DESIGN MANUAL FOR PUBLIC IMPROVEMENTS

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* The Naperville Municipal Code sections contained in Appendices A, B and C referenced above are attached for your convenience. However, please be aware that for the most up-to-date version of any of these Appendices, you will need to check the most recently updated Code sections for possible revisions.

SECTION 1
COMMERCIAL SITE DESIGN

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SECTION 1
COMMERCIAL SITE DESIGN

1.1 GENERAL DESIGN CRITERIA

This section covers the City of Naperville standards for site engineering for non-residential developments and apartments. Design elements that are incorporated into this section include parking areas, vehicular and pedestrian access, and drainage. Stormwater detention requirements are provided in Section 2 of this manual.

The City of Naperville has adopted the standards of the Institute of Transportation Engineers (ITE) for parking lot design. Reference is made to the Institute of Transportation Engineers (ITE) publication *Guidelines for Parking Facility Location and Design*, latest edition.

1.2 SITE ACCESS

1.2.1 Commercial Driveway Geometrics

Commercial driveways designed for one-way traffic flow shall not exceed 20 feet in width measured at the property line. Commercial driveways designed for two-way traffic flow shall have a minimum width of 24 feet and shall not exceed 35 feet in width measured at the property line. This width dimension is measured between the face of curbs.

The minimum turning radius for commercial driveways, measured along the curb return, shall be 15 feet. A right-in/right-out driveway access should have a 50-foot radius, measured along the curb return.

The angle between the curb line of the street and the centerline of a full access driveway shall not be less than 60 degrees.

1.2.2 Commercial Driveway Safety Standards

No commercial driveways will be permitted into any parking lot or other facility which is designed in such a way as to make it necessary for exiting vehicles to back onto the street.

No driveway will be permitted into any facility which would require and/or allow a vehicle to drive or maneuver on the sidewalk area in any manner other than to cross it.

No driveway will be permitted for the purpose of allowing vehicles to park on the public right-of-way.

In no case shall a driveway be constructed in such a way as to present a hazard to pedestrians or traffic on the public right-of-way.

In no case shall an object located within the right-of-way be permitted to obscure the vision of drivers of motor vehicles. Items in the right-of-way, within the required 30-foot sight triangle, shall be limited in height to no greater than 30 inches, and no less than 6 feet, including shrubs and tree branches.

1.2.3 Commercial Driveways on Arterial Streets

Any driveway onto an arterial street represents a potential impediment to traffic and/or a safety hazard. For this reason, access onto arterial streets shall be limited both in number of driveways and location, and may be granted only after review of the overall land development plan and traffic study for the project. Design criteria as established in this section represent minimum standards. Where hardships are demonstrated, exceptions to the minimum standard will be considered on a project-by-project basis. The use of cross-access easements or frontage roads are preferable alternatives to additional driveways on arterial streets.

1.2.3.1 Minimum Spacing

Driveways shall be located as far apart as practical. A minimum of 400 feet between centerlines of driveways on arterial streets (major and minor) should be sought.

1.2.3.2 Minimum Distance from Intersections

Driveway placement should always be designed to maximize the distance from the nearest intersections. Along major and minor arterial streets, the minimum distance of a full-access driveway from an intersecting public street shall be 250 feet. This distance is measured from the near edge of the intersection to the centerline of the driveway. Right-in/right-out driveways may be located closer, provided that they do not cause operational problems at the intersection.

1.2.4 Commercial Driveways on Collector and Local Streets

1.2.4.1 Location

Driveways on collector and local streets shall be located in accordance with the following:

The distance from the end of the driveway curb cut to the prolongation of the nearest intersecting street property line shall not be less than 20 feet on the near side of the intersection and not less than 10 feet on the far side.

The distance from the end of the driveway curb cut to the end of the intersecting street curb return shall not be less than 5 feet.

The distance from the end of the driveway curb cut to the nearest crosswalk shall not be less than 5 feet.

The distance between driveways, measured at the curb line of the street, shall not be less than 20 feet.

Where bus stops exist at locations where driveways are desired, the minimum allowable distance between driveways, measured at curb line of the street, shall be 40 feet.

No driveway shall be constructed which enters a public street within the limits of an intersection, with the limits of the intersection being defined as the area included within the prolongation of the lateral boundary lines of two or more streets or highways which join one another at an angle whether or not one such street or highway crosses the other.

At intersections where a separate right-turn lane exists, no driveway shall be constructed where the edge of the turning lane taper pavement is greater than 5 feet from the edge of the through pavement.

1.3 PARKING LOTS

1.3.1 Required Number of Parking Spaces

Refer to Section 6-9-3 of the City code (see Appendix A).

1.3.2 Stall and Aisle Dimensions

Parking stall dimensions shall be 9 feet wide by 17.5 feet in length, or as otherwise demonstrated to be in accordance with Table 2 of the *Guidelines for Parking Facility Location and Design*, published by ITE.

Minimum drive aisle width for two-way traffic is 26 feet.

1.3.3 Parking Lot Island Requirements

Islands are required at the ends of all parking rows and at intermediate locations such that there are a maximum of twenty (20) stalls between islands.

1.3.4 Parking Lot Pavement

All parking lots constructed in the City of Naperville must have a paved surface and a minimum pavement structural number of 2.5. The structural coefficients for pavement design are as follows:

STRUCTURAL MATERIAL	COEFFICIENT
Bituminous Surface	0.40
Bituminous Binder	0.40
Bituminous Base Course	0.33
Aggregate Base Course (CA-6)	0.13
Aggregate Sub-base (CA-6)	0.12

1.3.5 Boundary Controls

All parking lots shall have 6-inch concrete barrier curb around the perimeter.

1.3.6 Drainage

Storm sewers which serve parking lots shall be designed to accommodate the 10-year storm event without surcharging out of the rim. The maximum depth of ponding in parking lots is 1 foot. This applies where parking lots are used for stormwater detention and for other lots in the event that all storm sewers are blocked and surface overflows must be used to drain the lot.

1.4 LIGHTING

The City has developed exterior lighting standards to control glare and obtrusive light while maintaining a safe and secure environment for pedestrians and property. These standards are incorporated into City code Title 6 Chapter 14 (see Appendix B).

1.5 PEDESTRIAN ACCESS

All commercial sites shall be designed so that sidewalks or other delineated pedestrian routes are available to provide pedestrian access continuity between the public sidewalk adjacent to the site and the main entrance to the building.

1.6 LANDSCAPING

Parkway landscaping, perimeter landscaping, parking lot landscaping and refuse area screening shall be required as specified in Title 5 Chapter 10 of the City code, or as otherwise specified and approved in a required landscape plan (See Appendix C).

1.7 BARRIER-FREE ACCESSIBILITY

All commercial sites shall comply with the accessibility requirements of the Illinois Accessibility Code, as amended; the provisions of Title 5 (Building Regulations) of the City of Naperville Municipal Code, as amended; and the City of Naperville Fair Housing Ordinance, as amended.

To ensure compliance with the requirements referenced above, the following guidelines should be considered in the site design for new construction of commercial projects (and may not apply for additions, alterations, or historic preservation):

An accessible route should be provided from accessible parking and passenger loading zones to an accessible entrance. Accessible routes shall be constructed with a minimum slope (< 2%) and be free from obstacles.

The cross slope of sidewalks should be kept at a minimum (¼":1 foot) as necessary for drainage. This will make it easier for a person utilizing a wheelchair to move forward without veering left or right.

Sidewalks should be flush with grass areas on either side to help prevent wheelchairs from overturning should a wheel roll off the sidewalk.

Sidewalks should be 5 feet wide, minimum, to allow two wheelchairs to pass. In high pedestrian traffic areas, such as the Central Business District, sidewalks should be 8 feet wide.

Where passenger loading zones are provided, an adjacent access aisle should be provided where the sidewalks are flush with the pavement.

Entrance areas near the door should have a nearly flat area (allowing for proper drainage to avoid ponding and icing).

All power door pedestals with push plates should be clear of the door swing, typically 5 feet from the door.

Accessible entrances should be considered for secondary entrance points in addition to the main entrance.

Accessible parking stalls should be close to both the main and auxiliary entrances, to provide maximum access for persons with disabilities.

Accessible parking stalls should be constructed with minimal slopes (¼":1 foot) which provides a nearly flat surface for wheelchairs and minimum slopes necessary for drainage.

Concrete wheel stops should not be used in accessible parking stall loading areas, which would obstruct the accessible route from accessible parking to an accessible entrance.

The sidewalk adjacent to accessible parking stalls should be flush with the pavement to provide an accessible route to an entrance.

Accessible parking spaces shall be appropriately designated through signage and striping. Signs shall be vertically mounted on a post or wall at front center of the parking space, no more than 5 feet horizontally from the front of the parking space and set a minimum of 4 feet from finished grade to the bottom of the sign.

Speed bumps can create a hazard for low riding wheel chair vans.

SECTION 2
STORMWATER MANAGEMENT

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SECTION 2
STORMWATER MANAGEMENT

2.1 ADOPTION OF BEST MANAGEMENT PRACTICES

The City of Naperville has adopted the Best Management Practices (BMP) approach for the design of all stormwater and floodplain management system components. The basis of this approach is the City's support of "The Upper DuPage River Watershed Implementation Plan" developed by The Conservation Foundation and The DuPage River Coalition in 1998.

Except as modified and/or appended herein, all stormwater management components covered in this section shall be designed as Best Management Practices (BMP's) in accordance with the most current edition of "Urban Stormwater Best Management Practices for Northeastern Illinois" published by the Northeastern Illinois Planning Commission.

2.2 HYDROLOGIC ANALYSIS

2.2.1 General

The City of Naperville uses the term "Design Storm" to define precipitation events used in the design and analysis of all stormwater management facilities in the City. The Design Storm is the frequency with which a given rainfall event is equaled or exceeded, on average, once in a period of years. The probability of occurrence is equal to the reciprocal of the design storm frequency. For example, a 100-year design storm has a 1.0 percent probability of occurrence in any one year.

2.2.2 Rainfall Data

The Illinois State Water Survey (ISWS) publication entitled "Frequency Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois," commonly called "Bulletin 70" shall be used as the rainfall data reference source for the design of stormwater management facilities.

2.2.3 Design Storm

The standard design storm for all Minor Drainage System components will be the appropriate "10-year recurrence interval" rainfall, as defined in ISWS Bulletin 70. The standard design storm for all Major Drainage System components will be the appropriate "100-year recurrence interval" rainfall, as defined in ISWS Bulletin 70.

2.2.4 Topographic Data

Topographic data shall be referenced to at least one established City of Naperville benchmark. Contour intervals shall be one foot and shall directly correlate to the City datum.

2.2.5 Rainfall-Runoff Modeling Methodology

The following summarizes the application of common rainfall-runoff models:

Model	Product	Usage	Assumptions	Limitations
Rational Method	Peak Discharge	For estimating peak discharge rate.	Watershed size 1-20 acres	
TR-20	Hydrograph	For developing: Runoff hydrographs, Channel and reservoir routed hydrographs, Separated or combined hydrographs.		
TR-55 Tabular Method	Hydrograph	For measuring the effect of land use and/or structure changes in sub-catchments on the composite hydrograph for the watershed	• Sub-catchment size less than 20 square miles. • Precipitation runoff volume not less than 1.5 inches. • Little to no variation in soil and land use characteristics within a sub-catchment.	The TR-55 Tabular Method was derived from TR-20 using curve numbers of 75 and rainfall amounts sufficient to produce 3 inches of runoff volume. Characteristics should not vary significantly from those used in the method derivation.
TR-55 Graphical Method	Peak Discharge	For estimating peak discharge rate.	Same as the TR-55 Tabular Method. In addition, the initial abstraction must be less than 25 percent of the total 24-hour rainfall volume.	The Graphical Method was developed from the TR-55 Tabular Method, therefore the limitations are the same.
TR-55 Chart Method	Peak Discharge	For estimating the effect of development on peak discharge rate.	Watershed size: 1-2000 acres	
HEC-1	Hydrograph	For computation of flood hydrographs due to a single recorded or synthetic rainstorms, or snowfall-snowmelt conditions. Model can simulate dam-break conditions and compute expected annual flood damages.	Hydrologic processes can be simulated assuming that individual parameters can be used in representing average sub-basin temporal and special characteristics.	• Only one storm can be modeled for each program run because the model does not have a provision for soil moisture recovery during non-precipitation periods. • Results are in terms of discharge, not stage. If discharges are stage-dependent, a user specified rating curve must be provided. • Hydrologic routings used for open channel flow. If gradually varied, unsteady flow occurs, such as in very flat channels, then hydrologic routings are not accurate. • Hydrologic routings used for storage reservoirs. If reservoir outflow is dependent on downstream controls, then hydrologic routings are not accurate.

2.3 HYDRAULIC ANALYSIS

2.3.1 General

The following table summarizes the application of common hydraulic models:

Model	Usage	Assumptions	Limitations
HEC-2	For computing water surface profiles for subcritical or supercritical open channel flow.	One-dimensional, gradually-varied, steady flow conditions. Channel slopes are less than 10%.	Program is not capable of modeling movable flow boundaries such as those that occur due to sediment transport.
HEC-RAS	For computing subcritical, supercritical, and mixed flow regime open channel flow water surface profiles. Model has improved routines for evaluating the effects of obstructions such as bridges, culverts weirs, and structures in the floodplain.	Gradually-varied, steady flow conditions.	
WSP2	For computing open channel water surface profiles for subcritical open channel flow.	Model assumes only gradually-varied flow in a given reach. Since only friction losses are considered, velocity changes must be relatively small.	• Cannot model supercritical flow regimes. • For accurate modeling of bridges, the channel needs to be straight, and have a uniform cross-section and slope. • Culverts can only be modeled as standard circular rectangular, and arch shapes.
WSPRO	For detailed, accurate modeling of open channel flow through bridge openings. Model is able to simulate combined bridge-road overtopping, and multiple opening bridge situations.	Water surface profiles can be computed for any combination of subcritical, critical, or super critical flow as long as the flow can reasonable be classified as one-dimensional, gradually-varied, and steady.	
FEQ	For dynamic modeling of unsteady flow conditions in open channels and through control structures. Model can be used for a variety of stream configurations and is able to read HEC-2 and WSPRO cross-section input data.		
SWMM	For single-event or continuous simulation analysis of stormwater quantity and quality problems. Model is used most often on catchments having sophisticated storm sewer networks where accurate simulation of dynamic flow conditions is needed.	• Model performs best in urban areas with mostly impervious services. • Water quality simulations must be calibrated if the pollutant magnitudes are to be considered reliable.	• No sub-surface water quality routing • No interaction of water quality processes except for adsorption. • Wetland water quality processes are difficult to simulate. • Scour-deposition routine is weak. • Model uses hydrologic storage routing. User needs to calculate and input the hydraulic characteristics of storage components.

2.3.2 Gravity Flow

All stormwater management facilities in the City of Naperville shall be designed for gravity-flow conditions for the appropriate design storm. Stormwater pumping facilities will only be considered if it can be demonstrated that there is no means of providing for gravity-flow drainage. The design of each stormwater management component must be based on sub-critical flow conditions. Super-critical or critical flow conditions have the potential for high velocities that are dangerous and damaging. Furthermore, these conditions are unstable and can result in widely fluctuating and unpredictable flow depths.

2.3.3 Pressure Flow

Pressure flow conditions occur in a closed-conduit system when the hydraulic grade line (HGL) is above the crown of the pipe. When it is not possible to restrict the HGL to the crown of the pipe, due to topographic constraints, the HGL may be contained within the rim, as approved by the City Engineer. Storm sewers shall be designed for the appropriate design storm based on flowing-full conditions without any pressure head. While pressure flow conditions may occur for runoff events in excess of the design storm, such conditions should be avoided by allowing excess flows to be channeled to overflow routes.

2.4 MINOR DRAINAGE SYSTEM

2.4.1. General

The minor drainage system consists of curb and gutter sections, storm sewers (with appurtenant inlets, catch basins, and manholes), swales (side yard, back yard), and small natural or man-made open channels. The function of the minor drainage system is to quickly collect and convey the runoff from the smaller, more frequent storms. Except as modified and/or appended herein, all minor drainage system components covered in this section shall be designed in accordance with the most current edition of the Illinois Department of Transportation (IDOT) Drainage Manual.

2.4.2 Swales

Side yard and rear yard swales shall be analyzed as open channels with a triangular cross-section and a mowed turf grass surface. The minimum longitudinal slope should be 2 percent. Where hardship is demonstrated, 1.5 percent may be permitted. The maximum slope allowed is 25 percent. The swale shall have sufficient hydraulic capacity to convey the design storm peak flow rate with the appropriate freeboard clearances. For residential developments, there shall be not less than 1.5 feet of freeboard between the design high water level in the swale and the lowest adjacent top of foundation elevation. For commercial developments, there shall be no less than 1.0 feet of freeboard between the design high water level in the swale and the lowest adjacent top of foundation elevation.

2.4.3 Pavement Drainage

Maximum flow depths on any roadway shall not exceed 6 inches during the base flood condition. Inlets are to be located such that these encroachments are not exceeded and that flow will not cross-intersecting streets. These standards will apply to all local and collector streets. The following table provides equations that should be used in computing inlet spacing. The equations are based on the standard City of Naperville gutter width of 12 inches, and a recommended pavement roughness coefficient of 0.015. The maximum flow depth at the face of curb is about 1.7 inches which occurs for the steepest cross-slope of 2.5%. These equations; therefore, are applicable for both roll and barrier curb situations.

Flow Component	Pavement Cross-slope		
	3/16" per foot (1.56%)	1/4" per foot (2.08%)	5/16" per foot (2.5%)
Q_{Total}	(2.147) $S^{1/2}$	(3.068) $S^{1/2}$	(3.902) $S^{1/2}$
Q_{Gutter}	(1.464) $S^{1/2}$	(1.966) $S^{1/2}$	(2.412) $S^{1/2}$
$Q_{Grate\ Capacity}$	(0.014) K	(0.019) K	(0.024) K

S = longitudinal pavement slope in feet per foot.
K = conveyance factor that is unique to the geometry of each grate. Values for the conveyance factors are provided in "Inlet Grate Capacities" published by the Neenah Foundry Company.

For the ponded water condition, stormwater flow bypassed from uphill inlets accumulates at a low point. At lower depths, the flow into most inlet grates takes on the characteristics of flow though a weir. As the ponding depth increases, the inlet grate opening acts more like an orifice. The equations and assumptions applicable for both types of ponded condition flow are found in the above referenced Neenah Foundry publication.

2.4.4 Storm sewers

Storm sewers shall be designed in accordance with the procedures outlined in Chapter 8 of the IDOT Drainage Manual. These procedures use the Rational Method to determine peak stormwater flow rates for both inlet spacing and storm sewer sizing.

All storm sewers that will be within the City of Naperville right-of-way shall be designed with the appropriate ASTM Class of reinforced concrete pipe (RCP). Every effort shall be made to minimize the placement of storm sewers in side yard easements. All storm sewer pipes within side yard easements shall have gasketed joints. For RCP, these joints shall be in accordance with ASTM specification C-361.

Storm sewers sizes are to be determined based on flowing-full (non-surcharging) conditions for the appropriate design storm. The minimum and maximum allowable subcritical design flow velocities are 2.5 fps and 10 fps, respectively. A conventional development has one or more storm sewer networks that discharge to the detention facility for the site. To avoid surcharging conditions, storm sewer outfalls to detention facilities shall be designed such that the invert of the outfall pipe is at or higher than the normal high water elevation of the facility. An exception to this policy will be made if the hydraulic grade line calculations can demonstrate that the design water surface is kept below the street edge of pavement elevation throughout the site.

2.4.5 Culverts

All culverts that will be within the City of Naperville right-of-way shall be designed with the appropriate ASTM Class of RCP and will have the appropriately sized precast concrete flared-end section on each end. All culverts over 12 inches in diameter shall have the appropriate grating covering the flared-end section opening.

2.5 MAJOR DRAINAGE SYSTEM

2.5.1 General

The major drainage system consists of overflow routes (streets and larger natural or man-made open channels), man-made stormwater storage facilities (basins and ponds), large natural or man-made channels, and floodplains. The major drainage system serves both conveyance and storage functions. This may occur as a result of runoff from the larger, less frequent storms and/or from an obstruction in the minor system.

2.5.2 Overflow Routes

2.5.2.1 General

Overflow routes should exit a developed site in a common area that is preferably public property such as a park or public right-of-way. As a secondary choice, overflow routes can be designated along a common rear yard property line that is furthest away from homes and buildings.

2.5.2.2 Swales

Overflow route swales shall be analyzed as open channels with a triangular cross-section and a mowed turf grass surface. An overflow route swale shall have side-slopes that are a minimum of 2 percent and maximum of 25 percent. The longitudinal slope should be 2 percent. Where hardship is demonstrated, 1.5 percent may be permitted. The maximum slope allowed is 25 percent. The overflow route swale will have sufficient hydraulic capacity to convey the design storm peak flow rate with the appropriate freeboard clearances. For residential developments, there shall be no less than 1.5 feet of freeboard between the design highwater level in the swale and the lowest adjacent top of foundation elevation. For commercial developments, there shall be no less than 1.0 feet of freeboard between the design highwater level in the swale and the lowest adjacent top of foundation elevation.

2.5.3 Stormwater Storage

2.5.3.1 Floodplain Compensatory Storage

Existing floodplain storage will be preserved and maintained for the post-development condition. For streams with mapped FEMA Zone AE floodplain (base floodplain elevations determined and subsequently approved by FEMA), the floodplain will consist of the base flood elevation(s) set onto the approved site topography. For streams with mapped FEMA Zone A floodplain (no base floodplain elevations determined), the floodplain will need to be determined with hydrologic and hydraulic modeling acceptable to the IDNR and the City of Naperville.

2.5.3.2 Natural Depressional Storage

Isolated depressional areas can provide a significant amount of natural stormwater storage in a watershed. Therefore, they shall be included in determining the natural release rate to be compared to the allowable release rate.

2.5.4 Stormwater Detention

2.5.4.1 General

Detention requirements within the City of Naperville are subject to review under both the City's storm runoff control ordinance in addition to applicable county ordinances. Upon review, the more conservative application will apply.

The City of Naperville's storm runoff control ordinance states that detention is required for all commercial developments. Detention will also be required for residential developments of 2.5 acres or greater. For residential developments less than 2.5 acres in area, BMP's that facilitate stormwater infiltration will be required.

The stormwater release rate is the lesser value of: the applicable County release rate or the natural release rate.

2.5.4.2 Basins

A detention basin is a facility that normally drains completely between runoff events. The maximum side-slopes of a detention basin adjacent to a residential area, including multi-family developments, shall be 6 to 1 (6:1, or 6 feet horizontally for every 1 foot drop in elevation). The maximum side-slopes of a detention basin adjacent to a commercial area shall be 4 to 1. The maximum depth of stormwater storage in a detention basin shall be 6 feet. This depth is measured from the lowest point in the basin (located at the invert of the outlet pipe or at the rim elevation of an inlet grate) to the design high water elevation as illustrated below.

The bottom of a detention basin must be sloped toward the outlet or inlet grate(s) to provide drainage after it has stored stormwater. The bottom slope will be a recommended 2 percent with an allowable range of 1.5 percent minimum and 25 percent maximum.

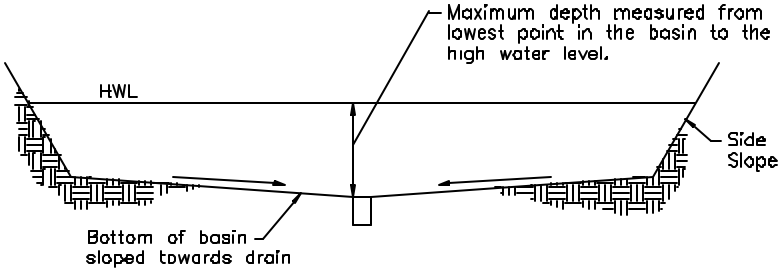
2.5.4.3 Ponds

A detention pond is a facility that maintains a fixed minimum water elevation between runoff events. This definition excludes the water volume losses due to infiltration, evaporation, or de-watering due to periodic maintenance. The maximum side-slopes of a detention pond adjacent to a residential area, including multi-family developments, shall be 6 to 1 (6:1, or 6 feet horizontally for every 1 foot drop in elevation). The maximum side-slopes of a detention pond adjacent to a commercial area shall be 4 to 1. The maximum depth of stormwater storage in a detention pond shall be 6 feet. This depth is measured from the normal water level elevation to the design high water elevation.

2.5.4.4 Aeration Facilities

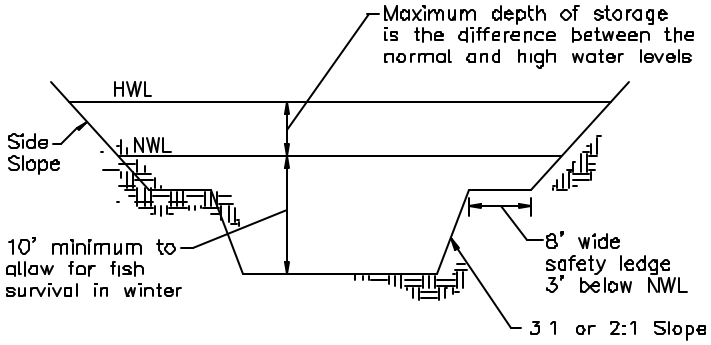
Aeration facilities to prevent pond stagnation shall be provided. Design calculations to substantiate the effectiveness of these aeration facilities shall be submitted with final engineering plans. Agreements for the perpetual operation and maintenance of aeration facilities shall be prepared to the satisfaction of the municipality.

When detention ponds have been designed to promote the growth of a riparian environment, the use of aeration devices may be waived with approval from the City Engineer.



TYPICAL DRY DETENTION BASIN

At least one quarter of the detention pond area (as measured at the normal water level) shall have a minimum depth of 10 feet below the normal water level to provide a refuge for fish to survive during the winter.



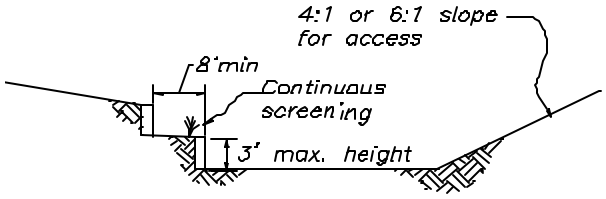
TYPICAL WET (RETENTION) BASIN

A detention pond must have an 8 foot wide safety ledge located 3 feet below the normal water level where emergent plants are not desired, unless a justification is otherwise provided and approved by the City Engineer. This safety ledge provides a stopping point for someone who may have inadvertently fallen into the water.

2.5.4.5 Retaining Walls Used for Detention Facilities

Retaining walls are not permitted in or adjacent to single- family residential developments.

Where permitted, retaining walls around stormwater detention facilities shall not exceed three feet in height. If a wall greater than 3 feet in height is required, the wall must be terraced after the first 3-foot high lift. A minimum horizontal space of 8 feet will be required between wall lifts. A landscape buffer will be required around the back of the bottom retaining wall as illustrated below.



PROPOSED RETAINING WALL SECTION

2.5.4.6 Parking Lot Detention

A maximum depth of 1 foot will be allowed for stormwater storage on parking lots.

2.5.4.7 Underground Detention

Underground storage is allowed if there is no practical alternative to construct a surface detention facility. The City will require that the owner of an underground detention facility have a qualified engineer inspect the system annually and subsequently furnish an inspection report to the City Engineer. The report will include a certification that the condition of the detention system is such that it will operate in accordance with the original design intent. The Plat of Dedication and/or Plat of Easement for the development will include specific language to cover this requirement.

2.5.4.8 Fee-in-Lieu-of Detention

A fee may be paid in lieu of a detention basin or pond if it can be demonstrated that site conditions are such that there is no practical means of constructing such a facility and that there will be no adverse impacts to areas downstream of the site if a detention facility is not provided. The Naperville City Council must approve this alternative before it can be implemented. The fee is computed as $94,000 multiplied by the acre-feet of storage that would be required for the proposed site development. This fee may be adjusted with time; therefore, the current fee amount should be confirmed with the City Engineer.

2.5.4.9 Location of Detention Facilities

The minimum separation between the right-of-way of a public street and the high water level of a detention basin or pond is 10 feet plus one and one half times the maximum design depth of the detention facility.

2.5.4.10 Use of Public Streets for Detention Prohibited

Public street pavements shall not be used for stormwater detention storage.

2.6 FLOODPLAIN MANAGEMENT

2.6.1 Development Standards

For streams with mapped FEMA Zone AE floodplain (base floodplain elevations determined and subsequently approved by FEMA), the floodplain will consist of the base flood elevation(s) set onto the approved site topography. For streams with mapped FEMA Zone A floodplain (no base floodplain elevations determined), the floodplain will need to be determined with hydrologic and hydraulic modeling acceptable to the IDNR and the City of Naperville with the resulting floodplain delineation based on the approved site topography.

2.6.2 LOMR Requirements

For streams with mapped FEMA Zone A floodplain, there will be, in most cases, a discrepancy between the FEMA delineated Zone A floodplain and the newer, refined delineation. Both delineations need to be shown on the final engineering master grading plan. New development will be allowed in FEMA delineated Zone A floodplain areas that are not part of the approved refined delineation. The developer will be required to apply for and receive a FEMA Letter of Map Revision (LOMR) before the City will issue building permits for the habitable structures proposed for these areas. The City of Naperville will require that the builder submit a FEMA Elevation Certificate for these structures at the time that the Final Grading Survey (FGS) is submitted.

SECTION 3
SANITARY SEWER DESIGN

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SECTION 3
SANITARY SEWER DESIGN

3.1 GENERAL DESIGN CRITERIA

3.1.1 Requirement for Sanitary Sewer

All sanitary sewage of domestic and other water borne wastes shall be collected and conveyed in a sanitary sewer pipe system to a point of discharge into an existing sanitary sewer system, City of Naperville interceptor, or sewage treatment plant. No sanitary sewage shall be allowed to enter any storm sewer system or discharge onto the ground or into receiving streams without first being treated in accordance with city, county, state and federal regulations.

3.1.2 Design Approval

The Department of Public Utilities shall approve all designs and shall alter the following design requirements as necessary to meet the City Utilities Master Plan. The Department of Public Utilities and the Transportation Engineering and Development Business Group shall review and comment on all designs.

Proposal of new sanitary sewer lift stations requires approval from the Director of Public Utilities, prior to the design and review process.

The City of Naperville's standard details, as currently adopted by the Department of Public Utilities, should be used in all construction plans. Any modifications to these standard details require approval from the Director of Public Utilities.

3.1.3 IEPA Permit Required

All public sanitary sewer mains require an IEPA Construction permit number and an Illinois Pollution Control Board permit number, prior to construction. Some private extensions may require a permit, dependent upon the design population equivalent.

3.1.4 Differentiation Between Public and Private Sanitary Sewers

Those portions of the sanitary sewer system that are located within the public right-of-way are the responsibility of the City. The City shall also maintain public mains, serving more than one customer. The maintenance and repair costs for the sanitary sewer system located on private property, beyond the limits of the right-of-way, are the responsibility of the property owner or property owner's association depending on the associate's covenants and guidelines. In such cases where the City performs maintenance or repairs on the private sanitary sewer system, the City reserves the right to charge the property owner for necessary work.

All engineering plans shall clearly differentiate between public and private sanitary sewers.

3.1.5 Easements

All public sanitary sewers that are not located within a publicly dedicated right-of-way shall be placed in a public utility and drainage easement, minimum 15 feet wide or as directed by the Department of Public Utilities, to the City of Naperville. The easement shall be granted to the City either through a recorded plat of subdivision or a recorded plat of easement. The City shall be granted access to these easements if not directly adjacent to public right-of-way.

At the discretion of the Director of Public Utilities, the City may require additional easements for future maintenance or repair of sanitary sewers, even those sewers that may be located within the

public right-of-way. For example, the City may have an extra deep sanitary sewer located within the public right-of-way. However, the City may require a public utility and drainage easement parallel to the edge of the right-of-way to accommodate future repair of the sanitary sewer if it ever needs to be excavated and repaired.

3.2 SANITARY SEWERS

3.2.1 Sanitary Sewer Pipe Materials

All sanitary sewer pipe materials and appurtenances shall be in conformance with Section 302 of the City of Naperville Standard Specifications.

3.2.2 Location in the Public Right-Of-Way

Sanitary sewers shall be located within the public right-of-way as directed by the City Engineer. In general, sanitary sewers shall be located 7.5 feet inside the right-of-way on the south and east sides of the right-of-way.

3.2.3 Curvilinear Alignment of Sanitary Sewers

Curvature of sanitary sewers is allowed for sewers 8 inches to 12 inches in diameter. Alignments must follow the general alignment of streets. Only a simple curve design is acceptable. The minimum allowable radius of curvature is 300 feet. Compression type pipe joints are required and manholes are required at the beginning and end of all curves. Maximum joint deflection shall not exceed the manufacturer's recommendations.

3.2.4 Sewer and Water Main Separation

Sanitary sewers and services that are laid in the vicinity of pipelines designated to carry potable water shall meet the conditions set forth in Section 5 of this manual.

3.2.5 Depth of Pipe Cover

All pipe shall be laid to a minimum depth of 7 feet measured from the proposed ground surface to the top of the pipe, unless specifically allowed otherwise in special circumstances by the Director of Public Utilities. If allowed, sanitary sewer and services with ground cover less than 4 feet or more than 25 feet must be constructed of ductile iron class 50 pipe with polywrap. All sanitary sewers and services with less than 4 feet of cover shall be insulated with a 2-inch exterior grade rigid insulation board. The insulation shall have a minimum R-value of R-9, and comply with ASTM C 578-92 Type 1X.

3.2.5.1 Overhead Sewers

The City reserves the right to require overhead sewers, dependent upon the depth of the main and the loading.

3.2.6 Sanitary Sewer Sizing

Sewer size shall be designed on the basis of a design average flow of not less that 100 gallons per capita per day and provide a minimum of 2.0 feet per second velocity when flowing full. The Director of Public Utilities may increase sewer size in accordance with Section 3.2.7 noted below. In no case shall a public sewer be sized less than 8 inches in diameter.

3.2.7 Oversizing and Extra Depth Requirements

The Director of Public Utilities may request that sanitary sewers either be oversized or installed at an additional depth in order to provide service to additional benefiting properties. Section 7-3-6 of the Municipal Code (City participation in construction of public improvements) outlines the City's policy relative to cost sharing for oversizing and extra depth installation.

3.2.8 Sanitary Sewer Slopes

All sanitary sewer slopes shall meet the requirements of the following sections**:**

3.2.8.1 Minimum Slopes

Sanitary sewers shall be designed such that the minimum slopes are not less than the following:

Pipe Diameter	Minimum Slope	Desired Slope
6 inch	1.00%	1.00%
8 inch	0.40%	0.45%
10 inch	0.28%	0.30%
12 inch	0.23%	0.25%

3.2.8.2 Maximum Slopes

Sanitary sewers shall be designed such that the slopes do not exceed a maximum of 12%. If the sanitary sewer system cannot be designed without exceeding a slope of 12%, then drop manhole assemblies shall be utilized.

3.2.8.3 Last Run of Manhole Sets

On last runs of all manhole sets, a minimum 1% slope needs to be provided in order to provide adequate flushing due to low flows.

3.2.9 Limits of Installation

At a minimum, sewers shall extend across the frontage of the property, at the developer's cost, such that a connection can be made with minimal disturbance in the future. In some cases, the City may require that the sanitary sewer be installed from one corner to the diagonally opposite corner, at the developer's cost.

3.3 SANITARY SEWER MANHOLES

Manholes for sanitary sewers shall have a minimum inside diameter of 48 inches and shall be constructed of pre-cast concrete units in accordance with ASTM C 478 and Section 32 of the "Standard Specifications for Water and Sewer Main Construction in Illinois," and shall follow the City of Naperville sanitary sewer standards.

3.2.2 Manhole Location and Spacing

Manholes shall be located at the junction of two sanitary sewer pipes or at any change in grade, alignment or size of pipe. The maximum spacing of manholes shall be 500 feet, or as approved by the Director of Public Utilities.

In general, the City of Naperville prefers to minimize the number of manholes needed for a project. This will help reduce future operation and maintenance costs.

3.2.2 Invert Elevations in Manholes

Inverts of similar size pipe are to match other inverts. Where a smaller pipe intersects a larger pipe, the spring line or top of pipe of both pipes shall be at the same elevation, unless otherwise directed by the Director of Public Utilities. This is also to be done when tapping (core and boot required) into an existing manhole.

3.2.2 Drop Manholes

Drop manhole assemblies shall be provided at the junction of sanitary sewers where the difference in grade is in excess of 2 feet. The drop assembly shall follow Naperville Standards with filleted inverts. Drops are to be made outside of the structure unless otherwise approved by the Naperville Department of Public Utilities. A minimum of 24 inches between the inverts of the drop assembly must be provided. If the difference between the inverts is less than 24 inches, the inverts must match.

When pipe inverts in a manhole do not meet the requirements of section 3.3.2, a drop manhole assembly shall be used.

3.2.2 Requirement for Inspection Manholes and Clean-Outs

All commercial, office, institutional, industrial, and manufacturing buildings shall have an inspection manhole located outside of the building that will allow the City to observe the discharge from the building into the public sanitary sewer system.

An inspection manhole is required for any multi-family building that has more than six (6) units. Additionally, clean-outs shall be required on multi-family services serving between two (2) and six (6) units.

A clean-out will also be required for any service line over 90 feet in length which does not have an inspection manhole.

3.3.5 Grease/Oil/Sand Trap Manholes

Grease/oil/sand trap manholes, as required by the Illinois Plumbing Code, shall be shown on the engineering plans.

3.3 APPURTENANCES

3.4.1 Casing Pipes

Manufactured non-metallic or non-corrosive casing spacers, adjustable runners, or cradles shall be used to support the pipe in the casing. A minimum of two supports shall be used per pipe for lengths up to 12.5 feet, and a minimum of three supports shall be used for lengths greater than 12.5 feet, or per manufacturer's recommendation. The annular space shall be filled with pea gravel or as required by permitting agency, and provisions shall be made so that no voids are left to prevent flotation.

3.4.1.1 Casing Pipe Material

The steel casing pipe shall be bituminous coated, a minimum of 30 mils thickness inside and out, and shall be of leak proof construction, capable of withstanding the anticipated loadings. The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall meet the requirements of ASTM A139, Grade B. Ring deflection shall not exceed 2% of the nominal diameter. The steel casing pipe shall be delivered to the jobsite with beveled ends to facilitate field welding.

Steel Casing Diameter	Minimum Wall Thickness (Inches)
20" and 22"	0.344
24"	0.375
28"	0.438
30"	0.469
32"	0.501
34" and 36"	0.532

3.4.1.2 Sizing of Casing Pipes

The diameter of the casing pipe shall be a minimum of 12 inches greater than the outside nominal diameter of the sewer.

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SECTION 4
STREET DESIGN

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SECTION 4
STREET DESIGN

4.1 GENERAL DESIGN CRITERIA

This section of the Design Manual generally follows the guidelines as established by the Institute of Transportation Engineers (ITE), the Illinois Department of Transportation (IDOT) and the American Association of State Highway and Transportation Officials (AASHTO). The references used to establish this Design Manual include the following:

- *Guidelines for Major Street Design* (ITE Publication No. RP-010A)
- *Guidelines for Residential Subdivision Street Design* (ITE Publication No. RP-011C)
- *A Policy of Geometric Design of Highways and Streets* (AASHTO, 1994)
- *An Information Guide for Roadway Lighting* (AASHTO, 1994)
- *Traffic Calming – State of the Practice* (ITE Publication No. 1R-098)
- *Illinois Department of Transportation Bureau of Local Roads & Streets Administrative Policies Manual*
- *Illinois Department of Transportation Bureau of Design & Environment Manual*

This chapter presents modifications to these guidelines in accordance with the policies and procedures established by the City of Naperville.

4.2 ROADWAY GEOMETRICS

4.2.1 Functional Classifications

4.2.1.1 Major Arterial

These streets are used primarily to carry the heavier traffic pattern providing continuity throughout the contiguous urban area. Access control will be maintained towards limiting access to intersections with other roads.

4.2.1.2 Minor Arterial

A street used primarily for intersections of sections of the City and deemed desirable for construction of other public utilities within the street right of way.

4.2.1.3 Collector

A street used primarily to provide ready collection of traffic from residential areas and to convey this traffic to the major arterial and highway system. Even though this street may carry some through traffic, its primary function is to feed traffic to the arterial streets and to provide local access.

4.2.1.4 Neighborhood Connector

Connect residential and local streets within a neighborhood to Collector streets and to the Arterial street network. All neighborhoods have at least one neighborhood connector street, and many have two or more.

4.2.1.5 Local Streets

The primary function is to serve adjoining property. They shall be arranged to conform to the topography, to discourage use by through traffic and provide access to abutting property.

4.2.2 Minor Street Design Guidelines

A minor street is defined as any street classified below the functional classification of an arterial. The design guidelines to be used in developing the minor street system layout shall be in accordance with Appendix E *"Guidelines for Residential Subdivision Street Design"* prepared by the Institute of Transportation Engineers, except as otherwise noted in the following provisions:

4.2.2.1 Pavement Width

The minimum pavement width for all local streets and cul-de-sacs is 28 feet, measured from back of curb to back of curb. The minimum pavement width for collector streets is 37 feet, measured from back of curb to back of curb. Neighborhood connector streets shall either be 28 feet or 37 feet depending upon the discretion of the City Engineer. Neighborhood connectors shall be 37 feet adjacent to all school sites, park sites or other major facilities and on approaches to all collector and arterial roadways.

4.2.2.2 Maximum Cul-de-Sac Length

The length of a cul-de-sac should not exceed 1,000 feet, as measured from the centerline of the intersecting street, along the centerline to the center of the bulb of the cul-de-sac. For lengths in excess of 1,000 feet, a secondary point of access must be provided.

4.2.2.3 Curbs And Gutters

The standard curb and gutter section for all cul-de-sac and local roads is a type M 3.12 mountable rolled curb. The curb and gutter section for all collector streets shall be a barrier type B 6.12 curb and gutter. Neighborhood connector streets can be constructed with either M 3.12 or B 6.12 curb and gutter. In general the M 3.12 curb and gutter will be used in the 28-foot wide sections of neighborhood connector streets while the B 6.12 curb and gutter will be used on the 37-foot wide sections.

4.2.2.4 Sidewalks

A 5-foot sidewalk is required on both sides of all streets and cul-de-sacs. Pedestrian circulation is to be provided so as to separate vehicular traffic from pedestrians.

4.2.2.5 Street Lighting

Street lighting, including underground service cable, is required throughout all subdivisions for all public streets.

4.2.2.6 Street Name Signs

Street name signs are required at all street intersections.

4.2.2.7 Pavement Design

All streets within the subdivision shall be surfaced with either bituminous concrete or Portland cement concrete. The pavement structure shall be designed according to the Sections 402, 403, and 404 of the City of Naperville Standard Specifications.

4.2.3 Right-of-Way Requirements

Type of Roadway	Minimum ROW (FT)
Major Arterial	120
Minor Arterial	100
Collector	80
Neighborhood Connector	Varies from 66 to 80
Local Street	66
Cul-de-Sac Bulb	62
Alley	30

4.3 INTERSECTION DESIGN

The design guidelines follow the *"Guidelines for Residential Subdivision Street Design"* as published by the Institute of Transportation Engineers. Table 3: Intersection Design Guidelines denotes three classifications for the type of terrain. In the City of Naperville, the terrain is generally level (has a longitudinal slope of 0-8%). Therefore the guidelines under this classification should be followed.

Criteria	Requirement
Approach Speed (mph)	25
Clear Sight Distance (length along each approach leg)(feet)	90
Minimum Angle of Intersection	70° (90° Preferred)
Minimum Curb Radius (feet)	
a. Local-Local	20
b. Local-Neighborhood Collector	25
c. Local-Collector	25
d. Neighborhood Collector-Neighborhood Collector	30
e. Neighborhood Connector-Collector	30
f. Neighborhood Connector-Arterial	30
g. Collector-Collector	30
h. Collector-Arterial	30
Minimum Centerline Offset of Adjacent Intersection (feet)	
a. Local-Local	125
b. Local-Neighborhood Collector	150
c. Local-Collector	150
d. Neighborhood Collector-Neighborhood Connector	200
e. Neighborhood Connector-Collector	25
f. Collector-Collector	200
Minimum Tangent Length (feet)	
Approaching Intersection (each length)	50

4.4 SIDEWALKS

4.4.1 Minimum Width

The minimum width for sidewalks is 5 feet, except where the volume of pedestrian or bicycle traffic justifies a greater width, or where parked vehicles may overhang onto the sidewalk. The minimum sidewalk width in the Central Business District is 8 feet.

4.4.2 Location

All sidewalks are to be located such that the outside edge of the walk is 1-foot from the dedicated right-of-way line, and entirely within the dedicated right-of-way.

4.4.3 Lateral Separation

The minimum lateral separation between the edge of a sidewalk and any above ground obstruction (i.e. posts, poles, tree trunks, utility boxes, etc.) shall be 1-foot. When such conflicts require a lateral change in sidewalk alignment, a 10:1 transition shall be made.

4.4.4 Slope And Grade

Transverse Slope, minimum 2% (¼" per foot)
Transverse Slope, maximum 4% (½" per foot)

Longitudinal Slope, maximum 5% (20:1)
Longitudinal Slope, in excess of 5% shall meet the requirements of the Illinois Accessibility Code.

4.4.5 Intersections

When a sidewalk approaches an intersection with a street to provide a pedestrian crossing; the curb and adjacent sidewalk shall be depressed, meeting the requirements of the Illinois Accessibility Code. Refer to the City of Naperville Standard Detail PVMT 4.

Sidewalks are to be continuous through paved areas such as driveways and parking lots.

4.5 STREET LIGHTING

4.5.1 Performance Standards

Streetlights along all local, neighborhood connector and collector streets shall meet the following performance standards:

Item	Collector Streets	Neighborhood Connector Streets	Local Streets
Maximum FC	≤ 5.0	≤ 3.5	≤ 3.5
Minimum FC	≥ 0.3	N/A	N/A
Average FC	≥ 1.1	≥ 0.4	≥ 0.4
Ave./Min. Ratio	≤ 4.0	N/A	N/A
Max./Min. Ratio	N/A	N/A	N/A
Bulb Type	HPS	HPS	HPS
Wattage	250	150	100
Lens Type	Flat Glass		
IES Distribution Type	Medium Cutoff Type II or Type III		
Maintenance Factor	0.7		
Pole Location	5 feet From Back of Curb		
Pole Type	Aluminum		

Item	Collector Streets	Neighborhood Connector Streets	Local Streets
Mounting Height (ft.)	32	23	23
Mast Arm (ft.)	10	8	8
Mast Arm Type	Truss or davit arm	Single member taper elliptical type or davit "bent fishing pole" arm	

4.5.2 Approval

Catalog cuts for all components of street lights must be submitted for review and approved prior to installation. The components must meet the requirements set forth in Section 600 of the City of Naperville Standard Specifications. Submittals include, but are not limited to: Poles, mast arms, breakaway couplings, luminaires, photo-cells, conduit, cable, fuses, handholes, junction boxes, ground rods, and controllers.

4.5.3 Location

Street Light poles shall be placed at the following locations:

- At each intersection, in the "stop sign" position, oriented at an angle of 90 degrees to the alignment of the street.
- Inside of all horizontal curves.
- On each cul-de-sac, at the point where the tangent meets the circular outside of the cul-de-sac (throat).
- At mid-block locations such that the spacing identified in the following sections is not exceeded.
- At additional locations where conditions warrant additional lighting per the City Engineer.

4.5.4 Cul-de-Sac and Local Street Design Standards

4.5.4.1 Mounting Height

The mounting height shall be 23 feet.

4.5.4.2 Mast Arm

The mast arm shall be 8 feet long.

4.5.4.3 Street Lighting Controller and Power Source

Street lighting controllers are not required for local streets and cul-de-sacs. Each streetlight shall be individually fed from the nearest power source as indicated by the City of Naperville Department of Public Utilities/Electric. Each streetlight shall also be equipped with a photocell.

4.5.4.4 Spacing

For either staggered or single side layout, street light poles shall be located based on the following recommended spacing, and comply with the performance standards established in Section 4.5.1:

Luminaire	***GE M-C-II***	***GE M-C-III***
100 watt	100 feet	125 feet

4.5.5 Neighborhood Connector Street Design Standards

4.5.5.1 Mounting Height
The mounting height shall be 23 feet.

4.5.5.2 Mast Arm
The mast arm shall be 8 feet long.

4.5.5.3 Controller and Power Source
All streetlights on neighborhood connector streets shall be run from a street lighting controller meeting the specifications noted in the City Standards. In general, the controller shall be located in the mid-point of all of the streetlights run by the controller. The power source shall be determined by the City of Naperville Department of Public Utilities-Electric. A photocell shall be placed on the nearest streetlight and connected back to the controller.

4.5.5.4 Spacing
For either staggered or single side layout, street light poles shall be located based on the following recommended spacing, and comply with the performance standards established in Section 4.5.1:

Luminaire	***GE M-C-II***	***GE M-C-III***
150 watt	150 feet	150 feet

4.5.6 Collector Street Design Standards

4.5.6.1 Mounting Height
The standard mounting height is 32 feet.

4.5.6.2 Mast Arm
The mast arm shall be 10 feet long.

4.5.6.3 Controller and Power Source
All streetlights on collector streets shall be run from a street lighting controller meeting the specifications noted in the City Standards. In general, the controller shall be located in the mid-point of all of the streetlights run by the controller. The power source shall be determined by the City of Naperville Department of Public Utilities/Electric. A photocell shall be placed on the nearest streetlight and connected back to the controller.

4.5.6.4 Spacing
Street light poles shall be located based on the following recommended spacing, and comply with the performance standards established in Section 4.5.1:

Staggered Streetlight Layout

Luminaire	***GE M-C-II***	***GE M-C-III***
250 watt	170 feet	170 feet

Single Side Streetlight Layout

Luminaire	***GE M-C-II***	***GE M-C-III***
250 watt	150 feet	150 feet

SECTION 5
WATER DISTRIBUTION SYSTEM DESIGN

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SECTION 5
WATER DISTRIBUTION SYSTEM DESIGN

5.1 GENERAL DESIGN CRITERIA

5.1.1 Design Approval

The Department of Public Utilities shall approve all designs and shall alter the following design requirements as necessary to meet the City water system plan. The Department of Public Utilities and the Transportation Engineering and Development Business Group shall review and comment on all designs.

The City of Naperville's standard details, as currently adopted by the Department of Public Utilities, should be used in all construction plans. Any modifications to these standard details require approval from the Director of Public Utilities.

5.1.2 IEPA Permit Required

All public water main extensions require an IEPA Construction permit, prior to construction.

5.1.3 Differentiation Between Public and Private Water Mains

When the water distribution system is complete and the improvements have been formally accepted by the City, the Department of Public Utilities shall be responsible for the repairs and maintenance of all service lines and water mains located in the public right-of-way and publicly dedicated water mains and loop systems. Maintenance and repairs for the portion of the system located on private property shall be the responsibility of the property owner, or property owner's association or a property owner's association depending upon the property owner's covenants and guidelines. In such cases where the City performs maintenance or repairs on the private water distribution system, the City reserves the right to charge the property owner for necessary work.

All engineering plans shall clearly differentiate between all portions of the public and private water distribution system.

5.1.4 Easements

All public water mains and fire hydrants that are not located within a public right of way shall be placed in a public utility and drainage easement, minimum 15-feet wide or as directed by the Department of Public Utilities, to the City of Naperville. The easement shall be granted to the City either through a recorded plat of subdivision or a recorded plat of easement. The City shall be granted access to these easements if not directly adjacent to public right-of-way.

At the discretion of the Director of Public Utilities, the City may require additional easements for future maintenance or repair of the system, even those portions which may be located within the public right-of-way.

5.2 WATER MAINS

5.2.1 Basis of Design

All water systems shall be designed using the Hazen-Williams method. The coefficient of roughness shall equal one hundred (c = 100).

5.2.2 Pipe Material

Ductile iron pipe shall be cement-lined, have a minimum Class 52 thickness designation, and polyethylene encasement. For information regarding applicable ANSI, AWWA, and ASTM designations, refer to Section 502 of the City of Naperville Standard Specifications.

5.2.3 Location in the Public Right-Of-Way

Water mains shall be generally be located on the north and west sides of the public right-of-way, or as directed by the Director of Public Utilities.

5.2.4 Sewer and Water Main Separation

Water mains and water service lines shall be protected from sanitary sewers, storm sewers, combined sewers, house sewer service connections, drains, and sanitary sewer force main. In addition to the following guidelines, refer to Section 503 of the Standard Specifications.

5.2.4.1 Horizontal Separation

Water mains shall be laid at least 10 feet horizontally from any existing or proposed drain, storm sewer, sanitary sewer, combined sewer or sewer service connection.

Water mains may be laid closer than 10 feet to a sewer line when:

- Local conditions prevent a lateral separation of ten feet;
- The water main invert is at least 18 inches above the crown of the sewer; and
- The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located to one side of the sewer.

When it is impossible to meet the conditions above, the drain or sewer shall be constructed of slip-on mechanical joint cast or ductile iron pipe, or PVC SDR 26 pipe meeting the requirements for water main. The drain or sewer shall be pressure tested to the maximum expected surcharge head before backfilling with no leakage allowed in the area of required water main protection. A City of Naperville representative shall witness this testing.

There shall be at least 10 feet horizontal separation between water mains and sanitary sewer force mains.

Water mains must be separated at least 25 feet from septic tanks, disposal fields, seepage beds, and sewage lift stations.

5.2.4.2 Vertical Separation

A water main shall be laid so that its invert is 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally or any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.

The sewer shall be constructed of slip-on or mechanical joint cast or ductile iron pipe, or PVC SDR 26 pipe, meeting the requirements for water main when:

- It is impossible to obtain the proper vertical separation as described above; or
- The water main passes under a sewer or drain.

A vertical separation of 18 inches between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking of the water main.

If the invert of the water main is not 18 inches above the crown of the sewer when the pipes cross, a casing pipe can be installed around either the water main or sewer in lieu of constructing the sewer with water main equivalent pipe. The casing pipe must be a material that is approved for use as water main. The casing must extend on each side of the crossing at least 10 feet as measured at right angles from the outside edge of water main pipe to the outside edge of the sewer pipe. Pipe support shall be provided within the casing pipe and ends of the casing shall be filled with an approved non-shrink grout.

At crossings when the invert of the water main is not 18 inches above the crown of the storm sewer, and the sewer crossed the water main at right angles, the storm sewer can be constructed with reinforced concrete pipe using flexible gasket joints meeting ASTM C-361 or ASTM C-443 instead of providing a casing pipe or constructing the storm sewer with water main equivalent pipe. If gasketed storm sewer piping is proposed, it shall be installed between adjacent storm structures. The drain or sewer shall be pressure tested to the maximum expected surcharge head before backfilling with no leakage allowed in the area within 10 feet of the water main. A City of Naperville representative shall witness this testing.

Construction shall extend on each side of the crossing until the distance from the water main to the sewer or drain line is at least 10 feet as measured at right angles from the outside edge of the water main pipe to the outside edge of the sewer pipe.

Where a water main passes over an existing or proposed forcemain, an 18-inch vertical separation shall be provided at the crossing. (Note: A forcemain shall not be allowed to be above the water main at the crossing.)

5.2.5 Depth of Pipe Cover

All pipe shall be laid to a minimum depth of 5 feet measured from the proposed ground surface to the top of the pipe, unless specifically allowed otherwise in special circumstances by the Director of Public Utilities. If approved, the pipe shall be insulated with 2-inch exterior grade rigid insulation board. One 2-inch thick sheet of insulation shall be provided for each 6 inches of cover below the required 5-foot minimum depth and extend a minimum of 12 inches on each side of the water main. The insulation shall have a minimum R-value of R-9, and comply with ASTM C 578-92 Type 1X.

5.2.6 Water Main Sizing

Water mains shall be constructed of 8-inch diameter or 12-inch diameter pipe, or as directed by the Department of Public Utilities.

5.2.7 Oversizing Requirements

It may be determined that the water main be oversized in order to provide service to additional benefiting properties. Section 7-3-6 of the Municipal Code (City participation in construction of public improvements) outlines the City's policy relative to cost sharing for oversizing.

5.2.8 Limits of Installation

At a minimum, water main shall extend across the frontage of the property, at the developer's cost, such that a connection could be made with minimal disturbance in the future. In some cases, the City may require that the water main be installed from one corner to the diagonally opposite corner, at the developer's cost.

All water main stubs for future extension shall terminate with a valve and hydrant. Restrained joints shall be located 40 feet from the capped end.

5.2.9 Gridiron or Looping

Each 8-inch diameter water main shall be looped at a distance not to exceed 1,000 feet.

Each 12-inch diameter and larger water main shall be looped at a distance not to exceed 3,000 feet.

No dead-ended water mains shall be allowed.

5.3 WATER SERVICES

No more than one building shall be supplied from one service pipe. Whenever possible, the service pipe shall enter the building in a direct line with the curb stop and tap. Said pipe shall be provided with a valve before and after the water meter, not less than 1-foot inside of the wall or above the foundation floor (main building shutoff valve). The property owner shall be responsible for the maintenance, repair or replacement of the main shutoff valves.

Every building, except auxiliary buildings shall be individually metered.

All valves shall be arranged so that each line can be shut off from the exterior of the building.

5.3.1 Pipe Material

Service lines 2 inches or less (≤ 2"), inside diameter, shall be copper pipe, "Type K". All services 3 inches or greater (≥ 3"), inside diameter, shall be Class 52 ductile iron pipe with cement lining.

5.3.2 Water Service Line Sizing

The following guidelines shall be used to size water service lines:

Water Supply Fixture Units	Size, diameter (inches)
< 60	1"
≥ 60	1-1/2"

5.4 FIRE PROTECTION

5.4.1 Fire Protection Supplies

Fire flow requirements will be approved by the Director of Public Utilities.

The required fire flows may be computed at a residual pressure of 20 psi for Fire Department use. It should be recognized that higher residual pressures may be necessary for specific fire protection demands.

The following flow requirements are guidelines which will be modified based upon construction types, size and height of the buildings:

Use	Flow (gpm)
Manufacturing and Storage	3,000 to 5,000
Institutional (Assumed limited hazard, fire resistive construction, or automatic protective devices provided)	3,000 to 4,000
Commercial and Mercantile	3,000 to 5,000
Business and Office (Assumed limited hazard)	2,500 to 3,500
Single Family Detached Residential (1,000 gpm typically used for average home size and spacing)	1,000 to 1,500
Town or Row Houses (1,500 gpm average, additional quantity due to risk of fire to adjoining structures or units)	1,000 to 2,000
Apartments (Low-end requirements for fire resistive structures, higher-end requirements for wood frame, similar construction)	3,000 to 4,000

5.4.1.1 Public Fire Flow Requirements

Public fire flow requirements (Fire Department pumper supply) and domestic consumption demands are cumulative.

5.4.1.2 Private Fire Protection

Private fire protection demands (standpipe systems, sprinkler systems, etc.) will not be considered cumulative with public fire flow demands. These requirements are based upon the building height, area, use and construction type.

5.4.2 Fire Hydrant Locations

Fire hydrants shall be located 7.5 feet from the right-of-way within north or west parkways.

All points of buildings shall be within 300 feet of all points of the building, as the hose lays (must be shown on engineering plans).

The linear spacing of hydrants shall not exceed 350 feet in single-family areas or 300 feet elsewhere.

Fire hydrants shall be situated in the parkway within 10 feet from a paved roadway and 50 feet from a Fire Department connection (Siamese).

Access to hydrants shall be provided by paved roadways (minimum structural number = 2.5) routes adequate in width, clearance and strength to support all fire equipment. Such routes shall be maintained during all seasons of the year.

5.5 VALVES

5.5.1 Valve Boxes and Valve Vaults

Valve boxes may only be used for fire lines that are less than 8 inches in size. The valve box shall be located in a grassy area; otherwise a valve vault must be used.

Valves for water mains or fire lines 8 inches or larger shall be provided with a vault.

5.5.2 Valve Locations

Valves shall be located such that no more than a maximum of 500 feet to 700 feet of main may be shut off at any given time. This spacing should be reduced, such that no more than 25 to 30 single-family homes, or 50 multi-family residences (excluding apartment buildings) would be shut off at any given time.

Where a “tee” is installed, at least two (2) valves will be utilized.

Where a “cross” is installed, at least three (3) valves will be utilized.

5.5.3 Pressure Taps

Pressure taps shall be cast iron or ductile iron tapping sleeves for size-on-size taps, or taps on mains greater than 12 inches (> 12”). Stainless steel tapping sleeves can only be used for non-size-on-size taps or taps on mains less than or equal to 12 inches (≤ 12”).

5.6 APPURTENANCES

5.6.1 Casing Pipes

Manufactured non-metallic or non-corrosive casing spacers, adjustable runners, or cradles shall be used to support the pipe in the casing. A minimum of three supports shall be used per pipe, or per manufacturer's recommendation. The annular space shall be filled with pea gravel or as required by the permitting agency, and provisions shall be made so that no voids are left. Water main installed within casing pipes shall have restrained joint construction the entire length of the casing pipe for future removal if necessary.

5.6.1.1 Casing Pipe Material

The steel casing pipe shall be bituminous coated, minimum of 30 mils thickness inside and out, and shall be of leak proof construction, capable of withstanding the anticipated loadings. The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall meet the requirements of ASTM A139, Grade B. Ring deflection shall not exceed 2% of the nominal diameter. The steel casing pipe shall be delivered to the jobsite with beveled ends to facilitate field welding.

Steel Casing Diameter	Minimum Wall Thickness (Inches)
20" and 22"	0.344
24"	0.375
28"	0.438
30"	0.469
32"	0.501
34" and 36"	0.532

5.6.1.2 Sizing of Casing Pipes

The diameter of the casing pipe shall be a minimum of 12 inches greater than the outside nominal diameter of the water main.

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