SECTION IV

STORM WATER DRAINAGE SYSTEMS AND APPURTENANCES

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A. GENERAL

All development under the jurisdiction of the Village of Northbrook shall include provisions for construction of stormwater management facilities designed in accordance with the standards herein.

No residential, commercial, or industrial subdivision or development shall be approved unless it is served by storm water drainage and detention facilities designed in accordance with this Section.

All storm sewers which are installed in the public rights-of-way or in public drainage and utility easements serving a central drainage system concept, shall be deemed to be dedicated to the Village of Northbrook upon acceptance of the subdivision.

Every subdivision shall have storm sewers separate and independent of the sanitary sewer system and with an adequate outlet or connection to an existing storm sewer system.

Storm sewers and appurtenances shall be sized to accept and convey storm water runoff from a 10-year design runoff rate as defined by the Watershed Management Ordinance. Storm sewer systems shall be installed in accordance with the Standard Specifications for Road and Bridge Construction and the Standard Specifications for Water and Sewer Main Construction in Illinois. Storm sewers emptying into a river or stream shall be designed using the 10-year, 24-hour storm event tailwater elevation.

B. SERVICE AREAS

All storm sewers, streams, channels, ponds, and basins shall be designed to accommodate all areas which naturally flow to the area of the development and any additional areas which are planned to contribute to the drainage area as identified by the Village Engineer. If extending the ultimate service area beyond the natural drainage area limits served by the proposed development results in additional construction costs within the development, a written agreement may be made with the Village for the recapture by the developer of the additional cost when future system extensions are made.

C. PUBLIC EASEMENTS AND UTILITIES

All public storm sewer extensions shall be located within publicly dedicated rights-of-way or easements. If located within an easement, the easement shall be centered on the pipe and appurtenances and extend 10 feet to either side.

To protect existing utilities all underground utility work shall be performed in accordance with the Illinois Underground Utility Facilities Damage Prevention Act and JULIE Excavator Handbook.

D. SYSTEM EXTENSION/CONNECTIONS

The location of proposed extensions and connections to the existing storm sewer system shall be approved by the Village Engineer.

E. BOUNDARY FLOW WAYS

Where the storm sewer system is being designed for connection to a development, and the tributary drainage area extends more than 100-feet beyond the boundary of the development, surface flow ways shall be constructed along the upstream boundary of the development to intercept and safely convey and bypass all storm water runoff from the upstream watershed. The bypass flows must not increase upstream flood stage or increase downstream flood stage or velocity for the 100-year design runoff rate.

F. DESIGN

1. Storm Sewer, Stream Improvement, and Open Channel Hydraulics

(a) Storm sewers, stream improvements and open channels shall be designed to provide adequate design flow capacity using Manning's formula:

$$Q = \frac{1.486}{n} * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

Q	=	Design flow rate (cubic feet/second)
n	=	the roughness coefficient of the pipe or channel (dimensionless)
A	=	the cross-sectional area of the pipe or channel (square feet)
R	=	The hydraulic radius of the pipe or channel (foot)
S	=	slope of the pipe or channel's energy gradient (foot/foot)

Storm sewer sizing software programs in addition to Manning's equation spreadsheets will be accepted. All software generated data shall include a visual representation of the storm sewer network and hydraulic grade line to demonstrate that the storm sewer system is not under pressure flow.

(b) Roughness coefficients ("n") shall be in accordance with the "Drainage Manual".

(c) The minimum velocity allowed in storm sewer pipe systems shall be three feet per second and the design mean velocity shall not exceed the following:

(1) Storm sewers - 10 feet per second.
(2) Open channels, concrete or asphalt lining – 15 feet per second.
(3) Open channels, sodded – five feet per second.

(d) Storm sewer manhole spacing shall be as follows:

Storm Sewer Pipe Diameter (inches)	Maximum Manhole Interval Spacing (feet)
12-24	350
27-36	400
42-54	500
60 or larger	600

(e) Inlet grate capacities shall meet or exceed design flows. Double inlets shall be installed where flows warrant their installation.

(f) All developments must be provided an overland flow path that will pass the 100-year, 24-hour storm event flow at a stage at least one feet foot below the lowest adjacent grade and 2 feet below the lowest entry elevation of adjacent structures, in the vicinity of the flow path.

2. Sewer Size

Storm sewers serving inlet structures shall not be less than 12 inches in diameter.

Storm sewer house service lines shall not be less than 4 inches in diameter.

Storm sewers of different inside diameters shall join only at structures. The invert elevations shall be adjusted to maintain a uniform energy gradient by matching the 0.8 depth points of the different diameters.

The end of storm sewer service leads shall be plugged with a pre-manufactured cap and shall be marked with a painted “green” 4" x 4" timber installed vertically.

3. Storm Sewer Depth

Storm sewers shall be constructed with a minimum depth of cover of 2 feet.

4. Storm Sewer Manholes

Manholes shall be located as follows:

- At the termination of all sewers which do not otherwise provide for access to the sewer pipe.
- At changes in direction, horizontal or vertical.
- At changes in pipe shape or size.
- At junctions with other storm sewers.

5. Storm Sewer Pipe

Storm sewer pipe class and type shall be determined based upon the “Standard Specifications for Road and Bridge Construction” and as approved by the Village Engineer. Pipe joints shall be bell and spigot with a rubber gasket. CMP, Clay, or Vitrified Clay Pipe is not an approved material for storm sewer.

Storm sewer pipe bedding shall be to the spring line of CA-7 or CA-11 crushed aggregate. At the direction of the Village Engineer, granular bedding and initial backfill may be omitted if the storm sewer is in an easement or near the foundation structure of an adjoining building.

Excavation in existing pavement shall be backfilled to the pavement base layer with controlled low strength material unless otherwise approved by the Village Engineer.

Sewers constructed via open cut within 3 feet of existing pavement or across proposed pavement shall be backfilled with approved granular backfill, thoroughly compacted in 8 inch lifts in place.

Storm sewer pipe concrete cradle, arch, or fill encasement shall be constructed whenever dictated by trench or embankment conditions and shall be approved by the Village Engineer prior to use.

6. Storm Sewer Pipe Alignment/Size

Storm sewer shall be laid using a laser beam and be straight in both horizontal and vertical planes between manholes, unless otherwise approved by the Village Engineer. Adequate separation from wells, water mains, and water services shall be provided in accordance with regulatory requirements.

All open channels and storm sewers shall be sized by the Rational Method of runoff determination for service areas up to 50 acres on the basis of a critical duration 10 year storm event and shall be sized to adequately carry flow from all tributary areas. The size calculations shall verify the capacity of the receiving sewer or channel.

$$Q = C\,i\,A$$

Where:	Q	=	Runoff flow, cubic feet per second (CFS)
	C	=	Runoff coefficient, characteristic of tributary drainage area in dimensionless units (C)
	A	=	Tributary drainage area, (acres)
	i	=	Average rainfall intensity, (inches per hour) using approved MWRDGC table

(a) Rainfall intensity:

The average rainfall intensity used for design shall be selected from Rainfall – Duration data as published in the Illinois State Water Survey Bulletin No. 75, Section 2, Northeast, or the latest published edition.

(1) Underground storm sewer water conduit sizes shall be determined using a minimum of a critical duration 10 year storm event.

(2) Surface streams and open channels shall be designed using a 24 hour, 25 year storm event, contained within stream or channel banks, including at any culverts.

(3) Overland flow and overbank flow shall be designed for a 24 hour, 100 year storm event, such that the storm flow can be conveyed to a storm water basin or downstream system without endangering structures or making roadways impassable. The overland flow way shall be clearly identified on the design drawings.

(b) Runoff Coefficient:

(1) The runoff coefficient C is the ratio of runoff to rainfall. Runoff coefficients shall be in accordance with the “Drainage Manual” except as follows:

i. All paved or impervious areas including gravel, decks, buildings, and patios shave have a C value of 0.95.
ii. All water features including pools, ponds, and other water surface, shall have a C value of 1.0.
iii. All pervious areas such as lawn areas (all areas not classified as impervious), shall have a C value of 0.50
iv. No Runoff Curve Number reductions will be allowed for any storm water analysis or design.

(2) The runoff coefficient used in design shall be the weighted average for the proposed tributary watershed.

(3) Within a development, the runoff coefficient shall be computed assuming ultimate development and a minimum future impervious area of 50 percent of the design area. Where ultimate development plans are not available at the time of the design of the storm sewer system, a runoff coefficient will be selected by the Village Engineer, based on the zoning classification, knowledge of the specific development, and the previous experience of the Village with similar developments. The area within the watershed, but outside the development, shall be computed for existing conditions if future development will be under Village control.

7. Drainage Computations

The drainage area, in acres, used for design shall be the entire watershed service area tributary to the point in the drainage system under design. It shall include any tributary service area that may be outside the development.

Design computations and drainage area drawings prepared by a professional engineer for the following facilities shall be submitted to the Village Engineer for review.

(a) On site ditches, swales, and storm sewers:

The minimum grade for a grass bottom ditch shall be 1.50 percent. For lesser ditch grade, the engineer shall submit design for paved invert or underdrain system as directed by the Village Engineer.

(b) Street drainage design:

Surface drainage inlets shall be provided so that surface water is not carried across any street intersection, parking lot or depressed drives. Surface runoff shall not extend more than 400 feet along the surface of the ground. Inlets shall discharge into storm sewers and shall not discharge into side lot or rear lot drainage ditches. Inlet structures shall be provided at all low points. Overland flow maximum depth allowed at centerline of roadway is 1.0 foot based on a 24-hour, 100-year storm event.

(c) Vacant lot drainage design:

Positive drainage and soil erosion control measures shall be established for each lot within seven calendar days following the end of active hydrologic disturbance.

(d) Parking lot drainage design:

Overland flow within and from parking lots shall be shown by arrows on design drawings. Inlet structures shall be provided so that flow from said lots is not carried across any public sidewalk or across or around any major intersection. The maximum depth for storm water detention provided in parking lots shall be limited to one foot.

The minimum longitudinal slopes shall be 0.5% and the maximum shall be 5% in the paved area of the parking lot. Inlet structures shall be located in driving aisles wherever possible.

Restrictors shall conform to the Village's Standard Detail and as approved by the Village Engineer.

An additional 1.5 inches of storage depth of parking lot detention shall be provided to allow for future parking lot resurfacing.

(e) Building drainage:

The point of discharge of sump pumps shall be shown on the Development Plan for each building served having a basement or crawl space. Storm sewer service lines from that point shall be provided to the storm sewer system in accordance with the Standard Detail.

Buildings shall be positioned on lots and the lots graded to drain away from the building to the lot line swales or ditches, which shall merge as quickly as possible and then discharge into a storm sewer. The route of flow of storm water away from each building into swales, ditches, and storm sewers, to where it leaves the site, shall be shown on the engineering plans.

Downspouts shall not drain directly onto paved surfaces intended for pedestrian or vehicular use. On single-family residences, downspouts shall be directed to the front or rear property lines and shall discharge a maximum of 9 feet from the building foundation, or as approved by the Village Engineer. Downspouts located at the middle of the home shall also be directed to front or rear property lines, and not pointed towards neighboring properties. Splash blocks are required on all downspouts and shall be directed towards on-site drainage swales or other infiltration practices. Where necessary, downspouts shall be connected to underground piping with a minimum 4-inch vertical air gap and discharge at a 'pop-up' emitter. Pipe shall be PVC SDR 26 conforming to ASTM D-3034 and Pop-up emitters shall terminate at a maximum of 9 feet from all foundations, or as approved by the Village Engineer.

G. DESIGN FLOW

Design flow used in sizing storm sewers and flow ways shall be the sum of the runoff determined as described herein plus the permitted release rate from any existing storm water detention facilities tributary to the point under consideration.

H. CONVEYANCE

1. Swales

All swales bottoms shall have a minimum width of 18 inches, must be sodded, and limited to a maximum water depth of 12 inches. Maximum side slopes of swales shall not be steeper than 3 feet horizontal to 1 foot vertical with a minimum longitudinal slope of 1.5 percent.

Underdrains may be required by the Village Engineer.

2. Open Channels

(a) Open channels in nonresidential areas may be provided subject to approval of the Village Engineer in lieu of enclosed storm sewer pipe when the channel will be draining large areas

(b) All open channels located within a development or in right-of-way or easements within 150 feet of the development shall be improved as follows:

(1) Maximum side slopes of channels shall not be steeper than 3 feet horizontal to 1 foot vertical with a minimum 1 foot bottom width.

(2) Underdrains, paved inverts, or other flow line protection measures may be required by the Village Engineer in channels with minimal slopes.

(3) The sides shall be stabilized with approved vegetation or structural measures, as approved by the Village Engineer.

(4) An easement for drainage, access, and public utilities, extending no less than 15 feet from the top of bank, shall be provided along open channels with a width adequate to include the area covered by the limits of a 24-hour, 100-year storm event.

(c) No open channel shall be permitted within 30 feet of a habitable residential structure as measured from the top of bank.

(d) Open channels shall be designed such that the high-water level from the 24-hour, 100-year storm event shall be at least 2 vertical feet below the lowest entry elevation of adjoining buildings.

(e) The Village Engineer may require that the channel be concrete lined to reduce maintenance costs and retain conveyance capacity.

(f) Where an existing waterway traverses a proposed development, the waterway and shoreline shall be cleared of obstructions and the shoreline shall be stabilized to create a stable cross section. Permits from regulatory agencies to perform this work shall be obtained by the developer.

(g) No open channel shall be permitted to be enclosed with a storm sewer unless approved by the Village Engineer. Hydrologic, hydraulic, and storage volume

calculations shall be provided by the developer as required by the Village Engineer.

3. Driveway Culverts

In areas where there is no storm sewer system, the Village Engineer may permit an open channel storm water drainage system with sodded swales and driveway culverts. Culverts shall be reinforced concrete pipe sized to convey the critical duration 25-year storm event with a minimum diameter of 12 inches. The culvert profile shall provide a minimum 8 inches of cover from the top of pipe to the pavement surface. Culvert length shall be sufficient to provide maintainable side slopes with a flared end section or headwall.

I. STORM WATER DETENTION REQUIREMENTS

1. General

Storm water detention is required for all development resulting in 1,000 square feet or more of new impervious surface area. Stormwater detention facilities shall be constructed during the initial phases of construction of a development. All detention systems shall be fully functional before any new impervious surface is constructed, or proposed building foundations are constructed.

2. Release Rate

The release rate of storm water for the 100-year storm event shall not exceed the storm water runoff from the area in its natural undeveloped state and shall not be greater than 0.15 cfs per acre. The release rate of storm water for the 2-year storm event shall not be greater than 0.04 cfs per acre.

3. Design Standards

The required detention storage volume must be a minimum of 100 percent of the calculated amount necessary to detain the runoff of the critical duration 100-year storm event, from the fully developed drainage area tributary to the reservoir, less that volume discharged during the same duration at the approved release rate.

All above ground detention basins shall be located such that the design high water level is a minimum of 10 feet from any property line, structure, and right-of-way. Underground detention shall be constructed a minimum of 10 feet from any existing or proposed building foundation in undisturbed earth.

Roof detention, infiltration trenches, and “under-building” storage is prohibited.

Streets or homes built adjoining storm water management facilities in flood prone areas shall meet the requirements of all current flood plain regulations.

If the Village elects that storm water management basin ownership shall remain with the Developer or property owner's association, the responsibility for the long-term operation and maintenance shall be identified in a written agreement with a copy being retained in the office of the Village Engineer or as noted on the Subdivision Plans. The fully executed long-term operation and maintenance agreement shall be submitted to the Village prior to

approval of project plans. Easements shall be provided for the inspection and emergency maintenance of all privately maintained facilities by the Village Public Works Department at the property owner's expense in case of failure to properly maintain the facility. Agreements and easements are to be included as part of the final plan submittal and Plat of Subdivision and properly recorded against the property.

A water quality treatment structure, type and size to be approved by the Village Engineer, shall be provided for all underground detention systems on all properties that are 0.5 acre, or larger in size.

All privately maintained underground detention facilities shall be inspected and cleaned a minimum of once per calendar year at the property owner's expense. A written inspection report and photographs or video evidence of the condition shall be provided to the Village Engineer demonstrating compliance. Property owner shall provide a notice of intent to perform any maintenance work identified by a specific date to be approved by the Village Engineer.

4. Residential Development

Where the development of a single residential property occurs the proposed stormwater detention system may include the following types of gravity drained stormwater detention facilities:

Surface stormwater detention. For detention on single family lots, the maximum water depth in dry detention basins shall not exceed 1 foot in depth; otherwise another suitable means for the detention requirements shall be utilized. No vertical walls will be permitted, and the maximum side slopes shall be 5:1. A restrictive covenant is required to be recorded for this type of stormwater management facility.

Permeable pavers. Detention volume shall be credited for installations conforming to the MWRDGC permeable paver standard for volume control. A restrictive covenant is required to be recorded for this type of stormwater management facility including long-term operation and maintenance requirements. The design engineer shall inspect and certify the elevation and area of the infiltration zone, the gradation of aggregate used, and as-built volume created.

Underground detention systems. Detention chambers may be constructed of pre-cast concrete, cast-in-place concrete, sewer pipe, and arc-chamber systems. Metallic materials shall not be permitted. Underground storage chambers are to be clearly labeled on Engineering plans as "Private Stormwater Storage Chamber". Sewer pipe connecting the building to the chamber shall be backfilled with bentonite to prevent migration of water along the trench. Access ports shall be constructed to permit access to all areas of the system for maintenance. A sump and access port shall be provided a the location of the incoming sewer pipe. A restrictive covenant is required to be recorded for this type of stormwater management facility including long-term operation and maintenance requirements. The design engineer shall inspect and certify all critical elements of the system and as-built volume created.

5. Detention Outlet

The outfall system shall include the outfall structure and the outfall sewer conveyance system. The outfall shall meet all requirements for storm sewer and appurtenance and shall operate by gravity unless otherwise approved by the Village Engineer.

Restrictors for detention basins serving residential property shall have a minimum 1.5 inch diameter and shall be easily accessible for cleaning and maintenance. Restrictors for other uses shall conform to MWRDGC Standard Details. The maximum discharge capacity of an outlet structure shall be its flow capacity with water in the reservoir at the design high water level and the water in the downstream receiving sewer at the crown of the sewer or, in the case of a surface receiving channel, with the water level at the hydraulic gradient under design storm conditions. An approved overflow shall be designated at 0.1 feet above design high water. Other edges of the detention area shall be 0.5 feet minimum above design high water to direct any overflow to the designated overflow.

6. Secondary Benefits

The design of storm water management facilities for low annual maintenance costs and to provide secondary aesthetic, recreational, and other benefits is encouraged. Approval of the design for such benefits shall consider protecting the public health, safety, and adjacent property values.

7. Storm Water Pumping Facilities and Force Mains

If necessary, for commercial or industrial properties, pumping facilities shall be designed in accordance with sound engineering practice and the detailed requirements of the Village Engineer. Standby power systems shall be required.

8. Control Facilities

When required by the Village Engineer for those pumping facilities where satisfactory performance is considered particularly critical, telemetering control and report back capability to the Village Public Works Department will be required.

9. Guard Rails and Fencing

All sharp or vertical breaks in grade at inlet and outlet structures shall be protected with guard rails or fencing with a locking gate.

10. Willow Trees

All existing willow trees within 75 feet of any proposed storm water facility or pipe shall be removed. If willow trees are not located on the property to be developed, the developer shall use their best efforts to obtain approval from the appropriate property owner for their removal. If the removed willow tree is the only tree within 1,000 square feet it shall be replaced with a minimum 3 inch caliper tree planted within the property limits.

J. MATERIAL SPECIFICATIONS

All storm sewer system elements shall conform to the following specifications:

1. Sewer Pipe

   (a) Sump pump service and sewer service pipe under 12 inches diameter shall be PVC SDR 26 ASTM D-3034 or Ductile Iron Class 52 pipe.

   (b) PVC storm sewer pipe shall be SDR 26 ASTM D-3034 or equivalent.

   (c) Reinforced concrete pipe (12-inch diameter and larger), circular reinforcement, minimum Class III, ASTM C76.

   (d) Reinforced concrete arch culvert pipe - double line reinforcement, minimum Class III, ASTM C506.

   (e) Reinforced concrete elliptical culvert pipe - minimum Class HE-III or VE-III, ASTM C507.

   (f) PVC underdrain pipe – PVC SDR 26 ASTM D2729.

2. Sewer Pipe Joints

   (a) PVC pipe – ASTM D3212, push-on type, except underdrain pipe, which shall have solvent, welded joints.

   (b) Reinforced concrete pipe shall have ASTM C443 O-ring gaskets.

   (c) Reinforced concrete arch or elliptical pipe – ASTM C877.

3. Casing Pipes

   Circular steel casing pipe shall conform to the approved and permitted plans. Stainless steel casing spacers and rubber end seals are required on all installations. Record drawings are required for casing location and elevation.

4. Manholes and Structures

   (a) Precast circular reinforced concrete structures – ASTM C478 and ASTM C443. All sections shall be tongue and grooved and sealed with butyl rubber joint sealant.

   (b) Control Structures must have a minimum of 10-inches of clearance between the top of the baffle wall and bottom of the concrete flat top structure.

   (c) A minimum of 4-inches of bedding stone shall be provided under the proposed structure.

   (d) Structures shall be sized in accordance with National Precast Concrete Association recommendations and the following:

- Single pipe inlet structures may be 24 inch inside diameter to a maximum depth of 4 feet.

- Minimum inside diameter of other structures shall be 48 inches inside diameter.

(e) Adjustment:

A minimum of 2 inches of precast adjusting rings shall be installed on every structure. No more than 3 adjusting rings with an 8-inch maximum height adjustment shall be allowed. Two butyl rubber sealant strips shall be installed between adjusting rings, the structure, and the casting.

(f) Pipe connections:

- All pipe connection openings shall be precast with mastic watertight pipe to manhole seals. External flexible watertight sleeves may also be used from the manhole cone to the manhole frame.

Or

- All pipe connection openings shall be precast and sealed with concrete brick and hydraulic cement in a workmanlike manner.

(g) Bottom sections:

- All bottom sections shall be precast concrete.
- Concrete benches shall be poured in all inverts to eliminate standing water.
- Catch basin sumps shall be 30 inches.

(h) Top Sections:

- Cone sections shall be eccentric and have a 3-inch integrally cast concrete collar.

5. Castings

(a) Manhole frames shall be Neenah R-1713 in pavement or R-1772 in turf areas, or equivalents. Solid covers shall be embossed “STORM SEWER” with concealed pickholes.

(b) All open grate castings shall be embossed “DUMP NO WASTE”.

(c) Curb and gutter inlet frames shall be Neenah R-3275, or equivalent.

(d) Yard inlets shall be Neenah R-4340-B, or equivalent.

(e) Parking lot inlets shall be Neenah R-2502, or equivalent

(f) “Vane” type open grates shall be utilized in gutter sections roadway to improve the hydraulic capacity where dictated by flow calculations.

(g) ADA compliant grates are required when installed within the limits of a pedestrian crosswalk.

6. Headwalls and Flared End Sections

Storm pipe discharging to a waterway or detention basin shall terminate at a reinforced concrete headwall with wing walls or with a precast concrete flared end section as approved by the Village Engineer.

Flared end sections shall be installed with precast concrete toe blocks and shall be joined to the adjoining pipe segment with 2 tie rods. Steel grates shall be provided for all flared end section 18 inches and larger.

Grating shall be installed on all headwalls for storm sewer pipe 18 inches and large and as approved by the Village Engineer.

7. Underground Detention Systems

Pre-cast, or cast-in-place, reinforced concrete only.

K. CONSTRUCTION REQUIREMENTS

Storm sewer and storm water management facilities shall be constructed in accordance with the Standards listed in this section. Where there is conflict between standards the more restrictive requirement shall govern.

All newly constructed structures shall be cleaned of any accumulation of silt, debris or foreign matter of any kind and shall be free from such accumulations at the time of final inspection.

L. INSPECTION AND TESTING

1. CCTV Inspection

Upon completion of construction but prior to initiation of the maintenance guarantee period, or as deemed necessary during the construction of the storm sewer, an internal inspection of the sewer shall be performed. CCTV footage and a written report of all CCTV inspections conforming to NASSCO standards shall be provided to the Village prior to connecting individual services and prior to the initial acceptance required by these Standards. The form of the report and format of the video footage shall be approved by the Village Engineer. The video shall be high quality and resolution, and the report shall explicitly identify all sags, connections, and defects.

2. Deflection Testing

Deflection testing of new flexible sewer shall be performed in accordance with the "Standard Specifications for Water and Sewer Construction in Illinois" or as approved by the Village Engineer.

M. RECORD DRAWINGS

Prior to acceptance of the Storm Sewer and Drainage systems, Record Drawings shall be submitted to the Village in electronic and hard copy formats as approved by the Village Engineer. The Record Drawings shall indicate all structure locations, the size, length, slope, and material of all sewer lines, and shall be certified as to accuracy by an Illinois licensed Professional Engineer or Illinois licensed Professional Land Surveyor. See As-Built Checklist for required format of As-Built submittals.