the City. The record drawings requirements are contained in the checklist at the end of this section.
- 9.1.2 The initial submittals shall be of 2 sets of black line prints providing the applicable information shown on the attached checklist. The minimum scale shall be 1"=50' and shall bear the seal of a registered professional engineer or surveyor licensed to practice within the State of Michigan. All record lengths and elevations must be labeled as record.
- 9.1.3 After the record drawings have been approved by the City's Engineer, the applicant shall submit 2 paper copies of the approved record drawings. A CD shall also be provided which contains a .pdf version of each sheet of the record drawing plan set. Each sheet within the .pdf file shall be an individually scanned sheet and named appropriately to match its content.

CITY OF HOWELL – AS-BUILT REQUIREMENTS CHECKLIST

SANITARY SEWER – IN PLAN & PROFILE SHOW:	N/A	OUTSTANDING	COMPLETED
All invert & rim elevations to USGS Datum			
Actual laying length between structures			
Type of pipe used			
Actual slope of pipe			
Size of pipe			
Tie down all structures via coordinates			
Lead information (distance from downstream manhole, riser length, depth, tie down end, etc.)			

STORM SEWER – IN PLAN & PROFILE SHOW:	N/A	OUTSTANDING	COMPLETED
All invert & rim elevations to USGS Datum			
Actual laying length between structures			
Type of pipe used			
Actual slope of pipe			
Size of pipe			
Tie down all structures via coordinates			
Lead information (distance from downstream manhole, depth, tie down end, etc.)			

WATER MAIN – IN PLAN VIEW SHOW:	N/A	OUTSTANDING	COMPLETED
Valve rim elevations			
Size & type of pipe			
Length of pipe			
Tie down all structures and hydrants via coordinates			
Call out actual offset from pavement			

DETENTION POND	N/A	OUTSTANDING	COMPLETED
Letter required by the design engineer stating that the pond is properly sized according to approved plans and the outlets are properly located and sized			

PAVEMENT	N/A	OUTSTANDING	COMPLETED
Sidewalk/bike path spot elevations every 50'			
Curbing and sidewalk ramp spot elevations			

SUBMITTALS	SUBMIT DOCUMENTS TO CITY FOR REVIEW	RESUBMIT WITH REVISIONS NOTED ABOVE	APPROVED - SUBMIT FINAL VERSION TO CITY
Public easements, including sketch, description & cover sheet			
Two (2) Paper Copies of Record Drawings			
Electronic Version (.pdf) of Record Drawings			

Additional specific information per site may be required at the discretion of the Engineer.

10. PLAN REVIEW AND OBSERVATION COSTS

- 10.1 At the time of submittal for construction plan review, a detailed estimate of cost must be provided for any proposed development, subdivision, site condominium project, or road development. This estimate will be used in determining the required amount to be deposited into escrow for construction plan review.
- 10.2 Prior to the project proceeding to the construction phase, the applicant shall deposit with the City a percentage of the total contract price for on-site construction observation. The following items shall be included within the construction costs which must be observed by the City; roadways (curbs, roads, etc.), on-site paving, storm sewer (manhole, pipe, etc.), sanitary sewer (manhole, pipe, etc.), water supply systems (hydrants, mains, etc.), sidewalks and storm water detention/retention facilities.
- 10.3 A minimum of 4 hours will be charged to the subject project if the observer keeps a scheduled observation appointment and the Contractor does not work. All costs incurred for consulting services will be billed against this account.
- 10.4 The actual fee for observation shall be borne by the applicant, and shall be on the basis of the actual costs incurred by the City's Engineers. Any unused amount of the deposit following observation and approval shall be returned to the applicant. If at anytime the City is of the opinion that the deposit is not sufficient to cover the services that are being provided, the developer shall be notified in writing as to the estimated deficiency. The developer shall deposit the required funds immediately. Observation work shall be suspended until the funds are received by the City.
- 10.5 The fees and charges specified in this section shall be in addition to those charged for debt service charges, connection charges, and other charges or fees for sanitary sewer and water supply.
- 10.6 Prior to final acceptance of improvements by the City, a 2 year maintenance and guarantee bond, equal to 25% of the value of the public utilities installed on the project, shall be furnished by the developer.
- 10.7 If an applicant requests a certificate of occupancy prior to completion of the required proposed site improvements, the City may require surety deposits or bonds, to assure completion of the improvements. When a deposit is required, the applicant shall file with the City a cash deposit, certified check or irrevocable bank letter of credit acceptable to the City. The amount of such deposit shall cover the cost of all remaining improvements plus 25% for administrative costs. Monies may be released to the applicant in proportion to work completed on the different elements after inspection of work and approval of the City. Any partial release of funds shall be less 10% which shall be retained by the City until all work has been completed and subsequently inspected and approved by the City.