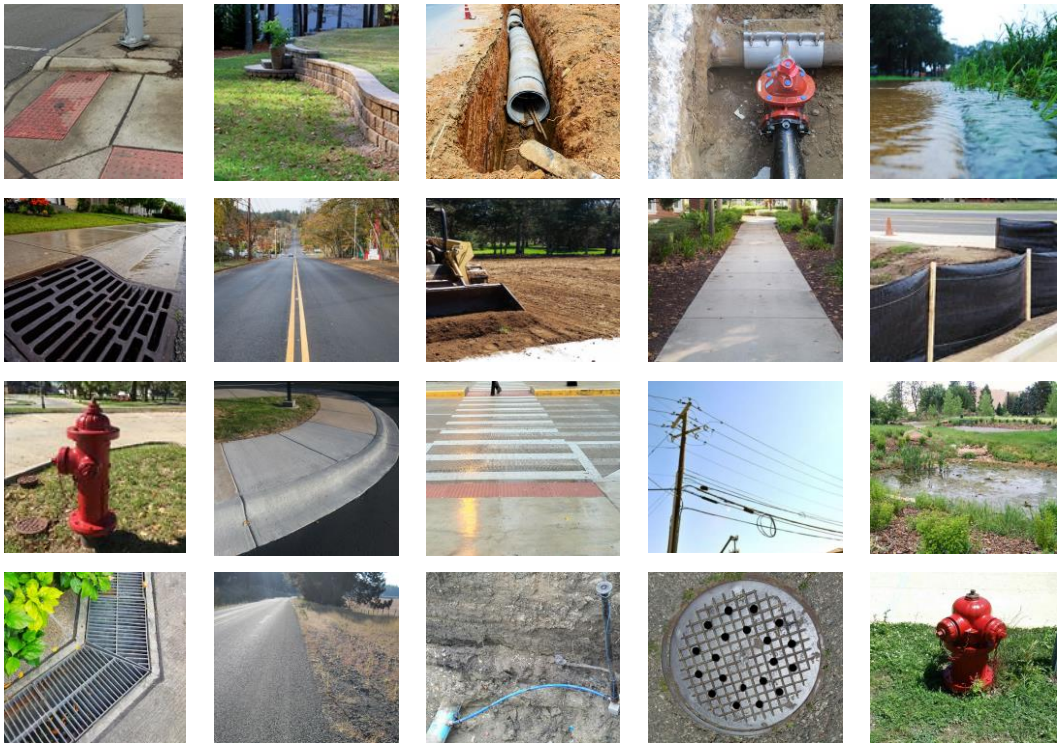
CITY OF HIGHLAND PARK

Engineering Standards

June 2023



Wayne County, Michigan
Damon L. Garrett, PE
12050 Woodward Avenue
Highland Park, MI 48203
In coordination with
Metro Consulting Associates, LLC

https://www.highlandparkmi.gov/

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Engineering Design Standards
City of Highland Park

The following Engineering Design Standards are intended to provide reasonable and proper basis for the design and construction of all commercial, industrial, and multiple family sites, and other project site improvements, including sanitary sewers, storm sewers, water main, paving, grading, and drainage. The basis for siting, designing, and installing multiple types of distributed energy resources (DER) is also provided in this engineering manual.

These standards reflect the requirements of the City of Highland Park Engineering Department. These standards are not intended for use as a substitute for sound engineering judgment.

City of Highland Park Engineering Department
Robert B. Blackwell Municipal Building
12050 Woodward Avenue
Highland Park, MI 48203
Phone: (833)-530-0300
Email: hpcityengineer@metroca.net
Website: https://www.highlandparkmi.gov/Services/Engineering-Department.aspx

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1 PURPOSE OF STANDARDS

1.1 These standards are intended to:

A. Provide a reasonable and proper basis for the design and construction of land improvements such as sanitary sewer, water facilities, stormwater management, grading, pavements, franchised utilities, off-grid distributed energy resources, grid-tied distributed energy resources, and public safety.

B. Establish uniformity in City requirements.

C. Describe the required information prior to submittal of Engineering plans such that Engineering plans will be complete and in proper form when submitted, thereby reducing the City's and applicant's time and expense in the review process.

D. Enable designers and applicants to estimate the cost of City requirements as early in the development process as possible.

E. Provide accurate on-site and off-site information for each project that will become permanent public records of the City.

1.2 These standards apply to all land improvements.

1.3 These standards are the minimum requirements necessary to promote public health, safety, and welfare within the City of Highland Park. These standards are not intended to interfere in any manner with the application or enforcement of the laws of the City of Highland Park, Wayne County, the State of Michigan, or the United States.

1.4 Deviations from these standards shall be approved by the City Engineer or designee.

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2 PLAN REQUIREMENTS FOR SITE PLANS AND ENGINEERING REVIEWS

2.1 General Requirements

A. All plans for land improvements shall be prepared on standard white prints with black lines, shall be drawn to an engineering scale, and shall be neatly and accurately prepared. Where more than one sheet is required to show the entire site, match lines shall be provided.

B. All plans submitted for Engineering or Administrative review shall consist of three (3) sets at twenty-four (24) inch by thirty-six (36) inch and one electronic copy in pdf format. Plans submitted for review to outside agencies shall be date-stamped received by the City of Highland Park at the time of the plan set submittal for Planning Commission review. The applicant shall be responsible for submitting the stamped plans to the appropriate outside reviewing agencies. All fees associated with outside agency reviews shall be the responsibility of the applicant and shall be paid to those agencies by the applicant.

C. All plans shall be prepared by a professional engineer registered in the State of Michigan whose seal shall be affixed to the first sheet.

D. Each sheet in a set of plans shall show the name and general description of the property; date; scale; north arrow; title of each sheet; and the name, address, and telephone number of the person or firm that prepared the sheet. Each sheet in a set shall be numbered consecutively, beginning with “Sheet 1” and shall have proper match lines or other keys to provide reasonable continuity and orientation. Sheets shall be ordered in the plan set to provide reasonable continuity.

E. The north arrow shall be displayed on the right side of the sheet and the plan shall be oriented such that north is up or to the left.

F. The scales throughout the set of plans shall be standard engineering scales at 1 inch = 20 feet, 30 feet, or 40 feet and shall be consistent throughout.

G. All elevations shall be based on the North American Vertical Datum 1988 (NAVD 88) and shall be noted as such.

H. Utility lines shall be placed underground for new development, unless approved by City Engineer.

I. With each re-submittal, the preparer shall provide a written response of revisions made to the plans.

J. It shall be the contractor’s responsibility to verify and/or obtain any information necessary regarding the presence of underground utilities on the project.

K. Contractor shall call MISS DIG at (800)-482-7171 at least (3) working days prior to construction. Contractor shall be responsible for any damage done to any existing utility during construction.

L. Contractor shall notify Highland Park City Engineering Department 48 hours prior to the start of construction. Phone: (833)-530-0300.

M. A preconstruction meeting shall be scheduled two weeks prior to the expected start of construction with the City Engineer. Contact the City Engineer at (833)-530-0300.

2.2 Information Required for Construction Plans

A. All information required for a preliminary and final site plans
B. Location and overall dimensions of existing structures and drives.
C. The first sheet in each set shall be the title sheet and shall include, at a minimum:
    1. Site and zoning data.
    2. Sheet index with consecutively numbered sheets.
    3. All revision dates.
    4. Project name at the top of the sheet.
    5. Parcel Identification Number at the top of the sheet under the project name.
    6. Address of the site at the top of the sheet under the project name.
    7. Vicinity map.
    8. The name of the project and the City identifying number (i.e. CE-ROW or SP-XX-XXXX) shall also be located in the lower right corner for all site development projects. City identifying number determined as follows:
        a. CE – City Engineer
        b. ROW – Right of Way
        c. SP – Site Plan
        d. XX-XXXX – Year and Permit Number
    9. Permit approval table listing all agencies requiring approval and the date approval is granted.
D. A fire protection sheet shall be included which shows the following items and nothing else:
    1. Roads
    2. Parking lots.
    3. Driveways.
    4. Buildings.
    5. Ingress/egress points.
    6. Building heights and uses.
    7. Water main.
    8. Domestic water service.
    9. Fire service lead.
    10. Hydrants.
    11. Post indicator valves (PIV).
    12. Fire department connections (FDC).
    13. Meter rooms.
    14. City fire apparatus turning template with dimensions maneuvering site.
    15. Four hundred (400) feet hose lay lines.
    16. Hazardous Materials Storage or Hazardous Equipment areas, including any energy production or storage systems listed in Chapter 16 – Distributed Energy Resources (DER).
    17. Fire lane no parking signs

E. A storm drainage narrative shall be included clearly and concisely describing the intended method of designing the storm drainage systems, including drainage areas, existing and proposed; detention or retention basins and discharge concepts; storm sewer and ditch design criteria; Wayne County Water Quality Management Division development criteria; and downstream capacity limitations. The narrative should be interspersed with all associated computations as they are developed. The narrative should also be prepared on standard 8 ½- inch by 11-inch sheets dated, numbered, and titled; and include the name, address and telephone number of the person or firm that prepared it. Maps of similar size portraying the concepts involved should also be included.

F. Nonresidential site plans shall provide access throughout the site for the appropriately sized vehicle and the City T-2 Fire Apparatus. Plans shall include both templates maneuvering the site with the appropriate template detail.

G. A permanent benchmark shall be established for each project and be shown on the plans.

H. Soil Erosion and Sedimentation Control Plan. Such plan shall be developed according to the Wayne County Soil Erosion and Sedimentation Control Permit requirements.

I. Proposed structures; addresses; distance between existing structures; finished floor elevations; basement floor elevations; finished grade elevations; indication of a walkout or a viewout; and sill elevations if a viewout.

J. Phase I and/or Phase II environmental impact study, if site warrants. To be determined by the City Engineer.

K. Drives or street names; right-of-way or easement width; surface type and width; surface elevations; location and type of curbs; length and width of turning lanes; curve radii.

L. Proposed parking areas – number and size of spaces; location of each space; type of surface; aisle width; angle of spaces; location of wheel stops and/or curbs, where applicable.

M. Proposed fences or screens – location; height; type; typical details, including elevations and sections.

N. Photometric Plan:

1. The Photometric Plan shall be a scaled plan and shall show the layout of the entire site including:
    a. Property Lines;
    b. Roadways;
    c. Driveways;
    d. Parking Areas;
    e. Sidewalks; and
    f. Existing and Proposed Building Locations.
2. The Photometric Plan shall also include the following minimum information:
    a. Location of all site lights including
        i. Area lights, including privately owned solar streetlights;
        ii. Driveway lights;
        iii. Pedestrian lights;
        iv. Building mounted lights;

v. Canopy lights;
vi. Sign lights; and
vii. Landscape lights.

b. A Luminaire Schedule indicating:
i. Type (“A”, “B”, “C”, etc.);
ii. Manufacturer;
iii. Model Number;
iv. Lamp Type;
v. Lumen output;
vi. Wattage;
vii. Number of Head; and
viii. I. E. S. photometric file number used for calculations for each luminaire.

c. Mounting height for each luminaire.
d. Photometric grid spacing shall be 20 feet x 20 feet maximum.
e. Footcandle levels at all property lines.
f. A Photometric Summary/Statistics Table indicating:
i. Maximum, Minimum and Average footcandle levels; and
ii. Maximum-to Minimum and Average-to-Minimum ratios
g. Limit the actual calculation zone to roadways, parking lots and pedestrian areas. Areas where light levels are less than 0.1 footcandle shall not be included in calculations.

3. Residential plans shall also include:
a. Cut-sheets for proposed luminaires;
b. Visual files (Lithonia Lighting); and
c. IES photometric files for use in analyzing the lighting plan.

O. Retaining Walls:
1. Location; dimensions.
2. Materials of wall and fill.
3. Typical vertical sections.
4. Design calculations for all walls exceeding 4 feet or walls adjacent to parking.
5. Weep tile material and size.

P. Drinking Water System:
1. Material type and size of lines.
2. Location of fire hydrants and valves.
3. Profiles below their respective plan views.
4. Location of meter room.
5. Location of irrigation meter pits and water meter schematic.
6. Fire riser schematic.
7. Calculations for the sizing of the domestic and fire service lead.

Q. Wastewater Collection System:
1. Material type and size of lines.
2. Inverts with direction and size annotated.
3. Location and size of manholes.
4. Profiles below their respective plan views.

5.
6. Design basis.

R. Stormwater Management System:
   1. Dimensions.
   2. Cross sections.
   3. Material type and size of storm sewers.
   4. Location and centerline elevations of swales or ditches.
   5. Inverts with direction and size annotated
   6. Direction of flow.
   7. Overflow route of surface drainage when the 10year event is exceeded.
   8. Profiles of storm sewers.
   9. Culverts.
   10. Design basis.

S. Franchise Utilities Services (Electrical, Telephone, Cable, and Gas):
   1. Location of underground lines and surface equipment/cabinets.

T. City-Owned Utilities or Distributed Energy Resource Equipment:
   1. Location of underground lines and surface equipment/cabinets

U. Privately-Owned Micro-Grid Utilities or Distributed Energy Resources:
   1. Location of underground lines and surface equipment/cabinets.

V. Private roads shall meet all requirements of Chapter 8 of these standards.

W. All water, sanitary sewer, and storm drainage lines and appurtenances together with all streets, lot lines, and outlines of all existing and proposed buildings, shall be shown on one sheet in each construction set of plans.

X. Evidence of approval by or letter of "no jurisdiction" by:
   1. Michigan Department of Environment, Great Lakes, and Energy (EGLE) – wetlands, lakes, streams, dams, floodplain.
   2. Michigan Department of Transportation (MDOT).
   3. Wayne Country Road County Roads Division.
   4. Wayne County Water Quality Management Division office. For site plans not within the jurisdiction of the WCWRC, a review and technical approval of the stormwater management concepts shall be obtained.
   5. Wayne County Environmental Health Section – wells, septic systems.

Y. Proposed building, address numbers, and parcel numbers.

Z. If a site plan is approved as a Drainage District, evidence that the Drainage District is established.

AA. If off-site easements are required to connect to public utilities, evidence that the easement has been recorded. This includes grid-tied DER and micro-grids.

BB. Temporary Dewatering Plan, if requested by the City Engineer. Specifications shall be integrated into the plans that address impacts on adjacent properties, wells and wetlands. The amount and location of flow at the discharge point and well abandonment plan shall also be shown on the plans.

CC. A hydrogeological study, if requested by the City Engineer, that investigates the fluctuation of groundwater and anticipated high groundwater elevations throughout the site.

DD. Current City Specifications and Detail Sheets.

EE. Design basis with supporting calculations for water and wastewater.

FF. All design shall be consistent with chapters 3-14 of the Current Engineering Standards.

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3 WATER MAINS

3.1 General

A. All construction shall be in accordance with the current "City of Highland Park Water Main" specifications and details. Specifications and details must be included in the construction plans and are located on the City's webpage.

B. All water mains shall be shown in plan and profile on standard twenty-four (24) inch by thirty-six (36) inch white prints having blue or black lines and shall be neatly and accurately prepared to an engineering scale.

C. A quantities table itemizing all proposed water mains shall be included.

D. Water main location, size, length and all easements shall be shown on the plan view.

E. Water main material, size, length, and appropriate controlled density backfill shall be shown in the profile view.

F. The minimum horizontal separation between water main and sanitary or storm pipe shall be 10 feet. The minimum horizontal separation between water main and any other utility pipe shall be 5 feet. Outside the road right-of-way or road easement, the minimum horizontal separation between water main and trees shall be 10 feet. Inside the road right-of-way or road easement, the minimum horizontal separation shall be 4 feet.

G. The minimum vertical separation between water main and any other utility shall be 18 inches at crossings. If minimum vertical separation cannot be met, water main must be encased in concrete. Top of pipe and bottom of pipe elevations shall be provided at each crossing.

H. Compaction of trenches is required in roadway corridors, sidewalks and parking lots (Class II Granular Backfill at 95% compaction). Roadway corridors constitute front of house to front of house in residential developments. This note shall be included in the plans.

I. Compaction of trenches is required in greenbelt areas (Class II Granular Backfill at 95% compaction) to one (1) foot above the top of pipe. Approved native material compacted to 90% maximum density is required for the rest of the trench.

J. Hydrant and post indicator valves (PIV) shall be shown graphically in plan and profile. The PIV shall be placed outside the building collapse zone.

K. It is recognized that water mains and appurtenances to be constructed as part of a project may often need to be oversized in order to be properly integrated into the City's system. The City shall not bear the cost of such oversizing. The proprietor shall bear all costs and provide required easements.

L. Water mains are to be designed within or adjacent to the road right-of-way. Back or side lot locations are exceptions for special applications or serviceability difficulties and shall be in a minimum 20-foot wide easement.

M. Utilities which cross or parallel proposed water main shall be shown with corresponding structure numbers from previously constructed projects or the current City GIS.

N. Use of vertical bends shall be minimized.

O. Two (2) 45-degree bends shall be used in lieu of one (1) 90-degree bend.

P. No water mains or appurtenances should be constructed or allowed to remain under or within 20 feet of any building, footings, or structural improvements.

Q. The developer shall submit the DEGLE Permit Application to the City Engineer. The developer shall also submit a tabulation of water mains consisting of the size, location, type, and length. The City will ensure proper submittal to the Michigan Department of Environment, Great Lakes, and Energy for their issuance of the required construction permit in conformance with Act 399, Public Acts of 1976, as amended. All permit costs shall be the responsibility of the contractor.

R. Shop drawings shall be submitted by the underground contractor for all water main and appurtenances that he or she will install. Shop drawings will consist of letters of certification for all pipe, and manufacturer's standard details or cut sheets for structures and appurtenances. Shop drawings must be approved prior to construction activity beginning.

S. Hard copy and electronic record "as-built" plans shall be submitted by the developer and reviewed and approved by the City Engineer after construction is complete. These plans shall show the location and elevations of all water mains and appurtenances per the City's current requirements. The approved electronic "as-built" plans shall be in AutoCAD format. As-built plans are due to the City thirty (30) days after the completion of construction, or as approved by City Engineer.

T. All water main materials and construction shall comply with the current City Details and Shop Drawing Checklist, and Wayne County Standard Specifications.

3.2 Sizes and Distribution

A. Each phase should be looped with a dual feed.

B. Water mains shall be extended to the property lines on all sides of the subject parcel. The location and phasing shall be approved by the City Engineer.

C. In general, water mains shall be looped and have minimum sizes as follows:

1. Low Density Residential – 8-inch.
2. Other Residential, Commercial and Industrial – 12-inch primary looping; 8-inch secondary.
3. Major System Looping – 12-inch and larger.
4. Section Line Infrastructure – 16-inch and larger.

3.3 Depth of Water Main

A. The typical depth of cover to top of pipe shall be 6.5 feet. Maximum allowable depth of water main is 8 feet, unless specifically approved by the City Engineer. Vertical bends are highly discouraged and only allowed when approved by the City Engineer. Where a vertical bend must be placed in a water main in order to pass under another utility, the length of the deep water main shall be kept to a minimum.

3.4 Easements

A. Easements shall be provided to the City of Highland Park for all public water mains. Water main easements shall be a minimum 20 feet wide and shown on the plan. These easements shall be prepared, executed and recorded by the developer prior to final acceptance of the project by the City of Highland Park. Easements shall be prepared in a form acceptable to the City of Highland Park.

3.5 Profile

A. Profiles shall be located below their respective plan view.

B. The following information shall be shown on the water main profile:

1. Continuous stationing in the plan and profile.
2. All structures and hydrants uniquely numbered.

3. Length of run between structures.
4. Type and class of pipe between structures.
5. Size of pipe between structures.
6. Top of casting elevations of all structures.
7. Finished grade elevations of all hydrants.
8. Existing and proposed ground elevations along the route of the water main.
9. All existing and proposed utility crossings with bottom of pipe and top of pipe elevations.
10. Sand backfill areas compacted to 95% under the influence of pavement, shown graphically.

3.6 Testing

A. No water main installation or portion thereof shall have a leakage exceeding 0.092 gallons per inch diameter of pipe per 1,000 feet of length per hour at an internal pressure of 150 psi. This test shall be conducted for a minimum of two (2) hours and shall not be conducted until 30 days have elapsed since installation.

B. All water main installations shall be disinfected in accordance with Michigan Department of Environment, Great Lakes, and Energy Standards.

3.7 Valves

A. Valves shall be located, at a minimum, as follows:
1. Spacing 800 feet maximum.
2. Minimum three at every cross and tee.
3. Not more than three hydrants between valves.
4. Not more than three non-residential or multiple-family residential buildings between valves.
5. At locations sufficient to provide the Fire Department with accessible water even with one or more valves are shut off.
6. At temporary dead ends (the water main shall be extended one pipe length past the gate well and include a temporary hydrant).
7. On property/lot lines where possible.
8. Valves shall be located outside of sidewalks or driveways. Valves must be located outside of all other pavement where possible.

B. Valves shall be the same size as the water main on which they are installed. Allowable valve type shall be:

Valve Size, (inches)	Valve Type
8 -12	Resilient wedge gate valve
16 and larger	Determined by Water Department

C. Gate wells are required on system valves 8-inch and larger. Gate wells shall be precast, eccentric, watertight and have a minimum inside diameter as follows:

Valve Size (inches)	Diameter (feet)
8	6
12	6
16 and greater	7

D. Clear openings in gate wells shall be a minimum of 24 inches.

E. Post indicator valves (PIV) shall be located on all building fire service lines. They shall be at least 1.5 times the building height from the building. The domestic service shall be separately tapped and valved. Both the PIV and domestic service valve shall be located together. Three (3) feet separation shall be maintained between service lines.

F. When connecting to an existing water main, a tapping sleeve and valve in wells are required unless connection to the existing water main can be made without interrupting service on the main as determined by the Highland Park Water Department.

3.8 Hydrants:

A. Hydrants shall be located such that all sides of buildings and structures will be within 300 feet of a hydrant and outside the collapse zone, but not closer than 50 feet. Measurements shall be made along the practical location of laying the fire hose.

B. Hydrants should be located at intersections and major driveways.

C. Hydrant leads should be a minimum of 6-inches in diameter.

D. Hydrants shall not be connected to the fire service lead.

E. EJ 5BR250 or engineered approved equal, conforming to AWWA C502 shall be used. The hydrant shall have two 33/4" (4.05" O.D.) pumper connections with National Standard 7 ½ threads per inch, one of which shall be equipped with a "Storz" adapter as specified in Chapter 11. Hydrants shall be breakable flange type and open left (counter clockwise) with 5 ¼" valve seat opening and 6" diameter inlet. All hydrants shall be painted red. A "Storz" fitting shall be placed on the left nozzle when facing the hydrant. All hydrants shall be 6'-6" bury or variable as required.

F. Hydrants shall be located 3 to 10 feet from the back of a curb.

G. The center of the hydrant nozzle shall be 18.5 inches above the ground. Finished grade shall be provided on the plans.

H. Hydrant outlets shall face the curb best approached by a fire apparatus. Final approval shall be by the Fire Marshal.

I. For all buildings that require a fire department connection (FDC), one hydrant should be located within 50 feet from the building. The hydrant shall be dedicated to the FDC and not located on the fire service lead.

J. In potential conflict areas, concrete filled 8-inch steel bollards shall be provided for protection of the hydrants. Bollards shall be painted yellow.

K. Access to fire hydrants shall not be obstructed by landscaping, vehicular parking, trash containers, transformers, retaining walls, snow piles, ditches or any other obstructions.

L. The City Fire Marshal shall review and approve all hydrant locations.

M. During the flushing of the water system and during acceptance testing, the entire hydrant head may be removed with approval from the Water Department.

N. Temporary hydrants may be required for phased construction.

O. Hydrants are required at all dead ends.

P. Existing hydrants to be replaced shall be returned to the Highland Park Water Department.

3.9 Joints:

A. Push-on joint restraints are not allowed on any water main except as approved by the City Engineer. All bell and spigot joints shall have "Mega lug" restraints. Concrete thrust blocks and locking gaskets shall also be used for joint restraint.

B. Petroleum resistant gaskets shall be used in areas where petroleum products have been stored or will be.

3.10 Water Services:

A. House meter templates and house meters will be installed by the Highland Park Water Department.

B. In residential developments, the service leads shall be brought to the property side of the public right-of-way and marked with a steel post painted blue. Curb stops and boxes shall be located at the ROW line with tails extending past the franchised utility easement. This will eliminate construction conflicts with gas, electric, phone and cable.

C. Building wall, finish floor elevation, basement floor elevation (if any) and bottom of footing elevation shall be shown in profile of service leads for non-residential developments.

D. All commercial and industrial service leads must be profiled below their respective plan views. This also includes fire service leads. The profile must show the location of PIV and service valves.

E. No private services will be allowed from a 6-inch hydrant lead, fire suppression lead, or a water main over 16 inches in diameter.

3.11 Meters:

A. For metering regulations, refer to the City of Highland Park Water Department.

B. For non-single-family homes, a water meter and service schematic shall be shown that includes the valves, meters, backflow preventers, and piping. The meter shall be in a heated, structurally sound room fully accessible from the building exterior or public common interior. It shall be located within 5 feet of the water service's penetration of the exterior wall.

C. The meter room for non-single-family homes must:

1. Be only one per building.
2. Be fully heated.
3. Have complete structural footings.
4. Be fully accessible from the building exterior or public common interior within five (5) feet of the water service penetrations of the exterior wall.
5. Be full height off the ground floor level.
6. Contain appropriate meters, backflow preventers and control valves.
7. Be clearly labeled on each ground floor plan or each building type.

D. The meter room must be fully coordinated between:

1. Site civil engineer.
2. Building mechanical engineer.
3. Building architect.

E. The location of Irrigation Meter Pits shall be shown.

3.12 Wells:

A. When an existing building is connected to the water system, the water well must be abandoned.

B. If water main is not available, a copy of the valid well permit from the Wayne County Environmental Health Section must be submitted prior to final approval.

C. Any property serviced by City water shall not install a water well for any purpose including irrigation. Should a well be existing, the well can continue to be used for

irrigation purposes only. Upon any failure of well and its components, the well shall be abandoned per Wayne County Environmental Health Section standards.

3.13 Structure Schedule:

A. A water main structure schedule shall be provided on the plans showing each hydrant and gate valve by structure number that includes:
   1. Casting type.
   2. Finished grade elevation/rim elevation.

3.14 Materials:

A. Refer to approved materials list for allowable water main pipe.

B. Service leads for 1-inch, 1-1/2-inch and 2-inch shall be Type K copper or blue polyethylene with tracer wire consistent with the current City Shop Drawing Checklist. Service leads for 4-inch, 6-inch and 8-inch shall be Class 54 or PC 350 ductile iron, double cement lined, or Schedule 40, C900 PVC. Each dwelling unit shall be served by a separate lead.

3.15 Jack and Bore and Directional Drill:

A. All Jack and bore and directional drilling must comply with MDOT standards.

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4 SANITARY SEWERS

4.1 General

A. All construction shall be in accordance with the current City of Highland Park Sanitary Sewer details and Wayne County specifications. Current detail sheets must be included for the construction plans and are located on the City's website.

B. All sanitary sewer shall be shown in plan and profile on standard twenty-four (24) inch by thirty-six (36) inch white prints having blue or black lines and shall be neatly and accurately prepared to an engineering scale.

C. A quantities table itemizing all proposed sewer and manholes shall be included.

D. Sewer location, material, size, length and requisite easements shall be shown on the plan and profile view.

E. All utilities shall be shown which cross or parallel the proposed sewer.

F. The minimum horizontal separation between sanitary sewer and any other utility shall be 10 feet. Outside the road right-of-way or road easement, the minimum horizontal separation between sanitary sewer and trees shall be 10 feet. Inside the road right-of-way or road easement, the minimum horizontal separation shall be 4 feet.

G. The minimum vertical separation between sanitary sewer and any other utility shall be 18 inches. If an 18-inch minimum vertical separation cannot be met, the sanitary sewer must be encased in concrete. Top of pipe and bottom of pipe elevations shall be provided at each crossing in the profile.

H. No live sanitary sewers or appurtenances should be constructed or allowed to remain under or within 20 feet of structural improvements. Existing sewers must be properly abandoned.

I. Compaction of trenches is required in roadway corridors and parking lots (Class II Granular Backfill at 95% compaction). This note must be included in the plans and graphically shown in all profiles. Roadway corridors constitute front of house to front of house in residential developments. This note shall be included in the plans.

J. Compaction of trenches is required in greenbelt areas (Class II Granular Backfill at 95% compaction) to one (1) foot above the top of pipe. Approved native material compacted to 90% maximum density is required for the rest of the trench.

K. Sanitary sewers shall be designed within or adjacent to the road right-of-way with back or side lot locations an exception for special applications or serviceability difficulties.

L. External grease traps shall be used for all new food service uses and be placed in the parking lot. A program proposal for continued maintenance and the title of the individual responsible for permanent grease trap maintenance shall be provided in the plans.

M. Sanitary sewers shall be designed, at a minimum, according to the Recommended Standards for Wastewater Facilities (Ten State Standards, latest edition). The peak sanitary flows shall be designed using 100 gallons per capita per day multiplied by the appropriate peaking factor.

N. For residential developments, design population factor should be at least 3.4 persons per dwelling unit.

O. Minimum design velocity for sanitary sewers shall be 2 feet per second with the pipe flowing full. Maximum design velocities shall be 10 feet per second.

P. The existing downstream sewer capacities shall be verified by the applicant to assure available capacity present for the proposed development.

Q. Sanitary sewer design calculations and a sanitary sewer service area map shall be included in the

plans. Sewer design is subject to the review and approval of the City Engineer.

R. Applicants shall submit the EGLE Permit Application to the City Engineer. The City will insure proper submittal to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for their issuance of the required construction permit in conformance with Part 41, Act 451, Public Act 1994, as amended. All permit costs shall be the responsibility of the contractor.

S. Shop drawings shall be submitted by the underground contractor for all sanitary sewers and appurtenances that will be installed. Shop drawings will consist of letters of certification for all pipe, manufacturer's standard details or cut sheets for structures and appurtenances, and a manhole component part list. Shop drawings must be approved prior to construction activity beginning.

T. Hard copy and electronic record "as-built" plans shall be submitted by the developer and reviewed and approved by the City Engineer after construction is complete. These plans shall show the as-built location and elevations of all sanitary sewers and appurtenances per the City's current requirements. The approved electronic "as-built" plans shall be in AutoCAD format. As-built plans are due to the City thirty (30) days after the completion of construction or as approved by City Engineer.

U. All sanitary sewer materials and construction shall comply with the current City Details, Shop Drawing Checklist and Wayne County Standard Specifications.

4.2 Sizes and Distribution:

A. Minimum 10-inch for public sanitary sewers.

B. It is recognized that sanitary sewers and appurtenances to be constructed as part of a project may often need to be oversized in order to be properly integrated into the City system. The City shall not bear the cost of such oversizing. The proprietor shall bear all costs and obtain the associated easements.

C. Sanitary sewers shall be extended to the property line on all sides of the subject parcel. The locations and phasing shall be approved by the City Engineer.

4.3 Depth of Sewer:

A. Minimum depth of cover to top of pipe shall be 5 feet, except the minimum depth shall be 10 feet when fronting residential parcels to be connected to the sewer.

B. Sewer leads shall be below bottom of footing.

4.4 Easements:

A. Easements shall be provided to the City for all public sanitary sewers. The easement width shall be a minimum of 20 feet. The trench depth shall be the maximum sewer trench depth on a particular run of sewer. These easements shall be prepared, executed and recorded by the developer prior to final acceptance of the project by the City of Highland Park. Easements shall be prepared in a form acceptable to the City of Highland Park.

4.5 Profile:

A. Profiles shall be located below the respective plan view.

B. The following information shall be shown on the sanitary sewer profile:

1. Continuous stationing in the plan and profile.
2. All manholes, uniquely numbered.
3. Length of run between manholes.
4. Type of pipe between manholes.
5. Size of pipe between manholes.
6. Rim and invert elevations of all manholes.

7. Sewer slope.
8. Existing and proposed ground elevations along the route of the sanitary sewer.
9. All utility crossings with top of pipe and bottom of pipe elevations. (18-inch minimum clearance)
10. Sand backfill areas compacted to 95% under the influence of pavement, shown graphically.

4.6 Testing:

A. All sewers shall be televised prior to air testing. Recordings shall be made and provided to the City Engineer.

B. No sewer installation or portion thereof shall lose air at a rate greater than 0.003 cubic feet per minute per square foot of internal pipe surface when tested at 3.0 pounds per square inch greater than back pressure. This test shall not be conducted until 30 days have elapsed after installation.

C. Deflection Gauge (Mandrel): Mandrel testing shall take place to ensure the flexible pipe has been properly bedded and back-filled. The deflection test must be conducted no less than 30 days after installation of the final backfill. The maximum allowable deflection is 5 percent.

4.7 Storm/Ground Water Discharge:

A. Downspouts, weep tile, footing drains, sump pump discharges, or any conduits that carry storm or ground water shall not be allowed to discharge into the sanitary sewer.

4.8 Grade:

A. Both ground and invert elevations shall be provided at the end of each sewer line.

B. Minimum slopes shall be as follows:

Sewer Size, Inches	Slope, Percent
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08

4.9 Manholes:

A. The location of each manhole shall be shown and labeled with a consecutive numbering system.

B. Manholes shall be watertight, made of precast concrete, and have a minimum inside diameter of 48 inches.

C. Clear openings in manholes shall be a minimum of 24 inches.

D. The 0.8 diameter points shall be matched in sanitary sewer design.

E. Internal or external drop connections are required when the invert of the outlet pipe is 18 inches or more below the inlet pipe invert, at the City Engineer's discretion. Internal drop manholes shall have a minimum inside diameter of 60 inches.

F. An allowance of 0.10 foot in grade shall be made for loss of head through each manhole.

G. Monitoring manholes are required for all non-residential buildings. These manholes shall be located such that they are accessible by vehicle and approximately 20-30 feet

from the building. Monitoring manholes are not required if a drop connection is used at the existing manhole. The proposed sanitary sewer will be considered a sewer lead if a drop connection is used.

H. Manhole spacing shall be maximized to provide as few manholes as is practical. Maximum manhole spacing shall be as follows:

Sewer Size, Inches	Manhole Spacing, Feet
15 and less	400
18 - 30	500

I. Manholes shall be located at:
1. Changes of grade or direction.
2. At change of pipe size.
3. At junctions and at the end of the sewer.
4. On property/lot lines where possible.
5. In greenbelt areas and not in sidewalks or driveways.

J. Flexible watertight joints are required for pipe connections to all manholes.

K. A manhole bench shall be provided on each side of the flow channel, per City detail.

4.10 Leads:

A. Non-residential leads shall be a minimum diameter of 6-inch and have a minimum slope of 2%. Leads shall be SDR 26 PVC pipe.

B. Residential service leads shall be 6 inches in diameter within the street right-of- way. The length of riser pipes should be shown in the profile, if applicable. Each dwelling unit shall be served by a separate lead. In residential areas, service leads shall be connected with wyes, where practical. The leads shall not enter against the flow.

C. In non-residential and industrial areas, all service leads shall enter manholes. They shall enter approximately 12 inches above the manhole outlet invert.

D. In residential developments, service leads shall be brought to the center of the lot so that both the sewer service and the water service can be brought to the house in a benched common trench. This location will generally result in the least disruption to the property.

E. In residential developments, the service leads shall be brought to the property side of the franchised utility easement that is adjacent to the public right-of-way and marked with a steel post painted green. This will eliminate construction conflicts with gas, electric, phone, and cable.

F. Cleanouts shall be the same size as the sewer lead and shall be located at all bends and distances greater than 75 feet.

G. The location, type, length, and slope shall be noted for each building service connection.

H. All non-residential and industrial service leads must be profiled below their respective plan views. Building wall, finish floor elevation, basement floor elevation (if any), and bottom of footing elevation shall be shown in profile of service leads for non-residential developments.
1. A sewer lead schedule shall be provided on the plans showing each lead with:
2. Lead elevation at main.
3. Riser height at main.
4. Lead length to stub.

5. Lead length from stub to building.
6. Slope.
7. Lowest building floor elevation.

4.11 Pump Stations and Force Mains:

A. Grinder pumps and pump stations are not permitted.

4.12 Structure Schedule:

A. A sanitary sewer structure schedule shall be provided on the plans showing each manhole by number that includes:
   1. Casting type.
   2. Rim elevation.
   3. All invert elevations with size and direction.
   4. Depth.

4.13 Materials:

A. Allowable types of sewer pipe are SDR 26 PVC for depths less than 15-feet. For depths greater than 15-feet, sewer pipe material will be determined by the City engineer.

4.14 Jack and Bore:

A. All jack and bore to comply with MDOT standards.

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5 STORMWATER MANAGEMENT

5.1 General

A. All construction shall be in accordance with the current City of Highland Park Storm Sewer details and Wayne County Specifications. Details must be included with the construction plan and are located on the City's website.

B. All stormwater systems shall be shown in plan and profile on standard twenty- four (24) inch by thirty-six (36) inch white prints having blue or black lines and shall be neatly and accurately prepared to an engineering scale.

C. A quantities table itemizing all proposed storm sewer and manholes shall be included in the plans.

D. Storm sewer location, material, size, length, and all easements shall be shown on the plan and profile view.

E. All utilities shall be shown which cross or parallel proposed storm sewer.

F. The minimum horizontal separation between storm sewer and any other utility shall be 10 feet. Outside the road right-of-way or road easement, the minimum horizontal separation between storm sewer and trees shall be 10 feet. Inside the road right-of-way or road easement, the minimum horizontal separation shall be 4 feet.

G. The minimum vertical separation between storm sewer and any other utility shall be 18 inches. If an 18-inch minimum vertical separation cannot be met, the storm sewer must be encased in concrete. Top of pipe and bottom of pipe elevation shall be provided at each crossing in the profile.

H. No live storm sewers or appurtenances should be constructed or allowed to remain under or within 20 feet of structural improvements. This does not pertain to edge drain or roof drains. Existing sewers need to be properly abandoned.

I. Compaction of trenches is required in roadway corridors and parking lots (Class II Granular Backfill at 95% compaction). Roadway corridors constitute front of house to front of house in residential developments. This note shall be included in the plans.

J. Compaction of trenches is required in greenbelt areas (Class II Granular Backfill at 95% compaction) to one (1) foot above the top of pipe. Approved native material compacted to 90% maximum density is required for the rest of the trench.

K. Improved open drains may be permitted only if the road cross-section or proposed use so warrants.

L. The 1% chance flood area elevation contour shall be provided on the plan. If no floodplain exists, a note shall be indicated on the plan.

M. Sump pump discharge lines shall directly tie into the nearest catch basin. The sump pump discharge line shall include back flow prevention. Receiving manholes shall be constructed with 6-inch diameter stubs for future sump pump discharge line connection.

N. Design calculations shall be submitted for:
   1. Storm sewers.
   2. Drainage ditches.
   3. Detention basins and retention basins.
   4. Restricted discharges.

O. The applicant shall submit evidence that the storm drainage plan has been approved by the following agencies, if they have jurisdiction:

1. Michigan Department of Transportation (MDOT).
2. Michigan Department of Environment, Great Lakes, and Energy (EGLE).
3. Wayne County Roads Division.
4. Wayne County Water Quality Management Division.

P. Storm drainage systems shall be designed at a minimum, in accordance with current Wayne County's rules. The method for computing storm runoff shall be based on Wayne County's standards.

Q. Shop drawings shall be submitted by the underground contractor for all storm sewer and appurtenances that will be installed. Shop drawings will consist of letters of certification for all pipe, manufacturer's standard details or cut sheets for generic structures and appurtenances, and manhole component parts list. Shop drawings must be approved prior to construction activity beginning.

R. Hard copy and electronic "as-built" plans shall be submitted by the developer and reviewed by the City Engineer after construction is complete. These plans shall show the as-built location and elevation of all storm sewers and appurtenances per the City's current requirements. The approved electronic "as-built" plan shall be in AutoCAD format. As-built plans are due to the City thirty (30) days after the completion of construction.

S. All storm sewer materials and construction shall comply with the current City Standard Details, Shop Drawing Checklist, and Wayne County Specifications.

5.2 Sizes and Distribution:

A. The minimum size for storm sewers shall be 12-inches in diameter. However, a sump pump lead or roof drain which accepts no direct surface runoff may be a minimum of 6-inches in diameter.

B. Storm sewer design computations shall be submitted for review on a sewer design form/spreadsheet. These calculations shall also be provided on the plan set.

5.3 Depth of Sewer:

A. Minimum depth of cover to top of pipe should be 3 feet. 2.5 feet of cover is acceptable for the most upstream catch basin. Any modification must be approved by City Engineer.

B. The maximum depth to invert of any storm sewer shall not exceed the depth recommended by the manufacturer for each size and class of pipe.

5.4 Easements:

A. All storm sewers must be located in a public right-of-way or an easement and shall be shown on the plan.

B. Easements shall be provided to the appropriate authority for all storm sewers, storm drains and swales. These easements shall be prepared, executed and recorded by the developer prior to final acceptance within three (3) months after City approval. Easements shall be prepared in a form acceptable to the City of Highland Park and the Wayne County Water Quality Division.

5.5 Profile:

A. A continuous stationed profile shall be provided for the storm sewer, through the detention basin and outlet structure.

B. The following information shall be included in the storm sewer profile:

1. Continuous stationing shall be provided in the plan and profile.
2. All manholes, uniquely numbered.

3. Length of run between manholes.
4. Type and class of pipe between manholes.
5. Size of pipe between manholes.
6. Rim and invert elevations of all manholes.
7. Storm sewer slope.
8. Hydraulic gradient line for the 10-year storm; maintained a minimum 2 feet below the top of all structures.
9. Existing and proposed ground elevation along the route of the storm sewer.
10. All utility crossings with top of pipe and bottom of pipe elevations. (18-inch minimum clearance)
11. Sand backfill areas compacted to 95% under the influence of pavement, shown graphically.

5.6 Grade:

A. Sewer slopes shall provide a minimum flowing full velocity of 3 feet per second and maximum flowing full velocity of 10 feet per second.

B. Where sufficient grade is available, storm sewers shall be constructed at a depth adequate to allow for gravity drainage of the building footing drains. Where grade is not available to allow for gravity drainage of the footing drains, a sump with pump shall be provided for each building with the pump discharge connected to the nearest catch basin or directed to an on-site improved open drain.

5.7 Structures:

A. In residential developments, drainage structures shall be located at every other lot line, thus reducing the need for rear yard cross lot drainage swales.

B. All manholes shall be watertight, made of precast concrete, and have a minimum inside diameter of 48 inches. Landings are required when the depth exceeds 20 feet.

C. Manholes and catch basins shall be consecutively numbered.

D. Clear openings in manholes shall be a minimum of 24 inches.

E. Maximum spacing between storm drainage structures shall be 400 feet.

F. In general, street catch basins shall comply with the standards of the Wayne County Roads Division and shall be located as follows:
1. At the radius return of street intersections. There should be a maximum distance of 150 feet along the street between a high point and a corner catch basin when drainage is required to traverse the corner. No drainage will be permitted to enter into the intersection.
2. At all low points in streets.
3. At intermediate points along the street such that there is a maximum distance of 400 feet along the street between a high point and a catch basin or from a previous intercepting catch basin.
4. At each corner of intersections with public roads to prevent drainage from passing through the intersection.

G. Storm drainage structures, other than manholes, shall meet the following minimum requirements:
1. 24-inch diameter structures are permitted if the depth from rim to top of the bottom slab is less than 5 feet and the structure is at the head of a run. Structures with a depth greater than 5 feet shall have a minimum inside diameter of 4 feet.

2. Clear openings in structures shall be a minimum of 24 inches.
3. All catch basins shall have a sump.

H. Structures shall be located at:

1. **Changes in grade.**
2. **Change in direction.**
3. **Change in pipe size.**
4. **At junctions.**
5. **At the end of the sewer.**
6. **Every other rear lot corner where stormwater is drained or carried through a rear yard, such as a swale.**

5.8 Service Leads:

A. The location, type, length, and slope of building service connections shall be shown on the plan.

5.9 Detention/Retention:

A. All Detention and Retention must comply with Wayne County Standards.

5.10 Stormwater Quality:

A. A stormwater treatment device may be required prior to discharge from the site. New development will be reviewed on an individual basis.

B. Means for delivery and maintenance of stormwater treatment structures shall be specified.

5.11 Structure Schedule:

A. A storm sewer structure schedule shall be provided on the plans showing each manhole, catch basin, and end section by number that includes:

1. Structure type.
2. Casting type.
3. Rim elevation.
4. All invert elevations with size and direction.
5. Depth.
6. Sump (Yes or No).

5.12 Stormwater Management Maintenance Agreement:

A. A stormwater management maintenance agreement, satisfactory to the City, shall be executed by the property owner prior to the pre-construction meeting.

5.13 Materials:

A. Allowable sewer pipe is reinforced concrete (C76-Class IV). Allowable culvert pipe is reinforced concrete or corrugated metal pipe (CMP).

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6 GRADING, DRAINAGE, AND EROSION CONTROL

6.1 General

A. Sufficient proposed grades shall be shown on the plans to ensure that:
   1. Drainage is adequately discharged off-site with proper retention/detention.
   2. No upstream drainage is restricted.
   3. Paving slopes are adequate.
   4. The site, in general, drains without standing water.
   5. Sight lines are not obstructed.
   6. Grades must be provided at least 100 feet off-site in all directions.

B. The following elevations shall be shown on the plans:
   1. Finished floor grade.
   2. Hydrants.
   3. Structure rims.
   4. Centerline of ditch.
   5. Retaining walls.

C. Proposed grading shall meet abutting property line elevations.

D. Differentials in grade must incorporate a 4 horizontal to 1 vertical maximum slope to the abutting property line.

E. Erosion control blankets may be required for slopes in excess of 4 horizontal to 1 vertical.

F. Easement from adjacent property owner will be required for any offsite grading. This document will need to be submitted prior to final engineering approval.

G. Any wall separating a differential grade of more than 4 feet shall be considered a retaining wall. Design Engineer will be required to submit a retaining wall design to the City Engineer along with a complete detail of the wall for a structural review.

H. Where retaining walls with differences in grade on either side of the wall in excess of 4 feet are located closer than 2 feet to a walk, path, parking lot or driveway on the high side, such retaining wall shall be provided with railings that are constructed in accordance with the Michigan Building Code.

I. Any face of a retaining wall shall have a minimum of 2 feet from the nearest property line. Easement from abutting parcels may be necessary.

J. A single-family lot shall be graded to drain away from the house to swales constructed along the lot lines. Swales shall discharge directly to a catch basin or other approved drainage course.

K. Driveway locations shall be included in the grading plan to ensure driveways do not conflict with proposed drainage patterns.

L. Grading plans shall take into account the natural features of the land as much as possible. Also grading away from proposed electrical/energy storage equipment.

M. No filling will be allowed within the floodplain of a river, stream, creek or lake unless under the terms of a permit granted by the EGLE.

N. The Owner shall certify that the as-built site grading and building setbacks conform to the City's approved site and engineering drawings at the completion of the improvements. This certification shall be prepared by and bear the seal of a professional land surveyor licensed in the State of Michigan. The following conditions shall be noted:
   1. No certificate of occupancy will be granted until grading certificates are

received and approved for each lot.

2. After a grading certificate is submitted, the City Engineer will spot-check grades at the City's discretion. The stormwater basin grades may be verified at this time as well.

O. The submittal of plans to satisfy this chapter may be made as a part of the submittal under other chapters of these standards. In no way do the requirements of this chapter alter the requirements of the Wayne County Soil Erosion and Sedimentation requirements. A separate and distinct procedure is called for therein.

P. No earth change activity may commence until a soil erosion control plan and application have been approved, a permit issued, and the soil erosion control measures inspected and approved. All trees shown on the approved site plan as being saved shall be tagged and have a protective fence placed around them at the drip line.

Q. Grading plans shall be drawn with existing and proposed contour lines at one-foot intervals. Spot elevations may be provided but shall not substitute for contour lines.

R. Grading plans shall include the finished grade elevation for proposed hydrants. Rim elevations shall be provided for each storm structure, gate valve, and sanitary manhole.

S. Grading plans shall show all the changes on the site required to convert its predevelopment state to a completed development.

T. Proposed contour lines shall connect with existing contour lines within the site unless grading easements are obtained from adjacent property owners. A clear distinction shall be made between proposed and existing contours.

U. Proposed grades shall generally not exceed a slope of 1 on 4. If a slope greater than 1 on 4 is necessary, the surface shall be planted with a ground cover that is suitable for stabilizing the slope.

V. All graded areas shall be planted or otherwise protected from wind or water erosion within five (5) days after final grading. Other means of stabilization may be substituted for plantings in unique situations if approved by the City Engineer. The plantings and other means of stabilization shall be properly maintained.

W. A perforated riser pipe with stone filter jacket will be required on all sediment basins for projects five acres or more in size.

X. A temporary crushed rock tracking pad will be installed at the construction exit. This tracking pad will be maintained with fresh stone. Construction traffic will be limited to the designated entrance and exit.

Y. A street scraping and sweeping schedule. (Minimum – at least one sweeping a week, and a scraping at the end of each workday.)

Z. Paved storm sewer inlets shall be protected by a high flow sack type inlet filter conforming to Silt Sack– High Flow by ACF Environmental or Inlet Pro –High Flow sediment bag by Hanes Geo Components or Catch-All Inlet filters by Marathon Materials Inc. or Dandy Curb Sack by Dandy Products, Inc.

AA. Rear yard (beehive-type) storm sewer inlets shall be protected by a SedCage Yard Inlet Protection manufactured by SedCatch Environmental Products. Or, a box filter fabric fence conforming to CSI Geoturf 36-inch MDOT spec silt fence securely fixed to 2" x 2" hardwood stakes spaced no more than 6.5 feet on center, tied to 4 ft. steel posts at all four corners and trenched a minimum of 10 inches into the ground. See Wayne County detail for Rear Yard Guard.

BB. All exposed earth shall be stabilized with seed and mulch or sod within 5 days of final

grade. Sediment basins shall be stabilized with seed and straw mulch blankets. Straw mulch blankets shall be staked into the ground 5 days after the construction of the sediment basin.

CC. An undisturbed, vegetative buffer strip of at least 25 feet shall be retained around rivers, creeks, streams, wetlands, drains, and other sensitive areas.

DD. Straw mulch blankets shall be used on slopes 3:1 or greater. (Three feet horizontal, one foot vertical.)

EE. Ditches, swales, and other areas that will channel concentrated runoff must be stabilized within 15 days of construction. Temporary rock check dams will be required to slow water to non-erosive velocities in areas of concentrated flow.

FF. Road right -of-ways must be stabilized a minimum width of 15 ft. back of curb with seed and mulch within 5 days of completing utility work in the right of way.

GG. Areas of earth change that are disturbed beyond the fall seeding deadline (Nov. 1) may require dormant seeding and straw mulch securely crimped to the ground.

HH. Rip Rap will be placed immediately following installation of pond outlets and culverts.

II. Single family lots, during construction, must have a silt fence barrier installed across the front and rear lot lines with a temporary crushed rock tracking pad for access and egress at each lot.

JJ. A single-family residence, prior to receiving a Certificate of Occupancy, must have a lawn or a temporary silt fence barrier installed per plan. Silt fence shall be securely trenched a minimum of eight inches into the ground. Or, place temporary annual rye seed mix covered by minimum width of 15 feet of straw mulch blanket anchored to the ground with stakes at minimum 15 feet back of curb across the entire front of the lot.

6.2 All contour lines and spot elevations shall be based on NAVD88.

6.3 Every parcel shall provide positive drainage that does not negatively impact adjacent parcels/lots.

6.4 The grade from a house to its adjacent street shall be not less than one percent (1%) and the proposed finished grade at the building shall not be less than twelve inches above the top of curb. The rear yard finished grade elevation shall not be less than twelve inches above the 100-year flood elevation.

6.5 Roof downspouts and sump pump discharges shall be directed to the stormwater system.

6.6 Sheet flow may be allowed into a wetland if adequate plant material exists as a buffer.

6.7 The longitudinal grade of rear yard drainage shall not be less than two percent (2%).

6.8 The finished first floor and bottom of footing elevations, if applicable, shall be provided on the grading plan. For single family homes it is understood that these elevations may vary slightly during construction based on the actual location of the house on the lot and the house type. However, all proposed deviations shall be approved in advance of construction.

6.9 When applying for a building permit for a single-family home in an area with an approved grading plan, the builder shall submit documents as required by the Building Department.

6.10 No grading is allowed within the floodplain boundary without an EGLE Permit.

6.11 Finish floor, finish grade, and top of footing elevations shall be provided and make sense in relation to each other.

6.12 Driveways:

A. Show location and width for proposed drive (s).

B. The number of drives shown is consistent with Wayne County Roads Division Permit.

C. The maximum slope of driveways shall be 6%.

D. The driveway shall not interfere with side or front yard drainage.

E. Edge of drives shall be offset a minimum of three (3) feet from side lot line.

6.13 Retaining Walls:

A. Walls greater than four (4) feet in height shall require an engineering analysis from a structural engineer prior to issuance of approval by City Engineer. In addition, a separate permit from the Building Department will be necessary for construction of this wall.
B. Unless adjacent to a driveway or parking lot, walls less than four (4) feet of height will be considered landscape walls and do not require an engineering analysis.
C. Retaining walls (other than for decorative purposes) are generally unacceptable. Where absolutely necessary due to steep slopes, retaining walls should not exceed five (5) feet in height. Terraced retaining walls shall be separated by a minimum of five (5) horizontal feet.

6.14 Pathways for any parcel on a main arterial road or as shown on the site plan, sidewalks and bike paths are required as designated on Non-Motorized Transportation Plan found in the City Master Plan.

6.15 SESC Permit (necessary for lots/parcels that are within 500 feet of a lake/stream/pond/waters of the state or lots/parcels over one (1) acre disturbed that are outside of recent established subdivision covered under blanket SESC permit for the site) must be issued prior to issuance of Building Permit.

6.16 A building permit cannot be issued until a final acceptance letter has been issued for the Subdivision. The "Ready for Use" letter cannot be completed until all utility testing is complete, a walk-through of the site has been performed, and necessary financial guarantees posted.

6.17 Grading associated with detention and retention basins shall meet Wayne County's minimum requirements.

6.18 All material used for fill under structural improvements shall consist of readily compactable materials meeting the following minimum requirements:

A. No inclusion of organic or other deleterious materials which may be subject to decay shall be permitted.
B. All fill shall be free of ice or snow.
C. No rock with a dimension greater than eight inches shall be buried within two (2) feet of finished grade or within two feet of a foundation base.

6.19 All areas of excavation and fill, exceeding two (2) feet, shall be shown on the plan.

6.20 All construction shall be in accordance with the current Wayne County specifications and Soil Erosion and Sedimentation Control requirements.

6.21 Requirements for Residential Developments:

A. The longitudinal slope along a rear yard drainage easement shall be not less than 2.0%. Drainage between lots shall be in a swale located on the lot line.
B. All grade point elevations shall be shown for each lot.
C. The general direction of overland drainage in the rear yard shall be indicated on each lot with an arrow. High points shall be indicated.
D. Overland drainage shall not cross from one lot onto another unless located within a drainage easement.
E. The emergency overland drainage path shall be shown, indicating the drainage characteristics of the site should the storm sewer system fail.
F. High and low street grade points, slope direction (by arrow), and the location of all catch basin inlets and drainage ditches shall be shown on the grading plan.

G. A maximum slope of 4 feet horizontal to 1-foot vertical shall not be exceeded for all terracing. The toe of slope shall be located outside of the rear and/or side lot line drainage easements.

H. Complete site grading plans shall be drawn to a maximum scale of 1" = 100' (e.g., 1" = 200' will not be accepted).

I. Grading plans shall include details of typical lot grading and drainage patterns intended to be used.

J. The grading plans shall show the existing elevation topography by contour lines. Topography on abutting property within 100 feet of the site boundary shall be shown.

K. All elevations shall be on the North American Vertical Datum 1988 (NAVD 88).

L. A detail of the typical lot drainage pattern shall be shown on the grading plan with all grade control points identified.

M. In general, for streets with ditches and no curbs, elevation of the front lot line shall be at least 6 inches above the centerline of the road.

N. Catch basins shall be placed in rear yard swales, at every second lot line, at low points per Section 5.07.A.

O. Siltsack or other acceptable temporary measures shall be provided at rear yard catch basins to prevent sedimentation of storm sewers. The Owner shall be responsible for maintaining temporary erosion control devices.

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7 PAVEMENT AND CURB

7.1 General

A. The applicant shall submit evidence that all approaches have been approved by the Wayne County Roads Division or the Michigan Department of Transportation (MDOT), for projects that fall under their jurisdiction.

B. All parking lots and drives shall be paved and have curb.

C. Parking lots and driveways shall have well-drained prepared subgrades. Adequate means of collecting and disposing of the drainage shall be provided.

D. All parking lots shall conform to the most current specifications of the ADA, including accessible path and parking space requirements. The design engineer shall certify that the parking lot design meets the current ADA standards.

E. All curbing shall be Portland cement concrete in accordance with the most recent MDOT standard specifications, type F4. Asphalt curbs are not permitted.

F. Where drainage is intended to run along the curb, integral curb and gutter shall be used.

G. Any road improvements in the Wayne County right-of-way are subject to the review and approval of the Wayne County Roads Division. A permit must be secured from the Wayne County Roads Division for construction.

H. Any road improvements in the MDOT right-of-way are subject to the review and approval of MDOT. A permit must be secured from MDOT for construction.

I. Cross-sections of all proposed pavement improvements must be shown on the plans with thicknesses and materials clearly indicated.

J. Concrete curb and gutter will be required for all parking lot construction. An appropriate detail shall be provided. Underground storm sewers will be installed with all paving, which requires concrete curb and gutter. The stormwater runoff from all proposed site development will be collected and conveyed by means of storm sewers to approved points of discharge.

K. Edge drains will be required for all paving improvements according to Wayne County Roads Division guidelines.

L. Soil borings must be taken and analyzed by a professional engineering firm qualified to do such work at the locations of all proposed roads. The City may request copies of the report. It is recommended that a soils investigation be done, and a report prepared for all areas where pavement is proposed.

M. Sufficient proposed grades must be shown on the plan to clearly show the drainage patterns.

N. Passing lanes, acceleration lanes/tapers and deceleration lanes/tapers will be required according to Wayne County Roads Division guidelines.

O. Minimum general paving slopes:
   1. Asphalt: 1.0%
   2. Concrete: 1.0%

P. Maximum general paving slopes:
   1. Road/Approaches: 6.0%
   2. Parking Lots and Sidewalks/Pathways: 5.0%

7.2 Typical Road Cross-Sections:

A. The following minimum thickness requirements are based on adequate subgrade, subgrade drainage and average live loads. Each site must be examined individually, and additional pavement thickness and/or base requirements may be necessary.

1. Residential, commercial, office, industrial, private roadways and sidewalks/pathways:
   a. Cross-sections shall follow the guidelines provided in Section 8 of these standards.
2. Parking lots:
   a. Cross-section shall match the Highland Park Standard Details. Concrete curb and gutter are required for all areas.
3. Loading/unloading areas, if required by the City, shall have 8" thick non-reinforced concrete over 6" of compacted Granular Material Class II.

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8 Private Roads

8.1 Intent

A. It is the intent of these standards to permit access to the interior of certain sections within the City by private roads which permit unobstructed, safe and continuous vehicle access in a manner that will promote and protect the public health, safety, and welfare and ensure that law enforcement, fire and emergency services can safely and quickly enter and exit private property at all times.

B. It is further the intent of this standard to ensure that private roads are maintained and repaired by the private property owners who own and use the road.

C. The procedures, standards and specifications set forth herein are determined to be the minimum procedures, and specifications necessary to meet the intention of these standards.

8.2 Definitions:

A. The following words, terms, and phrases, when used with these standards, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

B. *Easement* means the right of an owner of property, by reason of such ownership, to use the property of another for purposes of ingress, egress, utilities, drainage, and similar uses. In the context of this chapter, private road easements shall be designated for purposes of vehicle ingress and egress.

C. Lot means a parcel of land or real estate.

D. *Private road* means an area of land which is privately owned, has not been dedicated to public use other than access by emergency and public safety vehicles, is maintained by its private owners, and provides vehicular access to more than one lot, unless otherwise specified herein.

E. For purposes of this chapter, private roads shall be further defined and classified as follows:

1. Class I private roads shall be paved and shall meet one or more of the following criteria:
    a. Serves ten or more dwellings, parcels or lots, or has a reasonably foreseeable potential to be extended in the future to serve a total of ten or more dwellings, parcels or lots. The potential shall be based upon the amount of acreage serviced and the potential buildable parcels.
    b. Connects with or has a reasonably foreseeable potential to be extended at a future time to connect with another public or private road.
    c. Has a length of more than 1,000 feet, measured on the roadway centerline from the right-of-way of the public road it intersects to either another intersecting roadway or center of a cul-de-sac.
2. Class II private roads are those which do not meet the criteria for Class I roads as specified in subsection (a)(1) of this section, but which do exceed the criteria for Class III roads as specified in subsection (a)(3) of this section.
3. Class III private roads are those which will serve no more than four dwellings, parcels or lots.

F. *Public street or right-of-way* means a public or dedicated right-of-way which affords the principal means of vehicular access to abutting property, and which is under public ownership or control.

8.3 General Access and Permit Requirements:

A. Every lot in the City that is improved with a building shall comply with Section 1262.29, Subsection e, of the Zoning Ordinance.

B. No person shall construct, alter, or extend a private road without compliance with this chapter and obtaining a permit as hereinafter provided.

C. All lots which have been improved with a building prior to the date of adoption of the ordinance from which this section is derived shall comply with the provisions of this chapter, if the City Council, by resolution, determines that such compliance is necessary to protect and promote the public health, safety and welfare in accordance with the purposes set forth in Section 8.1.

8.4 Application for permit; requirements:

A. Applications for permits shall be delivered to the City zoning administrator and filed with the clerk and shall consist of the following information:

1. *Class I or II private road.*

a. Each application for a Class I or II private road shall be accompanied by completed plans prepared and sealed by a civil engineer registered in the State of Michigan, which includes the information contained herein. Where the required information is incorporated in the overall site plan of a development, separate road plans shall not be required.

b. The application and plans for a Class I or II road shall include the following information:

i. The names and addresses of the dwelling, lot or parcel owners to be served by the private road.

ii. A vicinity map of a minimum scale of one-inch equals 2,000 feet, showing the location of the private road in the City, any access roads and cross streets, road names, a scale and a north arrow.

iii. Existing topography at one-foot contour intervals for the portions of the site sufficient to determine drainage from the private road easement to a suitable stormwater outlet.

iv. Proposed improvements, including, but not limited to, roads, utilities, and ditches, shown in plan and profile indicating all materials, grades, dimensions and bearings in compliance with the standards set forth in Section 8.05. The plans shall also show all existing and proposed grades, the location of all existing and proposed drainage facilities, the location of existing and/or proposed utilities and structures, other structures, physical or natural conditions existing adjacent to such improvements, and any connections to existing public and private roads.

v. Soil borings within the proposed route of the road. Tree coverage and wetland areas within 100 feet of either side of the proposed route.

vi. The location of existing buildings on the lots or parcels being

served or intended to be served by the private road as well as any existing building or structures in or adjacent to any proposed road easement.

vii. The existing or proposed location of private utilities and easements, such as gas, telephone, and electric.

viii. A complete statement of all the terms and conditions of the proposed road easement, including copies of all agreements or intended agreements regarding the maintenance and improvements of the right-of-way and roadway. Furthermore, said maintenance agreements shall be in such form as to be recordable with the county register of deeds and shall specifically address the liability and responsibility of the parties to said agreement to maintain the private road pursuant to the specifications of this section, including, but not limited to, the responsibility of removing snow from said private roads. The recorded statement which runs with the land shall also inform subsequent purchasers that the road is private and may never be maintained or accepted by the county road commission.

2. *Class III private road.*

a. Each application for a Class III private road shall be accompanied by completed plans prepared and sealed by civil engineer registered in the State of Michigan, which include the information contained herein. Where the required information is incorporated in the overall site plan of a development, separate road plans shall not be required.

b. The application and plans for a Class III road shall include the following information:

i. The names and addresses of the lot or parcel owners to be served by the private road.

ii. A vicinity map of a minimum scale of one-inch equals 2,000 feet showing the location of the private road in the City, any access roads and cross streets, road names, and a north arrow.

iii. The location of existing buildings with existing and proposed grades in sufficient detail to depict drainage patterns. Existing utilities, storm drains, ditches, and swales crossing the road easement or adjacent to the easement shall be shown on the sketch plan.

iv. The relationship of the proposed road to an existing public roadway right-of-way which will serve as access for the private road.

v. The location of the proposed road and turnaround within the easement together with proposed drainage and grading.

vi. The proposed roadway materials, thickness, and width and the type of underlying soil.

vii. A complete statement of all the terms and conditions of the proposed road easement, including copies of all agreements or intended agreements regarding the maintenance and improvements of the right-of-way and roadway. Furthermore,

said maintenance agreements shall be in such form as to be recordable with the county register of deeds and shall specifically address the liability and responsibility of the parties to said agreement to maintain the private road pursuant to the specifications of this section, including, but not limited to, the responsibility of removing snow from said private roads. The recorded statement which runs with the land shall also inform subsequent purchases that the road is private and may never be maintained or accepted by the county road commission.

8.5 Design standards:

A. In addition to the standards and specifications set forth in the schedule of minimum requirements and specifications in subsection (b) of this section, all private roads shall meet the following additional minimum requirements and specifications:

1. The roadway surface and cul-de-sac area shall be centered in the right-of- way.
2. The connection between the private road and the public road shall conform to the standards and specifications of the County Road Commission. Where a Class II road connects to a paved county road, the Class II road shall have a paved approach. The applicant shall obtain a road permit issued by the Road Commission prior to approval by the City Board.
3. Underground crossroad drainage shall be provided where the proposed road crosses a stream or other drainage course. Necessary culverts and erosion treatments shall be provided in accordance with the specifications of the Wayne County Roads Division and/or Wayne County Water Quality Management Division.
4. The private road easement and road shall be adequately drained so as to prevent flooding or erosion of the roadway, avoid adverse impacts to adjacent properties, and respect natural drainage patterns, to the extent possible. Ditches shall be located within the private road easement. Connection to roadside ditches within public road rights-of-way shall be approved by the county road commission prior to the issuance of a permit.
5. Private road signs shall be designated with the word "private" and shall be erected and maintained in accordance with the Michigan Manual of Uniform Traffic Control Devices.
6. The road easement shall provide for ingress, egress, drainage, and installation and maintenance of public and private utilities.
7. The private road shall be subject to all other City, county, and state permits and regulations.

B. The following schedule of minimum requirements and specifications for private streets and roads shall apply:

MINIMUM REQUIREMENTS AND SPECIFICATIONS FOR PRIVATE STREETS AND ROADS

	Class I Private Roads	Class II Private Roads	Class III Private Roads
Easement width	55 feet	55 feet	30 feet
Subbase	Depth will vary depending upon native soil types. Spread to a minimum width sufficient to extend to the front slope of the roadside ditch.	Same as Class I	Same as Class I
Gravel base and/or surface	12 inches of 21AA limestone; compacted in two equal courses (see Private Road Cross Section in Appendix)	Same as Class I, except 12 inches of 21AA limestone compacted in two equal parts shall be required to a width of 24 feet.	Same as Class II except 16 feet wide
Pavement	Pavement of five (5) inches of hot mix asphalt, applied in two lifts; 3-inch base course and 2-inch top course. Mix design and binder requirements shall be consistent with current approved Washtenaw County Road Commission standards. In lieu of hot mix asphalt, seven (7) inches of MDOT P1 concrete, or approved equal, may be used. (see Private Road Cross Section in Appendix)	Not applicable	Not applicable
Turnaround area:			
Cul-de-sac	75-foot radius right-of-way, 50- foot radius roadway surface	Same as Class I	Same as Class I
T Type	Not permitted	May be substituted for cul-de-sac subject to review and	Same as Class II
Ditches:			
	Ditching with a minimum grade of one half of one percent (0.5%). Grades of less than four percent (4.0%) shall be stabilized with sod. Grades steeper than four percent (4.0%) shall be stabilized with rip- rap. Front and back slopes shall be one (1) on four (4) or flatter.	Same as Class I	Ditches shall be of sufficient width, depth, and grades to provide for adequate and positive drainage
Roadway grades:			
Minimum	1.0%	1.0%	1.0%
Maximum	6.0%	6.0%	6.0%
Roadway curves:			
Horizontal, minimum	175-foot radius*	Same as Class I	Same as Class I
Vertical, minimum	100 feet long for changes in gradient of 2% or more	Same as Class I	Same as Class I
Miscellaneous:			
Curb and gutter	MDOT F4 curb shall be used with Class I roads.		
Sidewalks	May be required in accordance with Part 12, the Planning and Zoning Code, Section 1244.06		

*Low volume residential roads	At low volume residential streets or roads, the following horizontal curve radii may be considered by the City Engineer: 100’ – 175’: The plan must demonstrate adequate fire apparatus turning movements, must demonstrate adequate sight stopping distance per MDOT standards, and indicate no parking within 50’ of curve on inside radius. 75’ – 100’: All requirements stated above, plus an eyebrow must be designed utilizing an outside radius of 35 feet to provide additional pavement and may be no greater than 90 degrees.

8.6 Permit approval procedure:

A. Application shall be submitted to the City Water Department and City Engineering Department.

B. The City Engineer shall report in writing to the board as to whether or not the proposed private road conforms to the standards and specifications of this section. Said report may include any suggested conditions to be attached to the permit which, in the City engineer's judgment, are necessary to achieve the intent of this chapter.

C. The City shall consider the application, the City engineer's report, and all other relevant information in determining whether to grant the permit application. If the information submitted by the applicant does not establish that the proposed private road will conform to the standards and specifications of this section, the City shall not grant the permit. The City shall impose such conditions on the approval of the permit as it deems necessary to achieve the intent and objectives of these standards, which may include, but need not be limited to, conditions suggested by the City Engineer. The breach of any such condition proposed by the City shall automatically invalidate the permit.

D. As a condition to the granting of any permit under this section, the City shall require that the applicant deposit with the City a performance guarantee in accordance with the provisions set forth in Section 1242.04 and 1272.06 regarding guarantees of the Zoning Ordinance.

E. Upon receipt of the required deposit and predetermined fees and approval of the applicant by the City, the City Zoning Administrator shall issue the permit pursuant to the terms established by the City approving the application.

F. Only the City shall have the authority to approve or deny applications for permits. No other permit issued by any City official or other governmental body or official shall be a substitute for a permit.

8.7 Inspection:

A. All work shall be performed in accordance with the current Michigan Department of Transportation Standard Specifications for Construction. All required improvements shall be inspected by the City Engineer at various stages of construction. The City Engineer shall make a final inspection upon completion of construction. The applicant's engineer shall certify to the City Engineer, before the final inspection and report thereon are made, that the required improvements were made in accordance with this chapter and all approved plans. A letter of completion by the City Engineer shall be delivered to the City Clerk, and the applicant. The costs of inspection, including compensation of the City Engineer, shall be paid by the applicant prior to the issuance of the certificate of completion.

8.8 Expiration of approval of permits:

A. A permit shall be valid for a period of one year from the date of issuance. If the required improvements have not been completed upon the expiration of the one-year period or the longer period of time, then the permit shall be void and of no force and effort and all deposits shall be forfeited to the City.

8.9 Recording of easements:

A. The easement, including all agreements as identified in Section 8.04, shall be recorded in the office of the register of deeds for the County prior to the issuance of the certificate of completion.

8.10 Certificates of Occupancy:

A. No certificate of occupancy shall be issued for any building on a lot subject to the provisions of this section until all work is completed. A certificate of occupancy may be issued prior to the issuance of a certificate of completion, upon recommendation by the City Engineer, and upon deposit with the City of a sum of money, certified check, or bank letter of credit in an amount sufficient to guarantee completion of the remaining required improvements.

8.11 Variances:

A. When there are practical difficulties or unnecessary hardships in the way of carrying out the strict letter of this chapter, such as topographical and other physical characteristics of a parcel, the City Council shall have the power to vary or modify the application of the provisions of this section so that the intent and purpose of the section shall be observed, and public safety secured. Any applicant may apply for a variance from any provision of this section by filing an application for variance with the City.

B. The City Council shall hold a public hearing upon such application within 45 days from its filing. The City Clerk shall give notice of the hearing to the owners of all property abutting and/or having access for ingress and egress of traffic by means of the private road described in the variance application, as well as law enforcement, fire and emergency service officials known by the Clerk to serve such property. The notice shall be mailed to each such party and published in a newspaper of general circulation in the City not later than twenty days prior to the hearing. Any party may appear and comment at the hearing in person or by agent or by attorney. The City Council shall keep a record of said hearing.

C. The City Council may attach reasonable conditions in granting any variance from any provision of this section, and the breach of any conditions or the failure of any application to comply with the conditions shall void the variance. The provisions of this section are intended, in part, to enable variances to be granted and conditions attached to the variance to facilitate the upgrading of prior nonconforming rights-of-way and private roads to the standards of this section, in a reasonably practical manner, including, but not limited to, such rights-of-way and private roads as have been established, recorded, constructed, or maintained prior to the date of adoption of the ordinance from which this section is derived, which cannot be brought into conformity with this chapter without unnecessary hardship or practical difficulty due to soil conditions, topographical considerations, or other factors.

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9 SIDEWALKS/PATHWAYS

9.1 General:

A. All sidewalks/pathways shall conform to the most current AASHTO requirements and the specifications of the ADA.

B. Sidewalks/pathways shall be required along the frontage of the proposed improvements. They will be in the right-of-way and 1 foot from the ultimate right-of-way line.

C. Proposed grades must be shown along the property line, driveways, and intermittent locations along the length of the walk.

D. Any structures, hydrants, poles, etc., which exist along the alignment of the walk, must be adjusted or relocated at the expense and coordination of the owner.

E. Sidewalks shall be at least 4 inches thick, except at driveways where they shall be at least 6 inches thick. Sidewalks shall be laid on a minimum 4 inches of sand base or approved equal.

F. All sidewalks shall be designed and constructed to meet current ADA standards. The ramp shall have at least the same width as its sidewalk approach. The upper and lower ends of the ramp shall have the same elevation as the adjacent sidewalk and pavement surfaces.

G. In general, sidewalks shall be located within the street rights-of-way, one foot from and parallel to the future right-of-way line. Exceptions will be made to accommodate existing conditions such as trees, utility poles and appurtenances, and distance to curbs.

H. Pedestrian paths located outside street rights-of-way may be constructed of materials other than Portland Cement Concrete, with approval of the City Engineer.

I. No downspout or sump pump discharge drainage shall be permitted to flow over any concrete sidewalk.

J. The design engineer shall certify that all sidewalks/pathways meet current ADA standards.

K. Where sidewalks intersect pavement at approaches, drives and parking lots, the sidewalk shall be carried through.

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10 DRIVEWAYS

10.1 A driveway which intersects a paved street shall be paved for a minimum distance of 50 feet from the pavement edge of the road, even if the remainder of the drive is not to be paved. Single-family residential lots shall not be subject to this requirement.

10.2 Driveway slopes shall provide a smooth, uninterrupted movement of traffic from the street to the site. The slope shall be low enough to prevent undercarriage drag or vehicle bouncing, in order to permit safe entry and exit when the drive surface is wet. The minimum slope shall be 1% and the maximum slope shall be 6%.

10.3 Curve radii at drive intersections with streets shall be large enough to permit smooth, uninterrupted movement of traffic between the site and street.

A. On County roads, the standards of the Wayne County Roads Division shall apply.

B. On State trunklines the standards of the Michigan Department of Transportation shall apply.

C. On all other roads, driveway intersection radii shall generally meet County Roads Division standards unless the nature and speed of traffic on the road justify a lesser standard.

10.4 The angle of the driveway intersection with the street shall be 90 degrees unless a directional one-way flow of traffic is intended, in which case the angle of deflection from the street to the drive shall not be less than 45 degrees.

10.5 Driveways shall be constructed of a minimum 6 inches of concrete over 4 inches of sand.

10.6 Driveways shall be designed to accommodate existing and future sidewalks. These sidewalks shall be ADA compliant.

10.7 Where sidewalks intersect driveways, the sidewalk shall be carried through.

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11 FRANCHISED UTILITIES (ELECTRIC, TELEPHONE, GAS, AND CABLE)

11.1 All procedures, design, and construction of utilities shall be in conformance with the requirements of the supplying utility company.

11.2 Plans of all proposed utilities, whether or not in public easements, shall be submitted by the utility company to the City of Highland Park for review. the City of Highland Park will issue a construction permit to the utility company when its plans are approved.

11.3 All existing and proposed utility information, including lines, poles and surface equipment shall be shown on the final site plan.

11.4 Surface equipment shall be located so as not to interfere with traffic flow, parking, building access, fire hydrants, or Fire Department connections.

11.5 Electrical, telephone, gas, and cable may not share a common trench with sewer and water mains and shall maintain a minimum of 10 feet of separation from them.

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12 FIRE PROTECTION AND PREVENTION

12.1 Access

A. In addition to the standards in Section 10.04 the following shall apply:

1. All roads, lanes or drives required for emergency access shall be posted as required by NFPA 1141, Sections 3-1.8 & 3-2.3 with the following exceptions:

a. Entryways and main drives adjacent and parallel to structures shall be posted with signs reading “No Standing – Fire Lane” or “No Parking – Fire Lane” on the side adjacent to the building and the opposite side shall be posted with signs reading “No Stopping – Standing – Parking – Fire Lane.” Parking shall be prohibited on one side of all main driveways.

b. Paved areas on the sides and rear of buildings which are less than thirty (30) feet wide shall be posted “No Parking – Fire Lane”.

c. Signs shall be installed with their faces perpendicular to the roadway, six feet, eight inches (6‘-8”) high, facing the direction of travel, and shall be located so that at least one sign is clearly readable from any location on the posted road, lane, or drive. Signs shall be two sided, where applicable. Landscaping or other obstructions shall not be placed around any structure, hydrant, Fire Department Connection (FDC), Post Indicator Valve (PIV), or other emergency equipment in a manner so as to impair or impede the visibility of, or accessibility to, said equipment for emergency operations. A 10% maximum slope shall be maintained within twenty (20) feet of the building. (i.e. 2 feet in 20 feet).Provide a minimum of three-sided access for buildings of irregular shape. Determination of compliance shall be determined by the Fire Marshal to all non- single family residential buildings.

B. Grass pavers generally are not permitted for access unless, in the opinion of the Planning Commission, their use is prudent and feasible.

C. Building overhangs or extensions must provide 12 feet of clearance in order to prevent a fire apparatus obstruction. Overhang clearance shall be noted on the site plan.

D. Fire lanes shall be a minimum of 22-feet wide.

E. In multi-family residential buildings in which there are units with no front vehicular access to driveways, access ways must be extended along both sides of the building extending 35 feet beyond the furthest structural component of the building, including porch overhang.

F. Site plans shall provide more than one (1) point of access to the site. Access points must be approved by the Fire Marshal.

G. Emergency access routes must be capable of handling the weight of the fire apparatus and must be twenty-two (22) feet wide. The surface shall be approved by the Fire Marshal. All emergency access routes must be approved by the Fire Marshal.

H. Emergency only access roads must be clearly marked by signage stating, “Emergency Access Only” at entrance points and “No Parking, Fire Lane” every 75 feet along the road as designated by the Fire Marshal or his/her designee. Entrance points must discourage non-emergency traffic while not impeding emergency apparatus.

I. Emergency access roads are preferred to encircle the structure(s). Dead-end emergency access roads must provide a cul-de-sac or hammer head type turn-a- round approved by the Fire Marshal. The Fire Marshal may exempt the turn a around depending on circumstances (i.e. length).

J. Ingress/egress gates, barricades, or obstructions must provide approved Fire Department “Knox Boxes/Knox Locks” for entry.

12.2 Alarm Systems:

A. Alarm systems must be installed according to NFPA 72.

12.3 Annunciator Panels:

A. The Annunciator Panel for the alarm/suppression systems must be located just inside of the main entrance and visible from the main entrance. Zone locations with legends must be available and placed inside of the Knox Box, or in the annunciation panel, at the discretion of the Fire Marshal.

12.4 Applicable Codes:

A. Fire protection and prevention for sites and structures shall be designed, constructed and maintained in accordance with the provisions of the International Fire Code, as adopted, the Fire Prevention Standards of the National Fire Prevention Association (NFPA), as adopted by reference, the Building Code of the City of Highland Park, these Engineering Standards, and other applicable ordinances.

12.5 Dry or Wet Hydrants:

A. Hydrant placement shall be measured as “hose-laying distance” from Fire apparatus. Hose-laying distance is the distance the fire apparatus travels along approved access routes between hydrants or from a hydrant to the structure.

B. No commercial, industrial, or multiple residential area shall be more than 300 feet from a hydrant or approved water supply. Adequate water supply shall be determined by NFPA 1142 or the Authority Having Jurisdiction (AHJ).

C. In single-family residential areas consisting of five (5) or more homes, an adequate water supply must be considered and recommended by the AHJ and approved by the

City.

D. Dry hydrants shall be at least three (3) feet, but no further than six (6) feet, from the back of the curb or road edge. Height of hook-up point shall be 18.5 inches.

E. Hydrant location shall be determined by the Fire Marshal, City Engineer, and Water Director. Hydrants should not be located in the collapse zone of a building.

F. Hydrants shall be protected by curbs, bollards, guard rail, or other acceptable methods if determined to be in a hazardous location.

G. Additional hydrants may be required depending on the type of hazard or use to protect the structure and/or contents.

H. Hydrants must meet the City of Highland Park Fire Department specifications. All fire hydrants shall have two pumper connections, one of which shall be equipped with a "Storz" adaptor as specified below. All hydrants shall be painted red.

I. Site plans shall note water sources including all dimensions of ponds, rivers, and accessibility, which a minimum of 2 feet below the 50-year drought level, as determined by a registered Engineer.

J. Dry hydrants, underground water storage tanks or static water supplies must be in compliance with all applicable referenced codes in the City of Highland Park Fire Department.

K. Hydrants and Fire Department Connections shall be unobstructed from posts, fences, vehicles, plantings, trash storage, or other materials. A clear space of three (3) feet shall be maintained unless otherwise approved by the Fire Marshal. Hydrants shall have a minimum of 15 feet clear area in the direction of the nozzles.

12.6 Fire Department Connections:

A. Fire Department Connections (FDC) shall be located in a location approved by the Fire Department.

B. Fire Department Connections shall be located so that firefighters and fire apparatus can make immediate access. Obstructions such as fences, bushes, trees, walls, electrical transformers, dumpsters, vehicles, gas meters, or other similar objects shall not be permitted for new or existing installations. There shall be 15 feet of clearance around FDC's.

C. Fire Department Connections shall not be located near electrical transformers or any form of electricity.

D. Buildings with multiple FDC's that have separate sprinkle suppression systems or zones must have strobe/horn warning devices located above them at the roof line indicating which system has triggered an alarm.

E. Fire Department Connections, where provided, shall be a four (4) inch "Storz" connector and shall be within fifty (50) feet of a public fire hydrant. Said connector shall be a "Hydra-Storz Adapter" manufactured by Harrington, or an approved equivalent. The Fire Department Connection shall be a minimum of 15 horizontal feet from any gas or electric service and clearly visible from the adjacent roadway or driveway. A sign shall be placed overhead of the connection station "FDC" with a red arrow pointing downward in a size and location acceptable to the Fire Marshal.

F. All structures, except one-and two-family dwellings built under use group R-3, shall be equipped with a "Knox Box" key storage unit. The location and number of the key storage units shall be determined by the City of Highland Park Fire Marshal.

G. Trash and debris at construction sites shall be disposed of in an environmentally sound manner.

12.7 Knox Box/Locks:

A. Where required. Where access to or within a structure or area is restricted because of secured openings or where immediate access is necessary for life – safety of fire-fighting purposes, the Fire Marshal is authorized to require a key box to be installed in an approved location. The key box shall be of an approved type and shall contain keys to gain necessary access as required by the Fire Marshal. Knox Locks shall be installed on gates or similar barriers as required by the Fire Marshal.

B. Knox Box Contents:
   1. Access keys, Fobs, Cards, etc.
   2. Emergency contact information.
   3. Elevator & Firemen Keys.
   4. Hazardous materials information.

C. The main office of each building shall have the following:
   1. "As Built" fire protection plans.
   2. Access keys, Fobs, Cards, etc.
   3. Emergency contact information.
   4. Elevator and Firemen Keys.
   5. Liquid run off information.
   6. Hazardous materials information.
   7. Firefighter Right-Know.
   8. Tunnel Information.
   9. Stairwell locations.

12.8 Radio Coverage in Building:

A. In some large buildings, radio communications are inadequate due to the construction materials or design of the building. Therefore, on new buildings or major renovations radio repeaters/amplifiers may be requested.

12.9 Signage:

A. Location of "Fire Lane-No Parking," "Fire Lane No Standing," "Emergency Access Only", "Authorized Parking Only", type signs shall be designated by the Fire Marshal or his designee. They shall be spaced 75 feet apart.

B. Fire Department road/parking type signage shall be 12" by 18" and meet the adopted International Fire Code and National Fire Protection Association Life Safety Codes.

C. Curb, asphalt, or cement painting may be required in fire lanes or authorized parking areas. (red or yellow paint)

D. Fire Department Connections shall be marked with signage approved by the Fire Marshal or his designee.

E. Red signs with white lettering shall be placed on fire suppression access doors. (3/4" minimum letters)

F. Signage shall be provided to mechanical, electrical, elevator, and HVAC rooms.

G. Exit routing signs shall be placed throughout the building and approved by the Fire Marshal and Building Official in accordance with applicable codes NFPA 101.

12.10 Stand Pipes:

A. Stand pipe hose connections are required in buildings with extensive corridors or long travel distances. These hose connections are required in single-story buildings as well as in multi-story buildings. Single-story hose connections shall be located towards the

center of the building as to accommodate shorter hose lays for firefighting. Multi-story buildings shall have hose connections located in stairwells to accommodate shorter hose lays in upper levels of buildings. The hose connections shall be 2 ½" diameter with 2 ½" to 1 ½" reducer caps provided. The Fire Marshal shall determine exact location and number of standpipe hose connections.

12.11 Site Plans:

A. The fire protection sheet must show an overall exterior foot print of the building and grounds that include roads, parking areas, ingress/egress (building & property), hydrants, water mains, post indicator valves (PIV), Fire Department Connections, gas, electric, hazardous storage, water supplies, etc. Site plans shall show interior layouts that include ingress/egress, fire suppression equipment, mechanical rooms, electrical rooms, roof access, attic access, hazardous material rooms, Annunciator panels, Knox Box, elevators, standpipes, hose outlets, etc.

12.12 Evacuation Plan:

A. Location Evacuation Plan shall be placed throughout the building to assist with ingress/egress ("You Are Here" type signage).

12.13 Sprinkler Systems:

A. All buildings are required to have fire suppression systems installed per NFPA 13.

B. Building sprinkler systems or other approved fire suppression systems shall be required in accordance with the current Building Code in use by the City of Highland Park.

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13 NOISE

13.1 Upon request of the City, applicants shall conduct noise impact assessments consistent with EPA document Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with Adequate Margin of Safety dated March 1974.

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14 PEDESTRIAN CROSSINGS

14.1 Pedestrian road crossings shall be built per the standards of the authority having jurisdiction and the ADA.

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15 CONSTRUCTION REQUIREMENTS

15.1 General Requirements

A. Payment of Fees

1. All fees, bonds, and connection costs (e.g. benefit charges, trunk line and transmission charges, tap fees and the inspection fee deposit [see below], etc.) must be paid prior to the scheduling of a pre-construction meeting.

B. Insurance

1. Certificates in accordance with the General Requirements and Procedures section of this document shall be submitted to and approved by the City prior to scheduling a preconstruction meeting.

C. Inspection Fees

1. Refer to the approved City of Highland Park Engineering Department approved Schedule of Rates for inspection fees.

D. Final Acceptance

1. Final Acceptance shall not occur until all homes are built. Prior to the preconstruction meeting, a performance guarantee shall be required in accordance with sections 1242.04 and 1272.06 of the Zoning Ordinance.

E. A preconstruction meeting shall be held prior to the start of all construction. Prior to scheduling a preconstruction meeting, the Proprietor shall deliver all necessary permits and fees to the City, as stated above. Preconstruction meeting requests must be made at least 10 business days prior to the date of the proposed meeting. Additionally, the owner should request the meeting time at least 10 days prior to start of work. The Proprietor, Project Managers, Underground and General Contractors, Design Engineers, City Staff, and the City Engineer must attend the preconstruction meeting.

F. Inspection

1. All underground utilities, private roads, bike path, sidewalks, driveway approaches, stormwater facilities, soil erosion control, and any other work designated at the preconstruction meeting must be inspected by the City Engineer. Grading may be spot checked by the City Engineer at the City's request. 48-hour notice is required (not including weekends or holidays) to schedule inspection prior to construction. This applies for construction start, and any time work is suspended for two days or more, contact the City Engineer. In addition, the City Engineer must be notified 48-hours in advance to any tap into a City utility.
2. Any work installed without inspection will not be accepted by the City and will not be allowed to connect to the system.

G. Trench Backfill Testing

1. All trench density testing shall be provided by the Owner through their Design Engineer or an independent testing company to verify the compaction requirements as required by the approved plans and specifications. This report shall be signed and sealed by a registered State of Michigan Design Engineer and submitted to the City Engineer.

H. Shop Drawings
   1. Shop drawings shall be furnished to the City Engineer. Shop drawings shall be reviewed and approved by the City Engineer prior to construction.

I. Final Inspections and Acceptance
   1. Prior to final acceptance for use and maintenance by the City, final inspections and all necessary tests of the system must be completed. Any portions of the work found to be unacceptable shall be repaired or replaced prior to acceptance. Any additional fees associated must also be paid before final acceptance will be given.
   2. Prior to final completion, a two-year maintenance and guarantee bond in the amount equal to the cost of the improvements shall be posted with the City by the Proprietor.
   3. Final acceptance will not be made until all improvements on the site have been completed.

J. The Contractor shall comply with current OSHA, MIOSHA, and confined space regulations.

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16 DISTRIBUTED ENERGY RESOURCES (DER)

16.1 Intent and Background

A. The electric grid has become increasingly decentralized and complex which means demand flexibility can play a significant role in helping maintain grid reliability, improving energy affordability, and integrating a variety of generation sources. Control strategies can change the way a property or building schedules energy use to avoid high peak load costs or to make building operations more resilient. Strategies may include reducing energy consumption, shifting energy to another time period, adjusting the power draw, or even increasing energy consumption to store it for later use. Source (DOE/EE-1922 • April 2019)

B. In broad terms, Distributed Energy Resources may encompass infrastructure, building materials, electronics, sensors, and other technological solutions related to energy efficiency and demand response.

C. Servicing the energy needs of a property may include but is not limited to:

1. Lighting and security systems
2. Appliances or equipment
3. Heating, ventilating, and air conditioning (HVAC) systems, including heat pumps
4. Water heating systems
5. Energizing or de-energizing energy storage devices, for example charging/discharging energy in battery banks
6. All energy-transfer-related-systems for each designated and permitted transportation vehicle parking spot including vehicle-to-grid (V2G) systems, etc.

D. Requirements for smaller (grid-tied) behind-the-meter distributed energy resource systems require little analysis by the Utility Company to approve them, with installations under 10 kW having minimal to no restrictions. For systems between 10 kW and 100 kW, more study is likely to be required for connection to the power grid by the Utility Company, but significant analysis and modeling by the utility engineer is not likely needed to determine impacts, and interconnection requirements should not be great. Above 100 kW, the impacts on the utility system can be significant, so more study is likely to be needed, and interconnection costs and review times are likely to increase. Paraphrased from this Source (DOE/GO-102002-1520 May 2002). *Note that Michigan laws and decisions made by Michigan Public Service Commission may supersede the legal and technical parameters and assumptions stated above.*

16.2 Definition of DER and Listing of Applicable Technologies and Equipment:

A. General Requirements:

1. All procedures, design, and construction of distributed energy resources shall be in conformance with industry standards and the requirements of the manufacturer.
2. Distributed energy resource systems shall also meet the requirements of the applicable ordinance and all other applicable building and construction codes, fire codes, federal laws, and state laws.
3. Each type of DER must pass or obtain required applicable inspections, licenses, certifications, permits, be an allowed use within the zoning district, and must

adhere to any specific Ordinances addressing it. For example, ordinance requirements may include maximum heights or setback distance requirements for each type of structure or vehicle or equipment, or limitations on parking or storing or operating certain types of vehicles within the zoning district.

4. Plans of all proposed distributed energy resources, whether or not in public easements, shall be submitted by the owner or developer to the City of Highland Park for review. The City of Highland Park will issue a construction permit to the owner or developer when its plans are approved.
5. All existing and proposed utility information, including DER shall be shown on the final site plan.

16.3 Shop Drawings:

A. Shop drawings shall be furnished to City Engineer for approval.

B. The Contractor shall comply with current Electrical Code and NFPA standards, as well as OSHA, MIOSHA, and confined space regulations.

16.4 Surface equipment shall be located so as not to interfere with traffic flow, parking, building access, fire hydrants, or Fire Department connections.

16.5 Electrical equipment and energy storage equipment, including enclosures and vaults, should avoid being set in a location where surface water runoff could pond and create a hazardous environment for maintenance or operation of that equipment.

16.6 Electrical, telephone, gas, and cable may not share a common trench with sewer and water mains and shall maintain a minimum of 10 feet of separation from sewer and water mains. There is one exception to the 10 feet of horizontal separation from watermain, which is the placement of solar PV streetlights. In the case of installing solar PV streetlight bases and any associated adjacent buried equipment, a separation of only 6 feet is required from the center of a physically located water main. This smaller separation is due to the depth of water main being more shallow than sewers which may be much deeper and require more separation to enable future excavations).

16.7 Solar Streetlight (Off-Grid) – See Standard Site-Work details and notes on sheet SW2.

A. Background:

1. The City of Highland Park Engineering Department considered the advantages and disadvantages of diverse types and styles of off-grid solar streetlights prior to establishing the engineering standard and the associated Site-Work Sheet SW2 Detail. The Engineering Department has determined that vertically-mounted and pole-integrated (“wrapped”) solar photovoltaic solar streetlights will provide the most reliable year-round service to residents. Winter months here in SE Michigan present many challenges including more hours of darkness compared to summer, the sun is much lower in the sky, cloudy and overcast conditions are common, and snowfall accumulates on non-vertical surfaces. Due to these challenges, a sloped “graduation cap” style solar streetlight pole is expected to provide less reliable light during long winter nights, especially during weeks when there is snowfall.

B. General:

1. The design, specification, calculation, manufacturing, testing, shipment, installation, and performance of solar photovoltaic (PV) and LED (or similar) lighting systems shall be in accordance with the applicable requirements of all

of The Engineering Department's civil, electrical, mechanical, and lighting standards for electrical distribution works, except as specified herein. Copies should be requested from The Department if not already held.

C. The Project's lighting design and luminance level requirements and the LED (or similar) street lighting luminaires shall be fully in accordance with the performance requirements in the table on City of Highland Park Engineering Site Work Details SW2.

16.8 Required Minimum Engineering Standards in the City of Highland Park:

A. Vertically mounted, pole-integrated solar PV systems only.

B. Monocrystalline silicon wafer PV construction.

C. Li-ion NMC, LiFePO(LFP), AGM battery technologies noting differences in battery life to be accounted for in life cycle costs. (or approved equal).

D. Batteries mounted below ground and contained within a secure concrete ANSI/SCTE rated box.

E. Standalone systems with batteries to have minimum 5-days autonomy –through performance data.

F. LED lighting fixtures complying fully with the requirements of the Department Lighting Specification.

G. Solar PV module input 0 -36V DC.

H. Specified for the project assessed solar energy yield in combination with wattage of LED luminaire used, battery size and usage of dimming.

I. Light On/Off controlled by sunset/sunrise.

16.9 Pole Assembly, Manufacturing Content, and Origin.

A. Assembly of PV-pole. The assembled and integrated PV-Pole shall be complete with all accessories, and all necessary component assembly undertaken at the factory. The final assembly of pole and components shall be ready for installation at site without any works required other than using suitable fixing tools and simple standard lifting and access equipment, such as a bucket truck.

B. Mast arm for the Luminaires. The mast arm for the luminaire shall be manufactured by the PV-pole manufacturer for the required length and may be fitted to the pole at the factory to account for the correct orientation of the pole and PV panel sections for specific project locations. The attachment of the mast arms shall be made of standard fasteners through the pole structure casting without any detriment to the PV-pole's IP rating. Solar system options for projects may be designed with lower luminaire mounting heights and associated closer pole spacings and an increase in poles on projects if justification can be provided. All pole maximum heights and maximum illumination fc levels are to be in accordance with the Departments Lighting Standards. The mast arm shall be self-supporting against all forces including uplift, without the use of any guy wires. The luminaire shall be fixed to the mast arm and electrically wired. The cable end shall be connected to the solar system inverter/controller as required by the system type at the service hatch(es) located in the pole base.

C. Manufacturing Content and Origin. All major PV-Pole component sub-assemblies, including LED luminaires, vertically integrated solar panels, battery packs, steel and aluminum masts, and control boxes, must be assembled in and shipped from within the United States or Canada. All final PV-Pole assembly and integration must be

completed in and shipped from within the United States by a manufacturer with a minimum of 50% ownership by U.S. citizens.

D. Warranty. Warranty from the PV-Pole system supplier shall be provided, accompanied with written proof, to the satisfaction of The Department, to warranty the materials and performance, as follows:

1. Provide a written minimum-five (5) year Warranty for on-site replacement: material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products. Finish warranty shall include warranty against corrosion, failure or substantial deteriorations such as blistering, cracking, peeling, chalking or fading. The warranty shall include the ability to maintain aesthetic integrity of the PV-pole, photovoltaic panels, accessories, components, and assemblies, without any partial or complete separation, corrosion, leaking, dislocation, disjointing, flaring, etc. of any elements of the PV-pole, system components and assembly with no cost to The Department.
2. Provide a written minimum-ten (10) year replacement warranty for defective PV-poles, photovoltaics, accessories, components, and assemblies with no cost to The Department
3. Provide a written minimum-five (5) year Warranty on the batteries for on-site replacement: material and workmanship. On-site replacement includes transportation, removal, and installation of new products. Warranty shall include substantial deteriorations such as leaking, buckling, corrosion, inability to be charged or withhold a charge, impacted system autonomy and reduced DC output with no cost to The Department.
4. Provide a written minimum-twenty-five (25) year replacement warranty for the photovoltaic (PV) modules for their output peak watt capacity to not fall below 80% at the end of twenty-five (25) years. With a minimum-ten (minimum-10) year replacement warranty for their output peak watt capacity to not fall below 90% at the end of ten (10) years. With no cost to The Department.

16.10 Materials and System Components:

A. Foundations - structural analysis shall be submitted to show that the foundation design meets the load of the given PV-pole type in its “Fully Loaded” state. Unless otherwise stated it is assumed the pole will sit above ground on a 6-inch plinth, on adjustable nut and bolt configuration to allow for precise vertical alignment of the pole during installation. All pole bases shall have a separate removable cover installation to protect the bolts and avoid dirt build up on bolt threads and below base plate. Bolt projections should be minimal and no greater than 4 inches above the concrete base and avoid any secondary bending stress exerted on the bolts. Plinth heights shall be determined by the consultant according to the site-specific needs, pertaining to safety from impact of vehicles and maintenance equipment such as lawn mowers and snow plowing.

B. Steel work - PV-poles’ steel work shall be manufactured out of hot dipped galvanized steel, powder coated to ASTM A-500 Grade B. Hot dipped galvanizing (100 Microns minimum coating thickness) surface treatment shall be applied to both internal and external surfaces. The base plate shall be in accordance with The Department’s standard specifications. Base plate shall be manufactured as specified on the Drawings. Where steelwork is in contact with aluminum work, the manufacturer shall ensure that bi-metallic corrosion is prevented by isolating the two surfaces.

C. Bracketry and Base Plate Cover. Pole brackets and base plate cover shall be manufactured out of steel. This shall have high strength and be finished to match the PV-pole. All steel components shall be hot dip galvanized to a minimum thickness of 100 microns and painted as per the applicable clauses of The Department's standard specifications. The base plate cover shall be supplied along with the pole.

D. Fasteners. All fasteners supplied shall be made of corrosion resistant materials such as stainless steel, Grade 316, brass, hot-dip galvanized steel etc., based on the materials with which it will be in contact. Bi-metallic contact shall be professionally designed to avoid any galvanic or bi-metallic corrosion.

E. Electric Equipment. Threaded studs shall be provided as an earth point. It shall be located within the lowest service hatch. The electrical termination cut-outs shall be supplied in accordance with the Supply Company's (Street Lighting) requirements and as shown on the Drawings.

F. Service Hatch(es). Each pole shall have its necessary service hatch(es) positioned no lower than 48 inches from finished ground level where all required electrical and solar components and connections are accessible. As required by the project the hatch(es) shall house general purpose outlets that can be accessed through an external lockable hatch. Hatch door keys shall be supplied as per The Department's requirements.

16.11 <u>Minimum Ingress Protection ratings for the PV-pole system</u>:

A. Mast component - IP40, IK-07
B. PVs and electrical components – protected to IP66
C. Glass components IK-08
D. Batteries – IP44
E. Battery housing above ground within pole – IP66, IK-07
F. Battery housing in ground box – below-ground – IP68
G. Pole access hole cover plates – IP67, IK-10

1. Mechanical - Degrees of Protection Provided by Enclosures (IP Code for ingress protection and IK Code for Mechanical Strength): IEC 60529 (IP) and IEC 62262 (IK).
    a. Testing of Materials:
        i. ASTM B 117-07a Standard Practice for Operating Salt Spray (Fog) Apparatus, 2007 and ASTM D1654 - 08 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments, or
        ii. ISO International Organization for Standardization. ISO 9227 Corrosion tests in artificial atmospheres—Salt spray tests, 2006.
        iii. ISO8289A: Low voltage test for detecting and locating defects
        iv. ISO 4892-1: Plastics -- Methods of exposure to laboratory light sources
2. Electrical - Electrical components must meet safety standards as outlined in - General and for Road Lighting Luminaires: EN 60598-parts 1, 2-1 & 2-3
    a. Electromagnetic Compatibility:
        i. EN 61547, EN 61000-3-2, EN 61000-3-3 & EN 55015 (CISPR-15) – for (Immunity Requirements, Harmonics

Requirements, Flicker Requirements & Radiated and Conducted Emissions, respectively).

ii. ANSI C82.77-2002 - Harmonic Emission Limits & IEEE Std 519 1992 - Harmonic Limits

iii. FCC 47 CFR Part 15 Radio Frequency Devices

iv. RoHS Directive 2002/95/EC, on the restriction of the use of certain hazardous substances in electrical and electronic equipment

3. Wireless communication complying with IEEE 802.15.4a

4. The proposed system shall be fully compatible with the specified LED luminaire and driver proposed for the project and the inverter/controller

   a. LED Luminaries - The design, specification, calculation, manufacturing, testing, shipment, installation, and performance of LED lighting system (or other equally sustainable technology) shall be in accordance with the applicable requirements of The Department's electrical and lighting standards for electrical distribution works, except as specified herein.

   b. Lighting fixtures must be LED, fully in accordance with the requirements of the Department's Lighting Specification for Roadway/Parking,

   c. All lighting calculations for parking lots/areas which are adjacent to roads must take into account the road lighting contribution into the parking lot lighting design and vice versa. All projects shall be undertaken, checked, and approved to meet the required roadway and parking levels as set out in the Department's Roadway Lighting Specification.

5. Inverter/Controller - The inverter/controller controls the charge and discharge of the battery, the battery status, and the status of the solar PV modules. The inverter/controller provides and controls the power for the street lighting fixture(s), including dimming and status.

6. Solar PV - All photovoltaic components shall be Monocrystalline silicon wafer types with efficiency of 20% or greater, manufactured, tested and installed as per the respective standards listed herein. The lowest level of the PVs on the PV-pole shall not be less than 108 inches from finished ground level to ensure they are out of reach of the public.

7. The PV panels shall be made in pre-assembled modules approximately 3ft tall each, to enable easy replacement in case of any damage. On-site replacement of any components including batteries, PV modules, light fixtures, controls equipment shall be easy to accomplish without the need for any heavy lifting equipment nor removal, nor de-erection of poles to achieve same.

8. Batteries – The type, size and quality of batteries specified shall be selected for their optimum performance and integration for the project specific requirements.

   a. IEC 60050 (IEV) Chapter 486: Secondary Cells and Batteries

   b. IEC 60086-1 BS 387, Primary Batteries – General

c. IEC 60086-2 BS, Batteries – General
d. IEC 61951-2 Ed. 3.0 b:2011, EN 61951-2:2011 Secondary cells and batteries containing alkaline or other non-acid electrolytes - Portable sealed rechargeable single cells
e. Li-ion NMC or LFP or AGM (or approved equal)
f. Selected for minimum 5-days autonomy system
g. DC voltage, rated. Output for powering LED fixture drivers
h. Projected Lifetime for the project design -10 Years
i. Guaranteed Lifetime for the project design – 5 Years
j. Rated capacity of the battery should be designed to operate between fully charged and load cut off conditions for general average operating conditions.
k. Manufactured, tested, and installed as per the respective standards listed herein.
l. Mounted either inside (contained within) the PV-Pole base or in a separate below ground concrete ground box or enclosure.
m. Where batteries are to be located below-ground, only a separate battery pit constructed as a ground box enclosure and rated to the necessary axle loading requirements of Standards ANSI/SCTE 77-2002, is permitted. The batteries must be housed in a separate watertight enclosure to meet IP68 standards specified herein and located within the separate below ground box. This is to ensure the maximum physical protection of the pit, ground box enclosure and ground box cover from damage. The location of the battery ground box is to be coordinated with and approved by the Department's roadway and landscape design consultants (if applicable) and made compatible with surface finishes to provide a flush top level of ground box to match the surrounding surface level finishes.

16.12 Final Inspections and Acceptance

A. Prior to final acceptance for use and maintenance by the City, final inspections and all necessary tests of the system must be completed. Any portions of the work found to be unacceptable shall be repaired or replaced prior to acceptance. Any additional fees associated must also be paid before final acceptance will be given.

B. Prior to final completion, a multi-year maintenance and guarantee bond in the amount equal to the cost of the improvements shall be posted with the City by the Proprietor. The length of the maintenance and guarantee bond varies by type of distributed energy resource infrastructure product.

C. Final acceptance will not be made until all improvements on the site have been completed

16.13 If and when a DER such as a solar streetlight is no longer operational and is to be abandoned, any ancillary equipment such as a battery vault or other wiring and control systems is to be decommissioned per manufacturer requirements and completely removed. No hazardous materials or stored energy devices or electrical equipment should remain. However, the remaining concrete pad or base of a solar streetlight may be reused for another purpose if it is deemed to be of sufficient integrity by a licensed structural engineer. If the base is not to be repurposed, decommissioning shall include demolition and removal of the top of the structure,

down to 10 inches below finished grade. Restore site to equal or better conditions than surrounding undisturbed conditions.

16.14 Distributed Energy Resources (DER): Technologies and equipment for generating, managing, and storing energy or electrical capacity at the place of consumption. They are typically small, modular, and generate or deliver less than 10 megawatts (MW) of electrical power. DER systems may be either connected to the local electric power grid (grid-tied) or isolated from the grid in stand-alone applications (off-grid).

16.15 Types of DER technologies include but are not limited to:

A. Grid-interactive Efficient Buildings (GEB)

B. Solar Energy Systems (SES):
   1. Photovoltaic (PV)
   2. Concentrated Solar Power (CSP)
   3. Solar Thermal System

C. Solar PV Streetlights (Off-grid)

D. Heat Pumps:
   1. Air-Source
   2. Water-Source
   3. Ground-Source (Geothermal)

E. Combined Heat and Power (CHP)

F. Electric Vehicle (EV) charging that include bi-directional capabilities to enable:
   1. Vehicle-to-home (V2H) and/or Vehicle-to-load (V2L)
   2. Vehicle-to-grid (V2G)
   3. Vehicle-to-everything (V2X)

G. Energy Storage Systems (ESS):
   1. Battery Banks (BESS) - not including handheld size batteries:
      a. Lead-Acid (Pb-Acid & AGM)
      b. Sodium-Nickel Chloride ($NaNiCl_2$)
      c. Lithium-Ion (includes NMC, NMCA, LFP, and other chemistries)
      d. Other Metal-Ion types: Sodium (Na-Ion), Aluminum (Al-Ion), etc.
      e. Sodium-Sulfur (NaS)
      f. Nickel-Zinc (Ni-Zn)
      g. Graphene (includes Graphene-Al-Ion, etc.)
      h. Solid State (types not containing a liquid or gel electrolyte)
      i. Metal-Air (Iron: Fe-Air, or Aluminum: Al-Air, etc.)
      j. Polymer
   2. Fuel cells
   3. Reciprocating engines
   4. Cogeneration
   5. Supercapacitors (both High-Power and High-Energy)

6. Flow Batteries
7. Compressed Air Energy Storage (CAES)
8. Molten Salt or Sand (Heat storage used for steam turbine electrical generation)
9. Superconducting Magnetic Energy Storage (SMES)
10. Hydrogen

Note that products and equipment may combine multiple types of DER into one unit.

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