

APPENDIX B
CHICAGO DEPARTMENT OF WATER MANAGEMENT
SUPPLEMENTAL DOCUMENTS

CITY OF CHICAGO - DEPARTMENT OF WATER MANAGEMENT

2016 REGULATIONS FOR SEWER CONSTRUCTION AND STORMWATER MANAGEMENT

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City of Chicago
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**Department of Water Management
Regulations for Sewer Construction
and Stormwater Management**

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CHAPTER I – GENERAL

1.0 AUTHORITY

These Regulations are promulgated by the City of Chicago DWM pursuant to authority granted by Sections 2-106-040, 11-16-300, 18-29-110 and 11-18-110 of the Municipal Code.

1.1 ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in these Regulations. Except where the context requires otherwise, terms defined in Section 11-18-020 of the Chicago Stormwater Management Ordinance have the same meaning when used in these Regulations. See Appendix I.

ADA	Americans with Disabilities Act
ASTM	American Society of Testing Materials
BMP	Best Management Practice
CDOT	City of Chicago Department of Transportation
cfs	Cubic foot per second
CIP	Cast Iron Pipe
City	City of Chicago
DOB	Department of Buildings
DIP	Ductile Iron Pipe
DWF	Dry Weather Flow
DWM	Chicago Department of Water Management
ECP	Erosion Control Plan
EPA	U.S. Environmental Protection Agency
ESVCP	Extra Strength Vitrified Clay Pipe
ft ²	Square foot
ft/s	Feet per second
ft ³ /s/acre	Cubic foot per second per acre
HWL	Highwater Level
ID	Inside Diameter of Sewer
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
ISWS	Illinois State Water Survey
MS4	Municipal Separate Storm Sewer System
MWRDGC	Metropolitan Water Reclamation District of Greater Chicago
NRCS	National Resource Conservation Services
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OD	Outside Diameter of Sewer
Ordinance	Chicago Stormwater Management Ordinance, Chapter 11-18 of the Municipal Code

PVC	Polyvinylchloride
RCP	Reinforced Concrete Pipe
RCRA	Resource Conservation Recovery Act
TARP	Tunnel and Reservoir Plan

CHAPTER II - SEWER REQUIREMENTS AND STANDARDS

PART 1 APPLICABILITY

Chapter II of these Regulations provides general design requirements and standards for sewer construction within the City.

PART 2 DESIGN SUBMITTALS FOR DEVELOPMENTS ON PRIVATE PROPERTY

2.0 PLAN REQUIREMENTS FOR NON-REGULATED DEVELOPMENTS

Plans requiring the review and approval of the DOB must provide sufficient information to convey the intent of the design for construction. As a minimum, plans must include the following information.

- a. A clear site location map showing the site, north direction, local streets, alleys, right-of-ways and easements.
- b. A brief description of the proposed development including existing and proposed land use.
- c. A detailed site plan showing the following information.
 - Building structures and fences
 - Roadways, parkway lots, driveways, sidewalks and other impervious surfaces
 - Pervious area including but not limited to grass and dirt
 - Adjacent roadways, ponds, channels or flood plains
 - Surface flow and grading directions
- d. Proposed sewers, sewer structures and cleanouts shall be shown on the plans. The details of such features shall include the following.
 - Size, and approximate location of city sewer
 - Connection location(s)
 - Sewer sizes, lengths and minimum slopes
- e. The location of all building downspouts shall be shown in the plans. Downspouts shall be splashed to landscaped areas, where possible.

2.1 ADDITIONAL REQUIREMENTS FOR REGULATED DEVELOPMENTS

In order to verify proper implementation of BMPs, a detailed grading and drainage plan accurate to within 0.01 feet must be submitted as part of the Plan for a Regulated Development. See Chapter III, Section 3.9- Submittals. In addition to the required information set forth in Section 2.0 of this chapter, the following information described in Sections 2.1.1, 2.1.2, and 2.1.3 must be included as part of the stormwater management plan.

For sites larger than or equal to 15,000 square feet, plan elevations shall be based on the City Datum, or for sites less than 15,000 square feet, relative grades are allowed but shall have a datum correlation to the City Datum.

2.1.1 PLAN REQUIREMENTS

For Regulated Developments, the Plan submittal shall include but not be limited to the following. All plan sheets shall include a North arrow and a graphic scale with plan information presented accurately at a standard engineering scale (1"=5', 1"=10', 1"=20', 1"=30', 1"=40', 1"=50', 1"=60', or 1"=100'). All plan sheets shall be 24"x36" maximum sheet size. If full-sized plans are larger than 24"x36", provide scaled half-sized sets. All plan sheets shall include a title block indicating the project name and street address, name and address of the designer, sheet title, sheet number, original drawing date, and revision dates.

C-1 COVER SHEET

- Indicate project title, project information, and street address of the site.
- Show location map of the project site with North arrow.
- Provide required City benchmarks with City reference number (see above for datum requirements).
- Include title blocks for Architect, Engineer, Owner and/or Developer with address and telephone numbers for each
- Provide sheet index.
- Provide Digger symbol and Handicapped signature block with notes required by CDOT including Duty to Indemnify statement.
- Provide legends for abbreviations and symbols.
- Provide signature and seal of licensed design professional.

C-2 TOPOGRAPHIC AND UTILITY SURVEY

- Indicate property lines and limits of proposed construction.
- Identify all streets, alleys, crosswalks, and sidewalks and indicate their width.
- Identify type of curb & gutter, driveways, ADA ramps with existing elevations throughout shown in enough detail to evaluate compliance with CDOT ADA Standards unless sidewalk or ramp removal and replacement is proposed.
- Identify sewer structures with rim and invert elevations.
- Indicate pipe sizes, material, and direction of flow.
- Show existing buildings and structures.
- Show contour lines or detailed spot elevations to fully describe topography.

C-3 DEMOLITION PLAN

- Topographic and utility survey provides the background of the plan.
- Show all demolition of pipes and sewer structures. If a pipe is abandoned in place, indicate method for plugging ends or filling with flowable fill.
- Identify items to be salvaged and what to do with them.
- Show all demolition of curb & gutter, pavement, sidewalk, etc.
- Indicate all items to be relocated.
- Indicate all other structures to be demolished.

C-4 GEOMETRIC PLAN

- Provide dimensions for property lines, buildings, parking lots, pavement markings, handicapped parking stalls, and other on-site features.
- Provide dimensions for driveways, alleys, streets, curb radii, pavement markings, curb ramps, and other features in the public right-of-way.
- Show CDOT required 12-foot sight triangles at driveways.
- Do not show demolished items on this plan.
- Show a line delineating the limits of construction.

C-5 GRADING PLAN

- Show proposed grades and contour lines in bold and existing grades and contour lines to remain in half-tone.
- Existing grade information at property lines.
- Existing grade information should extend at least 10 feet beyond property lines or as required by site design.
- Show curb & gutter, sidewalk, finished floor, pavement, ground, and other elevations necessary to completely define the proposed grading.
- Delineate the limits of ponding for surface detention by indicating the High Water Level (HWL) location and elevation.
- Identify sewer structures with rim elevations.
- Show overflow (overland flood route) location and elevation, typically indicated with large arrows.
- Show direction of surface drainage where needed, typically indicated with small arrows.
- Show a line delineating the limits of construction.
- Identify permeable pavement, drainage swales, bioinfiltration systems, rain gardens, impervious area, landscape area, any other BMPs, etc.
- Provide separate large-scale plan view details of curb ramps, alley returns, and driveways with detailed grading to demonstrate compliance with the latest revision of the CDOT ADA Standards.

C-6 UTILITY PLAN

- Show existing sewer pipe and structures in half-tone. Do not show demolished items on this plan sheet. Show size of existing sewer mains.
- Show all proposed underground utilities in bold.
- Indicate sewer pipes with length, size, slope, material, and direction of flow.
- Indicate proposed sewer structures with sequential number, structure type, structure size, rim elevation, and invert elevation.
- Indicate location, type, and size of restrictors.
- Delineate footprint of detention vault, and show necessary elevations.

- Show proposed sewer connections with the invert of the proposed connection and the invert of the existing sewer main at the connection point.
 - Indicate vertical separation of sewer and water lines with elevation at all utility crossings.
 - Show existing sewer drain stubs to be reused or abandoned.
- C-7 EROSION AND SEDIMENT CONTROL PLAN
- Show temporary erosion and sediment control measures applicable to the project.
 - Indicate proper maintenance schedule for each erosion and sediment control measure.
 - Show applicable details such as silt fence, inlet protection, construction entrance, temporary sediment basin, sediment bags, erosion control blanket, ditch checks, etc.
- C-8 OPERATIONS AND MAINTENANCE PLAN
- O & M Plan shall be prepared according to Chapter III, Part 6 of these Regulations and the *Stormwater Management Ordinance Manual*, Part 5 and Appendix C, latest revision.
 - Include signed and notarized Owner's Certification Statement, Appendix II-A Sheet A.108.
 - Label all stormwater BMPs. Indicate the type, size, and location of restrictors. Show sewer pipes with pipe size and material.
 - Delineate High Water Level (HWL) of all areas of surface ponding with maximum depth of ponding.
 - Indicate overflow location.
 - Include maintenance guidelines from the *Stormwater Management Ordinance Manual*, Appendix C as plan notes. These are the minimum maintenance requirements.
 - Include minimum design requirements from Chapter III, Section 6.2 of these Regulations as plan notes.
- C-9 STORM AND SANITARY SEWER DETAILS
- Provide all applicable sewer details from these Regulations including but not limited to catch basins, manholes, and sewer connections.
 - Indicate elevations and dimensions where required to complete the details, such as orifice diameter and invert on Appendix II-A Sheet A.19.
 - Show site specific detail of the catch basin with the restrictor, or clearly indicate on the Utility Plan the upper and lower invert of the half-trap, the inverts of any incoming pipes, etc. See Standard Drainage Structures for Private Development, Appendix II-A Sheet A.19.
 - Provide a cross-section of each volume control BMP indicating depth, gradation, and composition of each layer as required to fully describe the BMP.
- C-10 CIVIL (CDOT) DETAILS
- Provide the latest revision of all applicable CDOT details and all applicable CDOT ADA Standards.
 - Provide separate large-scale plan view details of curb ramps, alley returns, and driveways with detailed grading to demonstrate compliance with the latest revision of the CDOT ADA Standards. These may be provided on a Civil Detail Sheet or as a separate detail on a Grading Plan.

2.1.2 STORMWATER CALCULATIONS AND OTHER DOCUMENTATION

One hard copy of each of the following items shall be provided with each submittal.

- Provide a scaled copy of the sewer atlas maps showing watershed areas delineated for each sewer segment analyzed, unless standard maximum release rate is used.
- Provide a scaled copy of the drain atlas maps for the same area.
- Provide rate control and volume control calculations in the latest revision of the Chicago Stormwater Spreadsheet Tool including only the pages that are applicable to the project. Rate control sections can only be used for sites smaller than 20 acres.
- Provide scaled exhibit drawings of pervious and impervious areas, off-site areas, impervious areas tributary to volume control BMPs, etc. as necessary to clarify calculations.
- Provide calculation of allowable release rate using Tab 0.0 of the spreadsheet tool unless another calculation method is required or unless the standard maximum release rate is used.
- Provide orifice sizing calculation using Tab 1.3 of the spreadsheet tool unless another calculation method is required. Vortex restrictors do not require sizing calculations.
- Provide calculation to demonstrate the rate control volume provided in the detention facilities.
- Provide geotechnical report with soil borings and a written analysis of the groundwater elevation when volume control BMPs or underground detention vaults are proposed.
- Provide percolation test data using single ring or double ring infiltrometer method as described in the *Stormwater Management Ordinance Manual*, if an infiltration rate of 0.5 in/hr or greater is used in the calculations.
- Provide Appendix II-C Affidavit in Support of Soil Erosion and Sediment Control Measures, signed and submitted as a .pdf file, if the site does not discharge to Waters.
- Provide Appendix II-B Affidavit in Support of Stormwater Infiltration or At-Grade Discharge of Downspouts on Residential Buildings, signed and submitted as a .pdf file, if the plan proposes infiltration or residential buildings that discharge downspouts to grade.
- Provide storm sewer capacity calculations for large sites that provide the 100-year flood route through the sewer system.
- Provide roof plans and interior plumbing plans, as applicable to roof detention and interior vaults, respectively.
- Provide landscape and green roof plans, as applicable.

2.1.3 ELECTRONIC FILES

At the conclusion of the review process, the stormwater reviewer will contact the designer to inform him/her that the plans and calculations are acceptable. The designer must then submit the approved plans, calculations, and any required soil borings, affidavits, or other documentation required during the review process in electronic format for the DWM permanent archive. After this information is received, DOB can then issue the design approval.

The plans submitted in electronic form must be signed and sealed by a Professional Engineer or Licensed Architect. The plans and affidavits must include all required signatures.

Plans must be submitted in *.TIF format. All other documentation shall be submitted in *.PDF format. The following file naming conventions shall be followed:

File Name:

“Street Address”-“Descriptive Suffix”

Where:

“Street Address” is the legal street address of the site using standard Postal Service abbreviations such as “N”, “S”, “E”, “W”, “St”, “Ave”, “Pl”, “Ct”, etc. Periods shall be omitted from the street address.

“Descriptive Suffix” is one of the following or similar suffixes:

- “vac” for street vacation documents
- “cov” for covenant documents
- “ease” for easement documents
- “plan” or “plan 01” or “plan C-01” with sequential numbering for design plans
- “asbuilt” for as-built plans
- “specs” for specifications
- “geotec” for geotechnical reports, soil borings, etc.
- “o+m” for operations and maintenance plans
- “aff” for affidavits
- “calc” for stormwater calculations including spreadsheet tool, reports, maps, etc.

Example File Names:

1000 E Ohio St-calc

121 N LaSalle St-geotec

120 N Racine Ave-o+m

PART 3 REQUIREMENTS FOR DEVELOPMENTS ON PRIVATE PROPERTY

3.0 APPLICABILITY

The design requirements discussed in this section apply to all developments outside of the public right-of-way.

3.1 GRADING AND DRAINAGE REQUIREMENTS

General requirements for site grading are as follows:

- To the extent possible, no sheet flow or discharge of stormwater will be allowed to adjacent private property.

- Overflows must be directed to the street where sewers and sewer structures are available. Where this is not possible, an underground overflow to convey the 100-year peak discharge to the public sewer may be allowed.
- No more than 400 square feet of contiguous at grade impervious area must sheet flow directly to the public right-of-way.
- No more than 1500 square feet or 5 foot wide strip of contiguous at grade pervious area must sheet flow directly to the public right-of-way.
- Runoff from a public alley or street must not be allowed to sheet flow into the site.
- Minimum gutter slope shall be 0.4%.
- Minimum slope on pavement shall be 1.0% (e.g. parking lot).
- Minimum slope in drainage swales shall be 0.5%.

For gas stations, outside areas not more than 5000 square feet, when not drained to a drainage structure, shall have any impervious area sloped toward an equivalent amount of pervious area or street gutter connected to a public sewer to avoid spilling or the discharge of water onto adjoining property.

3.1.1 DISCONNECTION OF DOWNSPOUTS

In accordance with the plumbing provisions of the Municipal Code, Article XI, Section 18-29-1101.2.3, the disconnection of roof downspouts is encouraged, when feasible. Downspout flow must be directed to the public right-of-way without causing a safety hazard or nuisance to adjacent properties or be collected by an on-site storm water management system, as required. On residential developments where downspout disconnection is proposed, the DWM's affidavit form in support of the disconnection must be signed and submitted with downspout locations shown on the plan. The affidavit form is provided in Appendix II-B.

3.1.2 BY-PASS FLOWS

Flows generated upstream of a Regulated Development may be by-passed through or around the BMPs provided that means of conveyance to the public right-of-way and the right-of-way itself can safely accommodate such flow for all storm events up to and including a 100-year magnitude.

If the by-flow is routed through a storm water detention system, such system must not overflow to the public right-of-way for storms of less than a 25-year magnitude based on the maximum release rate of the developed site. Additional on-site storage must be provided to prevent such 25-year overflows. However, if the upstream area approximates that of the Regulated

Development, the maximum release rate to the public sewer system may be adjusted higher to prevent such 25-year overflow, but not more than the existing discharge rate to the sewer system.

3.1.3 SUNKEN DRIVEWAYS

Sunken driveways are driveways that slope down to a below-grade building level. Developers must assume full responsibility for the design and construction of a project and therefore must ensure that such design and construction will not create a flooding or safety hazard to the occupants of the subject property or to the public.

As part of the City's Rain Blocker Program (inlet control), the public right-of-way, outside of the Central Business District, is used to store rainwater. As such, any proposed driveway sloping down to a below-grade building level must prohibit the entrance of any storm water runoff emanating from the public right-of-way and/or adjacent properties.

Submittal requirements for sunken driveway review include a topographic survey signed and sealed by a professional engineer or professional land surveyor including the site and sufficient surrounding area to establish the overflow locations and elevations in the gutter line of the street. Overflow elevations in the right-of-way must be shown relative to the driveway/sidewalk elevation where water may enter the building. Design requirements for sunken driveways are as follows:

Overflow elevations in the right-of-way must be at least one (1) foot vertical clearance below the driveway/sidewalk elevation where water may enter the building, or a detailed hydrologic/hydraulic analysis of the potential area tributary to the driveway must demonstrate sufficient clearance as calculated from a 100-year high water level in the right-of-way. In addition, hydrologic/hydraulic calculations must demonstrate that sufficient clearance is provided from the surface of water flowing in the gutter line to the driveway/sidewalk elevation where water may enter the building. Means of alleviating flooding by way of mechanical pumping of runoff from the right-of-way or modifications to the City's Rain Blocker Program will not be allowed. Proposed driveway and adjacent sidewalk must also conform to current IDOT, CDOT, and ADA design standards.

3.2 SEWER PIPE REQUIREMENTS

3.2.1 SEWER PIPE MATERIAL

Sewers constructed in sizes 21 inches in diameter and smaller must be ESVCP, ASTM Designation C-700 with C-425 joints; DIP, class 52 or equivalent, with push on self-contained, pre-lubricated gaskets or mechanical joints; or CIP, with hot poured pure lead firmly packed with oakum or hemp. See Section 18-29-702.3 and 18-29-1102.4 of the Municipal Code of Chicago.

CIP or DIP must be used under building structures. If the sewer size is less than 24 inches in diameter and the cover is less than 3 feet, then CIP or DIP must be used. DIP encased in polyethylene wrap is the only type of iron pipe allowed for City sewers. Other means of corrosion protection for iron pipe may be considered for private sewers.

In conformance with IEPA requirements, the horizontal clearance between a waterline and sewer must be 10 feet edge to edge. If a sewer and waterline (i.e., main or water service) have less than 10 feet of horizontal clearance, then DIP must be used if the sewer is less than 18 inches below the waterline. Furthermore, if the sewer is above the waterline, DIP must be used. CIP is not allowed in the right-of-way.

RCP must be used for sewers 24 inches in diameter and larger, unless prior approved by the DWM. ASTM Designation C-76, Class-III, Wall-B with O-ring type joints is the minimum requirement for this type of pipe. If self-lubricating gaskets are used, the physical properties of the gaskets must conform to ASTM C-361. RCP may not be used for pipe 21 inches in diameter and smaller, inside or outside the private property.

No plastic pipe may be used for any underground sewer or drain inside or outside the property, except as specifically allowed by the Municipal Code of Chicago. The Municipal Code of Chicago, Section 18-29-702.3 and 18-29-1102.5, Subsoil Drain Pipe, allows (1) PVC pipe - ASTM D2729 (type Sewer Pipe, PS25, PS50 and PS100); or (2) PVC perforated subsurface drain pipe, ASTM F 891 with an encasement of non-woven filter fabric filled with CA-7 (filter fabric shall have a clearance of 4 inches minimum from the outside of the perforated pipe), ASTM D 3034, SDR 35 (4 inch to 15 inch). No corrugated subsoil drain pipe is allowed.

The following alternative pipe materials shall be allowed only for non-conveyance stormwater Best Management Practice (BMP) applications, according to the Municipal Code of Chicago, Section 18-29-702.3: (1) High Density Polyethylene (HDPE) ASTM F 2306 and ASTM F 2648; (2) Polypropylene (PP) ASTM F 2418, ASTM F 2736, ASTM F 2764 and ASTM F 2787; (3) Aluminized Steel Type 2 ASTM A 929. HDPE flat drains are allowed when used as perforated underdrains in stormwater BMPs.

3.2.2 SEWER PIPE SIZES

Storm and combined sewers shall be designed to convey at least a 5-year storm event without surcharge. Since dedicated detention facilities are typically designed for the 100-year event, storm sewers under surcharge must be capable of conveying design flows to such facilities. The following are criteria for minimum sizes:

- Minimum size of a combined house sewer shall not be less than 6 inches in diameter.
- Minimum size of sanitary or storm underground sewers shall not be less than 4 inches in diameter on private property and 6 inches in diameter in the public right-of-way.
- Perforated underdrains shall be a minimum of 4 inches in diameter and shall discharge to catch basins

3.2.3 SEWER PIPE SLOPES

The minimum slopes on combined and storm sewers must maintain a minimum full flow velocity of 3.0 ft/s, when feasible. The minimum slope on sanitary sewers must maintain a minimum flow velocity of 2.0 ft/s, when feasible. Whenever possible, the maximum full flow velocities within sewer lines must not exceed 10 ft/s. The following tables illustrate minimum slopes needed to achieve 3.0 ft/s.

For Vitrified Clay Pipe:

6" = 0.79 %	15" = 0.24 %
8" = 0.54 %	18" = 0.20 %
10" = 0.40 %	21" = 0.15 %
12" = 0.32 %	

Reinforced Concrete Pipe*:

24" = 0.18 %	36" = 0.11 %	60" = 0.052 %
27" = 0.15 %	42" = 0.09 %	66" = 0.046 %
30" = 0.13 %	48" = 0.07 %	72" = 0.040 %
33" = 0.12 %	54" = 0.06 %	78" = 0.036 %

*The maximum slope on reinforced concrete pipe shall be 3.33 percent.

3.2.4 SEWER GROUND COVER

The minimum cover over a sewer pipe shall meet IDOT standards. However, a minimum of 3.0 feet of cover must be placed over ESVCP. Unprotected sewers conveying DWF must have at least 3.5 feet of cover to guard against freezing. Flat top structures must be specified where necessary and shall be approved by the DWM.

3.3 SEWER STRUCTURE REQUIREMENTS

Sewer structures consist of junction chambers, manholes, catch basins, inlets, area drains, and clean-outs. Structures, frames, and lids shall be of City standard design as shown in the Appendix II-A. IDOT structures and manhole risers may be used for oversized pipe as part of stormwater detention facilities. The re-use of existing sewer structures is subject to City approval. Photographic documentation of the condition of sewer structures to be re-used must be provided when requested by the City.

3.3.1 STRUCTURE SPACING

Pipes measuring 12 inches in diameter and greater must have a manhole or catch basin placed at each change in pipe size, material, elevation, or direction. For pipes measuring less than 12 inches in diameter, a clean-out may be used. The maximum length of a sewer between structures shall be:

- 6" to 10" diameter = 150 feet
- 12" to 54" diameter = 330 feet
- 60" diameter and larger = 660 feet

3.3.2 CATCH BASINS

Outside areas greater than 400 square feet and not more than 5000 square feet, when drained to sewers, must be connected to catch basins not less 3.0 feet in diameter with sumps not less than 3.0 feet below the bottom of the trap. Contact the DOB for standards.

Each outside area more than 5000 square feet must be provided with a catch basin not less than 4.0 feet in diameter. The catch basin must have a sump not less than 3'-4" deep below the bottom of the trap. See the Appendix II-A Sheet A.18 for details of the DWM standard catch basin for public streets. See the Appendix II-A Sheet A.19 for catch basin details for private developments. Larger drainage areas may be permissible in cases where stormwater detention is required as approved by the DOB.

A catch-basin-to-catch-basin connection is allowed for stormwater drainage in a private development where sanitary flow and storm flow are separated onsite. The last structure before a connection to a combined sewer must have a half-trap. If this requirement cannot be met, all other upstream catch basins must have a half-trap.

A minimum 6-inch diameter outlet is required from catch basins, except for catch basins in the public right-of-way, which require an 8-inch diameter outlet.

3.3.3 INTERCEPTING GREASE BASINS

Establishments that prepare and process food and all multiple dwelling buildings with over six dwelling units (exclusive of townhouses) must have grease basins. All waste from sinks, garbage grinders, dishwashers, discharge from kitchens and all process waste must be intercepted before reaching the public sewer system, in accordance with Section 18-29-1003.1 and 18-29-1003.3 of the Municipal Code of Chicago, except waste from industrial/commercial garbage grinders and dishwashers.

Such interception must be made by an intercepting grease basin or special catch basin of a design and construction approved by the DOB, and as shown in Appendix II-A Sheets A.19 and A.20, or an approved grease separator, where applicable.

The intercepting grease basin must be located outside of the building served, when feasible. Intercepting grease basins must be vented when constructed inside the building. Plans for the approved basins and information regarding approved types of grease separators are available from the DOB. Individual grease traps under kitchen sinks in town homes where the private

drains from the individual units connect to the main sewer lines outside the buildings are permitted. This rule applies to connections to private main sewers as well as public main sewers.

3.3.4 LINT BASINS

Lint basins are required when washing machines are used commercially or in multi-residential buildings with more than 15 commercial washing units in a dedicated area. See the Appendix II-A Sheet A.21.

3.3.5 INLETS, AREA AND TRENCH DRAINS

Inlets are not permitted in the public way, unless specifically approved by the DWM due to utility conflicts. Area drains may be used to drain an outside area 400 square feet or smaller. Trench drains will be allowed in locations where a standard circular grate is impractical or does not have sufficient capacity to accept a design flow. An intercepting structure (with a 2-foot minimum sump) or catch basin must be installed downstream of the trench drain.

3.3.6 OIL/WATER SEPARATORS

Impervious areas tributary to Lake Michigan that are exposed to vehicular traffic must have an oil/water separator installed before connecting to a Lake Michigan outfall.

Such interception must be made by an intercepting oil/water separator basin or special catch basin of a design and construction approved by DOB.

3.4 CONNECTIONS TO CITY SEWERS

All private drain connections to the City sewer must be made in the street or parkway. No new connections to an alley sewer are permitted. Existing alley connections may be reused only if it is not feasible to tie to a main sewer line in the street. A minimum spacing of 15 feet between private drain connections to the City sewer shall be maintained, where possible.

Connections to existing ESVCP sewers shall be made with a vitrified clay wye junction or a properly sized saddle. No break-in connections will be allowed to existing clay, concrete sewers or lined brick sewers. Connections to existing concrete sewers must be cored. All connections to brick sewers which comprise one-half or more of the brick sewer's diameter require a

reinforced concrete collared structural detail, approved by a Licensed Structural Engineer. City standard connections as shown in Appendix II-A Sheets A.1, A.2, and A.19 must be made.

3.4.1 SINGLE CONNECTIONS FOR SITES SMALLER THAN 0.5 ACRES

All sites less than 0.5 acres will be allowed only one combined connection (i.e., storm and sanitary) to the City's main sewer. A separate sanitary connection will be allowed only if site constraints prohibit a single combined connection. A separate sanitary connection to another main sewer may be considered if the DWF comprises a significant portion of the maximum release rate. See Section 3.4.5 of this chapter, Connection Sizing.

A new connection should be made to the same city sewer line as the existing connection. If the location of the existing connection is non-existent or unknown, then the connection should be made to the street where the majority of the site's frontage is situated. An exception is single lot sizes (i.e., 125' x 30') where the connection is made at the front

3.4.2 SINGLE CONNECTIONS FOR SITES LARGER THAN 0.5 ACRES

For sites 0.5 acres and larger, typically a connection to the largest sewer line is made to maximize use of the sewer system's capacity. Connection to a larger sewer line must be made if all of the following conditions are met:

- The site is larger than 0.5 acres and has access to a larger sewer.
- The smaller sewer is not an auxiliary sewer (i.e., 4 feet in diameter and larger).
- The larger sewer has a capacity that is greater than or equal to the smaller sewer, or the larger sewer is located on the street where the majority of the site's frontage is situated.

If the connection to a smaller sewer must be made due to site constraints (i.e., utility, structural conflicts, etc.), then the maximum release rate from the site (in cfs/acre) to the smaller sewer must be reduced by 20 percent, or to a minimum of 0.15 cfs, whichever is greater.

3.4.3 MULTIPLE CONNECTIONS

The number of connection(s) required is generally a function of the size of the site. The number of new connections to the city's main sewer shall be limited whenever possible to avoid the extra time and cost of construction within the street.

If a site is 1.75 acres or larger, two or more connections must be considered in splitting the total discharge rate in a manner that will best utilize the capacity of the sewer system. The percentage of the split in flow is typically based on a ratio of the capacities (in cfs/acre) of the main line sewers. However, in the case of a flow diversion (Chapter II, Section 3.6), the discharge from a development must not reduce an existing sewer segment's (manhole to manhole) capacity by more than a maximum permissible percentage. Note - special requirements for Regulated Developments using multiple connections are provided in Chapter III, Section 3.5.1.

3.4.4 RE-USE OF EXISTING CONNECTIONS

The possibility of reinstating an existing connection must be examined to avoid disruption of traffic in the street and structural disturbance to the city sewer. All existing connections must be televised in the presence of a DWM inspector and approved in order to be reused. The recording must be in DVD format (or VHS format if approved in advance) and submitted to the DWM for review and approval prior to reuse. When proposing a new connection to an existing on-site private sewer system, the downstream system must be televised in the presence of a DWM inspector and approved in order to be used.

3.4.5 CONNECTION SIZING

The DOB must approve the size of each sewer connection. The size of the connection must be minimized to limit the hydraulic and structural impacts to the City's main sewer. The DWM's criteria for sizing connections outside of a building differ from those listed in the Building Provisions of the Municipal Code of Chicago, which pertain only to the interior of a building. See Appendix II-D for Connection Sizing.

The size of a combined connection must accommodate the anticipated 100-year flow and the peak DWF. Sanitary only connections must not be restrictive of the peak DWF without prior design approval. Any connection should be at least two sizes smaller than the size of the main sewer in the street. If the anticipated discharge rate exceeds the full flow capacity of the maximum connection size allowed, then the connection must drain under pressure and additional onsite design measures must be considered to safeguard against flooding. A further reduction in the stormwater release rate in conjunction with greater onsite detention storage, or watertight downspouts must be considered; otherwise, the construction of a larger sewer in the street may be required.

3.5 DRY WEATHER FLOWS

With regard to Regulated Developments (See Chapter III), if the Development's average DWF exceeds 10 percent of its allowable release rate, the average DWF shall be considered stormwater for purposes of calculating the maximum release rate. In computing the required storage, the maximum stormwater release rate must be reduced to compensate for the undetained DWF (above the 10 percent limit).

If the average DWF exceeds the maximum release rate from the site, then a minimum discharge rate 25 gpm may be used to determine the storage requirement- A 3-inch vortex (0.15 cfs), in lieu of a 25 gpm pump, may be used, if Chapter III, Section 3.1.1 –Lot-to-Lot Buildings applies to create more storage capacity. However, if the proposed total direct discharge into the City sewer system exceeds the existing 5-year discharge rate, then a pumped discharge rate of 25 gpm may be required as directed by DWM.

3.6 FLOW DIVERSIONS

A flow diversion occurs when an existing connection to a main sewer line is relocated to another main sewer line that is not within the same drainage area of the original main line, or if a new source of water is introduced into the line such as with a vacant lot without sewers. If the existing connections to a site are unknown, it will be assumed that an existing connection was made to the street where the majority of the site's frontage is situated.

In general, flow diversions must be avoided whenever possible. However, in some cases, a flow diversion may be beneficial by increasing the capacity of a sewer line with poor capacity (less than 0.3 cfs/acre), while reducing it slightly in another with excess capacity (over 1.0 cfs/acre). If a flow diversion to a local sewer must be made due to site constraints, as in the case of a vacant lot, the following reductions in the stormwater release rate must be followed.

- If the existing capacity of the sewer segment where the flow diversion is being made is greater than 0.90 cfs/acre, then capacity of that sewer segment where the connection is made must not be reduced by more than 5 percent. Otherwise, the maximum rate of diverted flow must be reduced accordingly to meet the 5 percent limit, or to a minimum of 0.15 cfs, whichever is greater.

- If the existing capacity of the sewer segment where the flow diversion is being made is between 0.7 cfs/acre to 0.90 cfs/acre, then capacity of that sewer segment where the connection is made must not be reduced by more than 4 percent. Otherwise, the maximum rate of diverted flow must be reduced accordingly to meet the 4 percent limit, or to a minimum of 0.15 cfs, whichever is greater.
- If the existing capacity of the sewer segment to which the flow diversion is being made is less than 0.70 cfs/acre, then capacity of the sewer segment where the connection is made must not be reduced by more than 3 percent. Otherwise, the maximum rate of diverted flow must be reduced accordingly to meet the 3 percent limit, or to a minimum of 0.15 cfs, whichever is greater.

The above requirements for flow diversions are waived for sites less than an equivalent 0.5 acres or if the connection to a larger sewer is mandated, as discussed previously in Section 3.4.1 of this chapter. Both the large sewer connection and flow diversion penalties may apply.

PART 4 REQUIREMENTS FOR THE PUBLIC WAY

4.0 SEWER CONSTRUCTION

In areas where there are no existing City sewers to tie into or where property development will cause insufficient sewer capacity, the developer may be required to construct new sewer lines in the street at no cost to the City. The DWM, via the DOB, must review and approve all sewer work and appurtenant construction within the public right-of-way. Consult with the DWM for main design and construction requirements including rate control requirements that may apply. Requirements for construction are also listed in the Standard Sewer Specifications of Book 3, available upon request from the DWM.

4.0.1 RIGHT OF WAY AS-BUILT PLANS

As-built plans of new or replaced sewers in the public right-of-way must be submitted to the DWM Sewer Design Section within 30 days after completion of the project. The as-built plans must be sealed by a Professional Engineer or Registered Land Surveyor and be submitted with the form in Appendix II-A Sheet A.27. Plan and profile drawings of the sewers and sewer structures must be submitted on a compact disk in *.TIF format. All electronic files must be submitted in a file folder with one file name reflecting the addresses of the project, with street name first: (e.g. Jackson St. 300-500 S.) A hard copy of the as-built plans must also be submitted.

4.1 OTHER UTILITY CONSTRUCTION

4.1.1 CLEARANCE REQUIREMENTS

In the relocation or construction of private or public utilities, including pipe underdrains and/or subdrains, the utility must be located as far away as possible from the City sewer main and appurtenant sewer structures. A minimum horizontal distance of the inner diameter (ID) of the sewer plus 4.0 feet must be maintained between the centerlines of the sewer and the non-water utility, and outer diameter of the sewer (OD) plus 4.0 feet for any water utility. See Section 3.2.1 of this chapter for material requirements for sewers with less than 10 feet of horizontal clearance to a waterline. If the outside diameter/width of utility conduit is more than the sewer OD, a minimum of 4.0 feet horizontal clearance must be obtained from the outside face to outside face. Four feet horizontal clearance is also required from all sewer structures. A minimum of 18 inches vertical clearance from sewers and sewer structures is required for all

utilities. Any deviation from the aforementioned clearance requirements must have prior approval from the DWM -Design Section.

4.1.2 EXISTING FACILITIES PROTECTION

For any utility construction in the public right-of-way, the requirements set forth in the DWM 's "Existing Facility Protection" document, attached to these Regulations as Appendix II-E, must be followed.

CHAPTER III - REQUIREMENTS FOR STORMWATER MANAGEMENT

PART 1 GENERAL

1.0 APPLICABILITY

Chapter III of these Regulations provides standards and requirements applicable to Regulated Developments, as defined in the Chicago Stormwater Management Ordinance, Chapter 11-18 of the Municipal Code.

1.1 PROVISIONS FOR STORMWATER MANAGEMENT

Among its requirements, the Ordinance sets forth stormwater management provisions for rate control and volume control of stormwater applicable to all Regulated Developments. Also see DWM 's "Sewer Permit Requirements and Fees" booklet, latest edition.

PART 2 STORMWATER PLAN REVIEW

2.0 DESIGN SUBMITTALS

The DWM has designated DOB as its authorized agent to enforce compliance with the Storm water Management Ordinance and its associated Regulations. The initial Plan submittal must be signed by the Applicant and sealed by a Professional Engineer or Licensed Architect. The submittal must be made electronically through the DOB E-Plan system. Projects that require only stormwater review may be submitted in paper hardcopy format to DOB at the following address:

Department of Buildings
City Hall, Room 906
121 N. LaSalle Street
Chicago, Illinois 60602

A hardcopy submittal shall include one copy of the plans, one copy of the calculations, and a check for the stormwater review fee.

2.0.1 DESIGN REVIEWS

The Plan must show in detail that the Development will comply with the Ordinance and these Regulations. This showing includes but is not limited to: maximum release rate computations

with drainage area maps, volume and detention calculations, grading and drainage plans, operation and maintenance plans, and erosion and sediment control plans, and BMP details as applicable. See Chapter II, Part 2 for detailed plan submittal requirements.

Any questions regarding the status of a review should be directed to DOB stormwater reviewer. An Applicant may request a meeting with the DOB to discuss the project. The DOB will make reasonable efforts to accommodate requests for meetings. The Applicant must keep the DOB informed of project cancellation.

2.0.2 DESIGN VARIANCES

The Commissioner of DWM will consider variances in accordance with Section 11-18-080 of the Ordinance.

2.0.3 PLAN APPROVALS

When the stormwater reviewer determines that no further corrections to the plans and calculations are required, the stormwater reviewer will issue a checklist for final plan approval, which is valid for 90 days. In response to the checklist, the designer must submit an electronic version of the approved plans in *.TIF format as well as stormwater calculations and any required soil borings, appurtenant affidavits, etc. in *.PDF format and any paper hardcopies requested before the DOB can issue the design approval to the Applicant. See Chapter II, Section 2.1.3 for more detailed instructions on electronic file format and file naming conventions. If the final checklist items are not received within 90 days, the Applicant must request a plan amendment to process the approval. If the final checklist items are not received within 365 days, the Plan must be resubmitted as a new Plan. Once issued, the design approval may have attached conditions that must be addressed in the final Plan before application for a sewer permit. Design approvals shall be valid for 365 days from the date of issuance. If a sewer permit is not obtained within this 365-day time-frame, the Plan must be resubmitted as a new Plan. The application/review fee will be waived if the Applicant can demonstrate that the delay was caused by the City or a State agency as part of another permit review process.

2.0.4 PLAN AMENDMENTS

Any modification that will affect the performance of any proposed BMP or otherwise affect the rate or volume of stormwater leaving the property shall be considered an amendment to the Plan

and shall be reflected in the as-built drawings. Examples of Plan modifications that require an amendment include but are not limited to:

- Changes in grading that affect available storage volume or drainage patterns.
- Changes in size or location of connections to the city sewer.
- Structural changes to BMPs that impact storage volume.
- Changes in material or quantity of sewers and BMPs.
- Changes in the operation and maintenance of BMPs.

Examples of Plan modifications that do not require an amendment include:

- Vertical and horizontal alignment adjustments to sewer and sewer structures that will not affect hydraulic performance and that comply with design standards as listed herein.
- Changes in onsite sewer bends, fittings and connections.
- Notification of a change in Ownership of the Regulated Development.
- Utility conflict resolutions, as approved by a DWM field inspector.
- Changes in the Erosion Control Plan that do not increase erosion, if approved by a DOB field inspector.

The Applicant shall submit all amendments to DOB for approval prior to their construction or implementation at the Regulated Development. All amendments that occur within 365 days of Plan approval must be made by submitting the original documentation with the modifications described in text format, shown on the drawings and any revised calculations. Modifications to the structural portion of a Plan that occur more than 365 days after approval must be made by submitting the modification as if it were a new Plan.

2.0.5 AS-BUILT PLANS

The as-built plans must be sealed by the engineer or architect of record who prepared the design plans. As-built plans prepared by the contractor are not allowed. As-built plans must be provided to a DWM sewer inspector for approval within 14 days after completion of construction. Any deviation from the approved plans must be brought to the attention of the DWM sewer inspector. Once approved, the drawings must be submitted to the DOB at the following address within 30 days:

Department of Buildings
City Hall, Room 906
121 N. LaSalle Street
Chicago, Illinois 60602

The as-builts of the grading plans, drainage plans, sewer details, and BMP details must be submitted on a compact disk (CD) in electronic *.TIF format. Electronic files must be submitted using the file naming conventions from Chapter II, Section 2.1.3 with the descriptive suffix “as-built”.

2.0.6 SITE INSPECTIONS

City personnel (DWM and DOB) will have the right to inspect the portions of the Regulated Development subject to the Plan without prior notice during regular business hours. Inspections, both during and after construction, will be conducted on selected sites as determined by the City.

PART 3 – RATE CONTROL OF STORMWATER

3.0 APPLICABILITY

The flow rate control requirements discussed in this section apply to all Regulated Developments. All of the items discussed in Part 3 of this chapter must be included in each Plan and be submitted to the DOB for review and approval.

3.1 DESIGN REQUIREMENTS

All Regulated Developments must be designed to manage the 100-year storm event and to provide means to manage and direct overflows to the public right-of-way. The maximum allowable rates of discharge are discussed in Sections 3.3 and 3.4 of this chapter. The number, size, and locations of sewer connections are also regulated. Applicants may need to provide detention as part of a Plan to accommodate the allowable size of a stormwater connection to the City sewer system.

A minimum of 0.1 feet of freeboard from the high-water level within any detention facility to the overflow to the right-of-way must be provided. An additional 0.1 feet (minimum) freeboard must be provided from the lowest overflow elevation leading to an adjacent property. No more than 400 square feet of impervious surface area can sheet flow to the public right-of-way without detention. This sheet flow requirement shall not apply to fueling stations.

3.1.1 LOT-TO-LOT BUILDINGS

With respect to Developments that are totally or almost totally (more than 85%) occupied by structures or buildings, including basements, the required storage shall be based on a minimum 10-year magnitude storm event for the building area. Building is defined as the greater of either the footprint of the foundation walls or footprint of the building at ground surface subject to Chapter II, Section 3.1.2- Buildings With Tributary Sidewalls or Significant DWF. For any remaining open space, the required storage shall be based on a 100-year magnitude. Means to safely accommodate all storm events up to a 100-year magnitude, via overflows to the right-of-way, must also be provided. Buildings with underground storage vaults must have plans (with backup calculations) sealed by a licensed architect or structural engineer to safeguard against structural failure of floor foundations and downspouts due to maximum hydrostatic pressures during sewer surcharges.

3.1.2 BUILDINGS WITH TRIBUTARY SIDEWALLS OR SIGNIFICANT DWF

If the sidewalls of a building are tributary to the connection, via side gutters or multi-level roofs, then 25 percent of the face of the critical sidewall must be considered as part of the drainage area, but not the release rate. Reference Section 3.4.5 of this chapter. This critical sidewall is the face of the building with the most surface tributary to the detention system. If a site is less than 15,000 square feet in area, standard stormwater detention requirements will apply if the drainage area with sidewalls and/or the average DWF component (without peaking factor) equals or exceeds 15,000 square feet. The conversion of average DWF to area is based on 1.0 cfs into one acre (43,560 square feet). If with the aforementioned considerations, the drainage area is less than 15,000 square feet, the size of the connection may dictate adequate stormwater management measures of detention be implemented.

3.1.3 OPEN SPACE DISCHARGING TO COMBINED SEWERS

Any at-grade impervious open space discharging to a combined sewer, where more than 7,500 square feet of substantially contiguous area will be created, reconstructed or resurfaced (scarified with bituminous or concrete overlay), will be subject to rate control requirements. In order to maximize the capacity of the sewer system in a manner that is economically reasonable, developments with more than 75 percent of substantially contiguous at-grade open space that is conducive to the ponding of surface waters shall not have a maximum release rate greater than 0.75 cfs per acre unless limited by the minimum practical rate of discharge, which is

accomplished by a 3-inch vortex restrictor with a 0.15 cfs release rate. This requirement shall not apply to fueling stations and Developments that discharge to waterways.

3.1.4 DIRECT DISCHARGING INTO WATERS

A Development that has access to an adjacent waterway must discharge its stormwater to that waterway. For Developments that discharge stormwater directly to Waters, the maximum release rate shall be 1.0 cfs/acre for at-grade open space. There is no release rate requirement for roof areas (without vehicular parking or waste storage) of any onsite buildings, provided the roof areas bypass the Development's stormwater detention system. Any at-grade impervious open space discharging to a waterway, where more than 7,500 square feet of substantially contiguous area will be created, reconstructed or resurfaced (scarified with bituminous or concrete overlay), will be subject to rate and volume control requirements. Any development over 5 acres with existing discharge to a waterway shall not exceed such discharge rates, to the extent possible, for all storm events up to a 10-year, including any new roof areas. All overflow pathways from the stormwater management system must be directed towards the waterway.

The 1.0 cfs/acre release rate to Waters does not apply to Developments that discharge to Lake Michigan, Lake Calumet, or the Calumet River North of the O'Brien Lock and Dam at 134th Street. There are no rate control requirements for discharge to these Waters.

3.1.5 BUILDING REHABILITATIONS

With respect to a project that consists of a building rehabilitation, the peak discharge to the City's sewer systems must be delayed or decreased if any new roof areas (proposed over additional stories) and/or additional DWFs (converted to equivalent area) exceed 15,000 square feet. This may be accomplished by disconnecting existing downspouts, installing controlled roof drains or green roof systems.

3.2 RATE CONTROL BMPS

The BMPs below, if properly installed, utilized and maintained, shall be acceptable for use in meeting the Ordinance's rate control requirement. Other BMPs may be acceptable, but only upon demonstration that the BMP will control flow rate as required and upon prior approval by the Commissioner. The following tables present minimum design requirements for the BMPs

that can be used to meet the requirements for rate control. Those BMPs with asterisk may also be used for groundwater infiltration purposes.

Rate BMP	Minimum Design Requirements
Restrictors	The maximum discharge released is equal to or less than the maximum permissible release rate for the site.
	DWM 3-inch and 4-inch vortex restrictors utilize 8-inch diameter outlet pipes to achieve release rates of 0.15 and 0.25 cfs, respectively.
	When specifying and installing vortex restrictors, the 3-inch vortex restrictor shall be obtained from DWM, and the 4-inch vortex restrictor shall be obtained from an approved manufacturer.
	Flow-restricting outlets shall be submerged in a catch basin, (i.e., with a half trap and 2-foot minimum sump), to prevent clogging.
	Storage facilities upstream of restrictor with half trap must be clear of standing water.
	The minimum restrictor plate size is 2.5" in diameter.
	The restrictor must be easily accessible for DWM inspection and for owner inspection and maintenance.
	For sites that combine sanitary sewage and stormwater downstream from a restrictor, see the Stormwater Manual, Section 2.4.1 for recommended design guidelines.

Detention Basins	If the outlet from a dry bottom basin is less than 2 feet above of the crown of the combined outlet sewer, a check valve must be installed to prevent combined sewerage from backing up into the basin.
	Dry bottom basins must be capable of draining within 72 hours of a storm event.
	Maintenance access to the facility must be provided.
	The bottom of the storage area in a detention basin must be above the seasonally high groundwater table.
	For wet detention basins*, a safety ledge at least 4 feet in width must be constructed at a depth of 1 to 2 feet below the normal water surface.
	Wet detention basins without vegetation shall be at least 3 feet deep. The side slopes shall be no steeper than 3H:1V without erosion protection. The sides of the pond that extend below the safety and aquatic benches to the bottom of the pond must have a slope that will remain stable, and be no steeper than 2H:1V. For dry bottom detention basins, side slopes shall be 4H:1V or flatter.
	A sediment forebay shall be incorporated into all wet bottom detention basins.
	After excavation and grading of a stormwater wetland basin, at least 6 inches of topsoil must be applied to the basin bottom and sideslopes. Reference Stormwater Manual.
	At sites where infiltration is too rapid to sustain permanent soil

	saturation, analysis of the proposed plantings or intended wetland functions must be undertaken. If needed, an impermeable liner (geotextile fabric) shall be designed to maintain adequate hydrology. Where the potential for groundwater contamination is high, such as runoff from sites with a high potential pollutant load, the use of a liner is required.
	Basins incorporating wetlands shall include a buffer to separate the wetland from surrounding land where feasible.

Detention Vaults	Detention vaults under buildings designed only for a 10-year storm capacity, shall be provided with means to safely accommodate 100-year overflows.
	Buildings with underground storage must have plans (with backup calculations) sealed by a licensed architect or structural engineer to safeguard against structural failure of floor foundations and downspouts due to maximum hydrostatic pressures during sewer surcharges.
	Proper ventilation of underground vaults for buildings must be provided in accordance with Building Code Articles 9 and 11, as applicable, to equalize interior downspout pressures and to prevent siphoning effects through the piping and sewer systems.
	Vaults must be designed to be water-tight unless used for groundwater infiltration purposes or unless the bottom of the vault is at least 7 feet above the groundwater table.
	For vaults using infiltration*, soil must have at least a 0.5 in/hr infiltration rate or greater and the bottom of the vault must be at least 3.5 feet above the groundwater table when connected to a combined sewer. Means to control sediment and/or debris from entering the vault must be provided. Pretreatment measures are required for all infiltration vaults.
	If the outlet from a vault is lower than the crown of the combined outlet sewer, a check valve must be installed to prevent combined sewerage from backing up into the vault.

Oversized Pipes	Locking manhole covers shall be provided for pipe diameters 4 feet and larger in areas where children may be present.
	If the outlet from an oversized pipe is lower than the crown of the combined outlet sewer, a check valve must be installed to prevent combined sewerage from backing up into the oversized pipe.
	Structures for oversized pipe must be properly sized.

Parking Lot Detention	Maximum allowable ponding in a parking lot shall be 12 inches. If more than 10 inches of ponding, the O&M Plan must indicate such.
	Adequate visible warning must be provided for any depressed islands during flood stage.

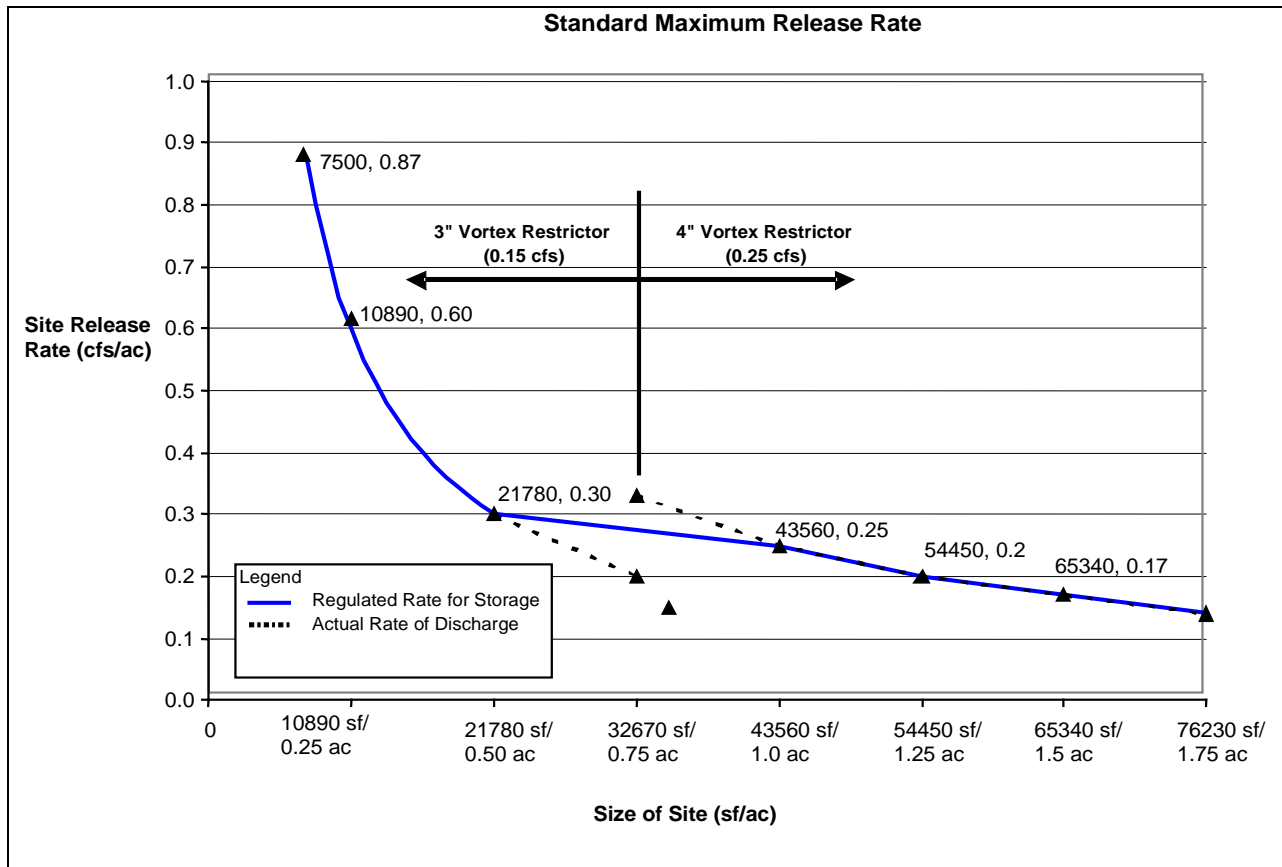
Rooftop Detention	Provide a grading plan of the roof to verify available storage.
	Provide details and hydraulic characteristic of any controlled roof drains in the Plan
	Provide scuppers or overflows to accommodate 100-year storm events.
	Include approval and seal from a Registered Structural Engineer or Licensed Architect.
	In addition to other applicable code requirements, Sections 18-29-1105, 1106, and 1110 of the Municipal Code must be complied with.

3.3 STANDARD MAXIMUM RELEASE RATE

All Regulated Developments must control the 100-year storm event. Regulated Developments of 7,500 square feet to 1.75 acres in size have the option to accept a standard maximum release rate for the site, as shown below in the Maximum Release Rate Control Chart, or to calculate their own maximum release rate, using the procedures in Section 3.4 of this chapter. The standard maximum release rate is as follows.

- For sites between 7,500 square feet and 21,780 square feet (one-half acre), the maximum allowable release rate is 0.15 cfs, the maximum release rate from a 3-inch vortex restrictor. The required storage is based on 0.15 cfs, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites between 21,780 square feet (one-half acre) and 43,560 square feet (one acre), the maximum regulated release rate is a linear interpolation between 0.15 cfs (equivalent to use of 3-inch vortex restrictor on a one-half-acre site) and 0.25 cfs (equivalent to use of 4-inch vortex restrictor with 0.25 cfs release rate on a one-acre site), respectively. The required storage is based on the linear interpolation of the two release rates, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites between 43,560 square feet up to 76,230 square feet, the maximum allowable release rate is 0.25 cfs, the maximum release rate from a 4-inch vortex restrictor. The required storage is based on 0.25 cfs, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites larger than 76,230 square feet (1.75 acres), Applicants must compute their own maximum release rate using the procedures in Section 3.4 of this chapter.

The above requirements are illustrated in the following chart.



3.4 COMPUTED MAXIMUM RELEASE RATE

In lieu of utilizing the Standard Maximum Release Rate, the Applicant may submit documentation in support of a computed maximum release rate. The 5-year capacity of a sewer line (in cfs/acre) shall be based on the ratio of its full flow segment capacity (in cfs) to its corresponding tributary area (in acres). The computed maximum release rate shall be the lesser of the “Outlet Sewer Capacity” at the downstream end of the system and the critical “Local Sewer Capacity” as defined by sewer sizes 3.5 feet in diameter or smaller. The following subsections describe the computation to be followed in determining the computed maximum release rate for the Regulated Development.

3.4.1 OUTLET SEWER CAPACITY

The city’s combined sewer system conveys flow to MWRDGC interceptor sewers. Outlet sewers are found near the outfall to a waterway or near an MWRDGC, TARP structure. Outlet capacities consider the interconnected network of the sewer system. For the purpose of

determining maximum release rates, the capacity of each auxiliary sewer shall be assumed to be the associated outlet sewer capacity. Outlet sewer capacities (in cfs/acre) of the sewer system shall be obtained from a map and table in Appendix III-A of this chapter.

3.4.2 DRAINAGE AREA COMPUTATIONS

The corresponding drainage area (in acres) to a sewer main segment shall be determined from the Sewer Atlas Maps and Drain Atlas Maps. A Sewer Atlas Map(s) delineating the assumed drainage boundary must be submitted with the release rate calculations.

The upstream limits of a sewer line shall be identified by summit manholes or back flow connections to other sewer lines. Drainage area boundaries shall be assumed along right-of-way and property lines. If there are no property lines shown on the Drain Atlas to delineate the drainage boundary, the largest possible drainage area must be assumed. Otherwise, a drainage plan, generated by field reconnaissance or other documentation, must be presented for justification of existing conditions. If there are main sewers on either side of a standard city block, then the main sewer in question shall be assumed to drain each half block (up to the alley) immediately adjacent to it. If there is no main sewer on the other side of the half block, then the main sewer shall be assumed to drain the entire block.

The drainage area to a Development's connection point must be included within the drainage area of the main sewer line. Vacant areas that are currently undrained, must be included in the delineation. A reasonable estimate of vacant area that may be tributary to the main sewer line (upon future development) must be considered in the drainage area delineation.

An adjustment for land use to the computed drainage area of the main sewer line must be made. Adjustment factors to the drainage areas shall be based on a percentage of each land use type. Land use may be determined from aerial photographs. It shall be assumed that a typical residential drainage area, 1.0 acre in size, will yield a 5-year discharge rate of 1.0 cfs. Therefore, if the land use within the drainage area is primarily residential, no adjustment factor to the computed drainage area is required. If the land use within the drainage area is primarily commercial, as in the Central Business District, an adjustment factor of 1.3 must be multiplied to the drainage area. If the land use within the drainage area is primarily industrial, an adjustment factor of 1.5 must be multiplied to the drainage area.

3.4.3 LOCAL SEWER CAPACITY

The local capacity of a sewer line (in cfs/acre) shall be obtained by the ratio of the sewer segments capacity (Q) divided by the respective drainage area adjusted for land use (in acres). In computing the capacity of the local sewer, the proposed drainage area from the site (in acres) must be included (if applicable) in the drainage area (in acres) of the local sewer.

3.4.4 CRITICAL LOCAL SEWER CAPACITY

The critical local sewer capacity (or lowest cfs/acre) shall be the sewer segment with the lowest cfs/acre within a sewer line. Typically, the critical local sewer capacity can be found at the downstream end of a sewer line, but each upstream sewer segment to the point of connection shall be examined to determine the critical section.

3.4.5 MAXIMUM RELEASE RATE

The critical local sewer capacity shall be compared with the outlet sewer capacity of the system. The maximum release rate for the site shall be based on the lesser of the two values. This release rate may have to be adjusted pending applicable site conditions specified in Sections 3.1.2, 3.4.1, 3.5 and 3.6 of Chapter II, and Sections 3.1.3 and 4.1.4 of this chapter. The maximum release rate typically applies to all storm events up to a 100-year magnitude subject to Section 3.1 of this chapter. The proposed discharge rate from a site must be less than or equal to the existing discharge rate unless otherwise approved by DWM. The maximum discharge rate (cfs) from the Regulated Development shall be based on the maximum release rate (cfs/ac) times the disturbed land area (ac). An example of the maximum release rate computations is presented in the Chicago Stormwater Manual.

3.5 COMPLIANCE WITH APPLICABLE SEWER REQUIREMENTS AND STANDARDS

In making release rate calculations, Applicants must refer to Chapter II, Sewer Requirements and Standards to determine the following: where to make a connection to the city sewer system; the number of connections; and the size of the connections impacting the maximum release rate from the site. The Applicant must also take into account any other applicable special requirements for flow diversions, multiple connections, and dry weather flows.

3.5.1 REQUIREMENTS FOR MULTIPLE CONNECTIONS

Except for developments that are less than 0.5 acres or which adopt a 0.15 cfs –3” vortex restrictor(s) for the site, an alternative analysis is required when using multiple connections. See

Section 3.3 of this chapter- Standard Maximum Release Rate. The analysis must demonstrate that the selected alternative will maximize use of the sewer system, thereby optimizing the hydraulic benefit to the surrounding neighborhood. At least two alternatives must be examined. The alternative analysis must examine connection points to different sewer lines or different split percentages in flows.

The alternative analysis must include a tabulation comparing the existing and proposed 5-year capacities (in cfs/acre) of the sewer segment where each connection is made. See Section 3.4.3 of this chapter- Local Sewer Capacity. The existing/proposed drainage patterns from the site along with an estimation of the existing/proposed DWF component must be considered in the tabulation. In computing the existing capacity of a sewer segment (in cfs/acre), existing runoff conditions from the site shall be based on the area (in acres) tributary to the connection point. The proposed drainage area from the site (in acres) can be assumed as the total discharge rate (in cfs), from the Development converted on a one to one basis to acres. Any existing/proposed DWF must be considered (without peaking factor) as part of the total discharge from the Development.

If previous means of rate control have not been provided or are inadequate, then the proposed release rate from a development must always be less than the existing discharge rate. For developments that do not meet the aforementioned criteria or that consist of an area 5 acres and larger, may require, as an alternative, upgrading the sewer system in the street. See Chapter II, Part 4.0 for main sewer improvements in the public right-of-way.

3.6 RESTRICTOR CALCULATIONS

Restrictors must be sized in accordance with the maximum release rate and upstream tributary area. When using the standard release rate, the City's 3-inch or 4-inch vortex restrictors must be used as shown on the chart above, "Standard Maximum Release Rate". When other control structures are used, the discharge shall be calculated using the orifice equation with the correct discharge coefficient (Cd) as follows:

- Cd= 0.61 for sharp-edged plate bolted to a catch basin
- Cd = 0.82 for pipes less than 2 feet long grouted into sewer

The hydraulic head on a restrictor must be computed from the high water elevation to the upper invert of the half-trap with restrictor.

3.7 REQUIRED STORAGE

The amount of required 100-year storage must be based on the Modified Rational Method. The City of Chicago’s rainfall intensities are provided in Appendix III-B and (effective September 1, 2014) are now based on Bulletin 70 regional rainfall data. If the size of the Regulated Development is over 20 acres or if dynamic flood routing computations become necessary, such as multiple flow control restrictors at different elevations, then a computational hydrograph method must be used utilizing Bulletin 70 regional rainfall data and Huff distributions from the ISWS including a critical duration analysis for 30 minute, 1 hour, 2 hour, 3 hour, 6 hour, 12 hour, 18 hour, and 24 hour storm durations. The C-values or curve numbers (CN) to be used in the analyses shall be based on the following:

		<u>C-values</u>	<u>CN¹</u>
•	Asphalt Roof, Pavement	= 0.95	98
•	Gravel	= 0.70	89-91
•	Sandy Soil, flat 0% to 2%	= 0.18	61 ²
•	Sandy Soil, ave 2% to 7%	= 0.27	65 ²
•	Sandy Soil, steep >7%	= 0.36	70 ²
•	Heavy Soil, flat 0% to 2%	= 0.30	74-80
•	Heavy Soil, ave 2% to 7%	= 0.42	78-83
•	Heavy Soil, steep >7%	= 0.47	80-85
•	Woodlands, flat 2%	= 0.39	70-77
•	Dry bottom basins to HWL	= 0.75	91-92
•	Wet bottom basins to HWL	= 1.00	100
•	Native Vegetation w/prepared soils	= 0.10	39
•	Green Roof (Reference USGBC, LEED Reference Guide, current version)		

Notes:

1. Where an upper and lower limit is shown for CN, the lower limit assumes hydrologic soil group C and the upper limit assumes hydrologic soil group D. See SCS TR-55 for more information. Soil borings will be required to substantiate use of group C soils.
2. Assumes hydrologic soil group B. Soil borings will be required to substantiate this soil group.

3.7.1 RESIDENTIAL LAND USES—RIGHT-OF-WAY STORAGE

A Regulated Development for residential purposes shall be designed to accommodate the 100-year storm event by providing a corresponding amount of flood storage. Flows exceeding the

required onsite storage may be allowed to overflow to the right-of-way, if proper site and roadway grades permit. Right-of-way storage may be utilized as long as onsite storage is provided for a minimum of the 5-year storm event. There must be a sufficient amount of available onsite storage and right-of-way flood storage to meet the 100-year storage requirement. Right-of-way flood storage shall be permitted under the following conditions:

- Right-of-way flood storage (i.e., ponding) is limited to half of the street (from centerline to sidewalk) along the frontage of the property.
- Street grades along the centerline and gutter must allow for such ponding.
- Right-of-way flood storage must meet freeboard requirements to adjacent property.

Right-of-way flood storage is not permitted in alleys, arterial streets or in areas tributary to street viaducts. It is also not permitted in lot-to-lot developments, mixed-use residential developments or when building downspouts along the frontage are splashed directly to the right-of-way without detention.

3.7.2 COMMERCIAL/ INDUSTRIAL/ PUBLIC DEVELOPMENTS

Subject to Sections 3.1.1 and 3.1.5 of this chapter, the amount of required onsite storage shall be based on a 100-year storm event. Use of the right-of-way for storage shall not be permitted, unless approved by a Plan variance.

3.8 AVAILABLE STORAGE

3.8.1 CALCULATION OF STORAGE

Volume of available storage for detention ponds and parking lots must be calculated using the frustum of cone equation: $Volume = (H/3) * (A1 + A2 + \sqrt{A1 * A2})$, where H=depth and A= areas between the depth. If the topography precludes the use of the frustum of cone equation, as in the case of calculating street storage (if any), then the average end area method with minimum cross sections of every 25 feet shall be used.

3.8.2 DETENTION CREDIT FOR STORMWATER CAPTURE FACILITIES

Special storage facilities designed to capture and reuse stormwater shall be entitled to receive credit toward detention storage for up to 10 percent of the total required detention storage. The stormwater capture facility may be separate or partitioned from the main detention facility and must be designed to be dewatered within 14 days of filling. A gated or valve connection must be

provided between the stormwater capture facility and the main detention facility that can be opened to create a freely draining condition when there is no need for the captured stormwater to be reused (such as winter months for irrigation systems). If the stormwater capture facility is hydraulically connected to a combined sewer, a check valve must be installed to prevent sewage back-up if the connection is within 2 feet of the crown of the combined sewer.

PART 4 VOLUME CONTROL OF STORMWATER

4.0 APPLICABILITY

The volume control requirements discussed in this section apply to all Regulated Development. Additional requirements apply to Regulated Developments that discharge to Waters as defined in the Ordinance or to a municipal separate storm sewer system.

4.1 DESIGN REQUIREMENTS

4.1.1 GROUNDWATER INFILTRATION BMPS

For use of standard infiltration BMPs for groundwater recharge, subsoil infiltration rates must be 0.5 inches per hour or greater. If subsoil infiltration rates are less than 0.5 inches per hour, a prepared soil and underdrain system shall be used to facilitate implementation of volume control BMPs. When infiltration is claimed as a benefit for computing required rate control storage, the underlying soil must have a permeability of 0.5 in/hr or greater. The high groundwater table must be at least 2.0 feet below the bottom of all proposed groundwater infiltration BMPs. If connected to a combined sewer system, the high water table must be at least 3.5 feet below the bottom of the BMP.

Infiltration structures with open bottoms or perforated piping require special care during maintenance. Such infiltration systems may become damaged by standard vector truck maintenance procedures. Special lids as indicated in Chapter II, Appendix II-A shall be used to identify these infiltration systems. Groundwater infiltration BMPs must be located at least 10 feet down gradient of existing building structures and foundations; otherwise, the affidavit in Appendix IIB must be submitted.

4.1.2 INFILTRATION EXCEPTION

The City will not approve the use of groundwater infiltration BMPs in circumstances where their use would violate any requirement of federal or State law, or any other provision of the Municipal Code, or any regulation issued under federal or State law or the Code, or where their use would breach any agreement that prohibits their use. Examples of circumstances where use of groundwater infiltration BMPs will not be approved include the following: (a) in portions of Developments requiring Spill Prevention, Control and Countermeasure Plans pursuant to 40 CFR 112 for safe handling of oil and oil products; (b) in portions of Developments permitted pursuant to RCRA Part B (35 Ill. Admin. Code Part 724) related to Hazardous Waste Management; (c) in portions of facilities subject to the permit requirements of Chapter 11-4, articles XIX and XX of the Municipal Code regarding Recycling Facilities and Urban Farm Accessory Composting Permits; or (d) in portions of Developments subject to a court or agency order that prohibits the use of groundwater infiltration BMPs.

4.1.3 DRAINAGE AREAS AND VOLUME CONTROL

If a portion of a Development lacks adequate volume control measures, the Applicant must construct a correspondingly oversized volume control BMP in another area of the Development to compensate. The maximum credit that may be claimed for an oversized BMP shall not exceed the amount of runoff generated from one-inch of rainfall over the tributary area to the oversized BMP.

4.1.4 OVERSIZED STORMWATER DETENTION

Subject to approval, the Applicant may show that retention of water captured by a groundwater infiltration BMP is impractical due to insufficient depth to groundwater, or the presence of environmental conditions described in Section 4.1.2 of this chapter. In addition, for Developments that have more than 85 percent of the site covered by structures and where green roofs are impractical, oversized detention may also be utilized. For these Developments, oversized stormwater detention may be utilized to fulfill the volume reduction requirements over impervious areas. This volume shall be provided in addition to any storage volume required for rate control. If additional volume is provided, the release rate shall be reduced to fully utilize the additional volume for a given design storm (up to a 100-year storm event). If this reduced release rate is less than 0.15 cfs, then a 3-inch vortex restrictor may be used subject to Chapter II, Section 3.5.

4.1.5 VOLUME CONTROL STORAGE

The available storage for volume control shall be in addition to the storage required for rate control if the available storage for volume control is reflected in the runoff coefficient, or C-value, as initial rainfall abstractions. In this case, the C-value as listed in Section 3.7 of this chapter is utilized for the BMP. Alternatively, the following equation may be used to determine a C-value; $C = 1 - [(BMP \text{ storage volume}) / (\text{rainfall volume})]$ provided that the BMP storage volume is accessible to the generated runoff. Reference the Stormwater Manual for further clarification.

The available storage for volume control may be included with the detention storage for rate control if a C-value of 1.0 is utilized for the BMP. In this case, the storage volume provided by the BMP may be used towards the detention storage. Furthermore, if the existing subsoils below the aggregate are permeable (greater than 0.5 in/hour), then the percolation rate within such subsoils may be used in addition to the maximum release rate in determining a Development's detention storage requirement. Percolation rates must be verified in accordance with Section 4.3 of this chapter.

4.1.6 DIRECT DISCHARGE TO WATERS

For sites that discharge stormwater directly to Waters, there are no volume control requirements for roof areas of any onsite buildings, provided that the roof runoff does not come into contact with any at-grade impervious surfaces and by-passes all volume and rate control BMPs. Runoff from all at-grade impervious surfaces shall be routed through a volume control BMP prior to its discharge into Waters or MS4. The receiving BMP shall be sized to capture the amount of volume control storage (0.5-inches over the impervious areas) required. If groundwater infiltration is impractical for reasons described in Section 4.1.2 of this chapter, the captured volume shall be released at a maximum rate of 0.04 cfs per acre. If the computed volume control release rate is less than 0.15 cfs, then a 3-inch vortex restrictor shall be used. A two-staged outlet structure shall be utilized to fulfill the 100-year stormwater detention requirements beyond those of the volume control requirement.

4.2 VOLUME CONTROL BMPS

The BMPs below, if properly installed, utilized and maintained, are acceptable for use in meeting the Ordinance's volume control requirement. A volume control BMP that infiltrates to subsoils

must be designed such that adjacent building basements and foundations are not adversely impacted. If sufficient clearance to existing building cannot be met, the affidavit in support of stormwater infiltration in Appendix II-B must be provided. Other BMPs may be acceptable, but only upon demonstration that the BMP provides the required volume control benefits. The following table presents minimum design requirements for BMPs that can be used to meet the requirements for volume control. Those BMPs with asterisk may also be used for groundwater infiltration purposes.

Volume Control BMP	Minimum Design Requirements
Bioinfiltration Systems	The design of a bioinfiltration facility shall allow no more than 12 inches of depressional ponding in the vegetated area.
	The growing medium soil must be a mix of 40% sand, 30% topsoil and 30% compost. The soil must be at least 2 feet deep and must be 4 inches deeper than the largest planted rootball.
	The underlying soil shall have a permeability of 0.5 in/hr or greater. If the underlying soils do not meet the permeability requirement, underdrains may be installed.
	Bioinfiltration systems must be designed to drain within 5 days of a storm event.
	Soil borings or other data must verify that the depth to groundwater table is greater than 2 feet from the bottom of the BMP (lowest excavated elevation), or 3.5 feet when connected to a combined sewer system.
	The water flowing to a bioinfiltration facility requires pretreatment for sediments. Where such pretreatment is not provided by an upstream BMP facility, it must be included in the bioinfiltration facility design.
	The bioinfiltration facility shall be located at least 10 feet down gradient from buildings, otherwise submit affidavit in Appendix IIB.
	Maintenance access to the facility must be provided.
	Measures to avoid clogging and compaction of the bioinfiltration facility are required during construction.
	If the bioinfiltration system includes storage in the void spaces of an aggregate layer, the aggregate layer must be completely surrounded by filter fabric and must be comprised of crushed angular stone free of fines. For IDOT gradations CA-1 and CA-7, the maximum aggregate porosity of 0.38 may be used.
Drainage Swales	Velocities must be 1 ft/sec or less during the 2-year storm event.
	Longitudinal slope must be between 0.5 and 2.5%
	Utilize 3H:1V side slopes or flatter. Use slope protection when side slopes are steeper than 3H:1V.

	Surface volume control storage must be provided behind check dams.
	The growing medium soil must be a mix of 40% sand, 30% topsoil and 30% compost. The growing medium soil must be at least 2 feet deep.
	If the drainage swale includes storage in the void spaces of an aggregate layer, the aggregate layer must be completely surrounded by filter fabric and must be comprised of crushed angular stone free of fines. For IDOT gradations CA-1 and CA-7, the maximum aggregate porosity of 0.38 may be used.
	Soil borings or other data must verify that the depth to groundwater table is greater than 2 feet from the bottom of the BMP (lowest excavated elevation), or 3.5 feet when connected to a combined sewer system.
	The underlying soil shall have a permeability of 0.5 in/hr or greater. If the underlying soils do not meet the permeability requirement, underdrains may be installed.

Green Roofs	A structural engineer or architect's seal must be included on the Plans to approve of load-bearing capacities of the proposed roofs.
	The maximum permissible slope for extensive green roof systems shall be 25 percent.
	The maximum permissible slope for intensive green roof systems shall be 10 percent.

Natural Landscaping	Areas of natural landscaping shall be planted with deep-rooted vegetation.
	The soil must consist of sandy loam, loamy sand, or a loam with clay content less than 25% and sand content greater than 50%, or a prepared growing medium soil with a mix of 40% sand, 30% topsoil and 30% compost.

Permeable Paving ¹	Subsoils must have at least a 0.5 in/hr infiltration rate or greater. Otherwise, an underdrain system must be used if soil infiltration rates do not meet this requirement.
	The bottom of the aggregate shall be at least 2 feet above the groundwater table or bedrock, 3.5 feet if discharging to a combined sewer.
	Compaction of the soils underlying the permeable pavement system must be avoided during construction.

¹ NOTE: If a permeable paving BMP is used, a civil engineer must certify by letter that the subsoil is suitable for permeable pavement usage.

	Permeable pavement or infiltration systems must be situated at least 10 feet down gradient from buildings that are not waterproofed against basement seepage, otherwise submit affidavit in Appendix II-B.
	Minimum and maximum slopes on permeable paving shall be 0.5 percent and 5 percent, respectively.
	All aggregate material shall be crushed angular stone and free of fines. For IDOT gradations CA-1 and CA-7, the maximum aggregate porosity of 0.38 may be used.
	When using an underdrain system, the water level within the underlying stone base may not rise to within 8 inches of the permeable pavement surface for a 10 year storm event.
	The underlying stone base must be designed to drain within 48 hours of a storm event.
	When using an underdrain system, any impermeable subsoil material must be graded with a minimum 1 percent slope to such system, and the top 3 inches of impermeable soil must be mixed with at least 3 inches of sand.
	For pervious concrete, signage must be placed on the property that states, "This surface is pervious concrete pavement. No sealcoat or overlay material is to be used on this pavement. Call XXX-XXXX before treating this pavement with any material." Insert the number of the property management company or owner.
	When an area of conventional impervious pavement drains toward permeable pavement, a maximum ratio of 3:1 impervious to permeable is allowed.

Rooftop Runoff BMPs (Planter Boxes, Rain Barrels and Cisterns)	If a rain barrel or above ground cistern will hold more than a 6-inch depth of water below the drain, it must be securely covered to prevent small children from gaining access to the standing water and to prevent mosquitoes from breeding.
	Above ground cisterns with a capacity of more than 55 gallons must be designed with proper structural foundations.
	Rain barrels and cisterns must include inlet screens to minimize the number of foreign objects entering the vessels.
	Excess water entering the rain barrel or cistern must be designed to overflow to a treatment train or stormwater conveyance system.
	The system must have a convenient and functional means of water withdrawal.
	The system, if applicable to stormwater detention, will receive credit for up to 10 percent of the required site storage and must be drained within 14 days of a storm event.

Stormwater Trees	New trees or existing trees must be on the development site within 20 feet of an on-site impervious surface to count as a volume control BMP. They must also be at least 2 inches in diameter at 4.5 feet above ground level.
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Vegetated Filter Strips	The entire filter strip area shall be more than 2 feet above the groundwater table.
	Filter strips must have longitudinal slopes of 1 to 5 percent (2 percent optimum) in the direction of flow.
	The longest flow path of the contributing drainage areas must not exceed 75 feet.
	A level spreader is required whenever the tributary area is not uniformly sloped toward the filter strip..
	When filter strips are used to accept roof runoff for the purposes of volume control, a level spreader must be utilized. The hydraulic loading rate may not exceed 75 feet of roof per one foot of filter strip width.
	The soil must consist of sandy loam, loamy sand, or a loam with clay content less than 25% and sand content greater than 50%, or a prepared growing medium soil with a mix of 40% sand, 30% topsoil and 30% compost. The approved soil type must be at least 18 inches deep.
	The slope up gradient of a level spreader must be less than 1 percent for at least 20 ft while the slope down gradient must be less than 6 percent.
	The length and depth of the level spreader must be at least 6 inches.
	Level spreader must be absolutely level along its width.

4.3 GEOTECHNICAL INVESTIGATIONS

Appropriate hydraulic calculations must be submitted to substantiate proper function of the BMP. The Chicago Stormwater Manual depicts a map showing general areas of the City where sand and clay predominates.

If a site utilizes a subsurface infiltration BMP or detention storage BMP that is not water-tight, and is connected to a combined sewer system, via underdrain or piped connection, then soil boring information must be submitted. As part of any soil boring submission, at least one soil boring must be obtained for every 15,000 square feet of the BMP footprint, and at least 2 soil borings are required if used to determine groundwater elevation.

If the in-situ soil is found to be uniform with sand, or coarser material, for least 2.0 feet below the proposed bottom of the BMP, then a maximum infiltration rate of 1.4 inches per hour may be assumed. Otherwise, percolation tests in the field must be performed to justify a higher infiltration rate. If percolation testing is necessary, at a minimum, one percolation test must be provided for each separate BMP area. If a BMP area is larger than 15,000 square feet, additional percolation tests will be required for every 15,000 square feet of BMP area. If the BMP is in silty-clay or silty-sand without a piped connection to an outlet sewer, percolation testing is required. Testing must follow the appropriate standards from the American Society for Testing and Materials (ASTM) International or as set forth in the Chicago Stormwater Manual. When the percolation testing has been done, the maximum design infiltration rate shall be 3.6 inches per hour.

PART 5 EROSION AND SEDIMENT CONTROL

5.0 APPLICABILITY

All Regulated Developments that discharge stormwater to any location offsite, including but not limited to a waterway, water body, storm sewer or combined sewer, must install and maintained soil erosion and sediment control measures during construction to reduce or prevent the discharge of sediment and other pollutants in stormwater runoff from the Regulated Development.

5.1 EROSION AND SEDIMENT CONTROL BMPS

All erosion and sediment control BMPs shall be implemented in accordance with the standards and specifications set forth in the “Illinois Urban Manual” published by IEPA and the NRCS. It is available at <http://www.il.nrcs.usda.gov/technical/engineer/urban/contents.html>.

5.2 SUBMITTAL REQUIREMENTS

The City requires the following submittals for compliance with these Regulations.

5.2.1 DEVELOPMENTS DISCHARGING TO COMBINED SEWERS

Applicants with Regulated Developments discharging to combined sewers must submit the DWM's affidavit (and checklist) to the DOB, stating that they will comply with all appurtenant sediment and erosion control measures during construction. A copy of the affidavit must be kept on site during construction and made available upon request to City personnel. See Appendix II-C.

5.2.2 DEVELOPMENTS DISCHARGING TO WATERS

Any Development discharging to a local waterway or storm sewer, regardless of size, must develop and submit to the DOB, a detailed Erosion Control Plan (ECP) that includes the following.

- Temporary erosion and sediment control measures applicable to each phase of construction activity
- Permanent stabilization measures including landscape seeding and sodding plans
- Means of accommodating 2-year stormwater flows onsite and by-passed during construction
- A maintenance schedule for each erosion control measure. During construction, each erosion control measure shall be inspected weekly or after more than 0.5-inch of rainfall.
- Means to protect infiltration BMPs during construction

A copy of the ECP must be kept onsite during construction and made available for review upon the request of a City field inspector.

Discharges to waterways shall only comprise of stormwater or groundwater. Clean process waters may be discharged pending prior approval by MWRDGC. See DWM booklet "Permit Requirements and Fees", latest edition, for submittal of permits from other regulatory agencies. Signage identifying the discharge as storm only, indicating the address of the discharger, must be posted and be visible along the waterway at the outfall pipe. See Appendix II-A Sheet A.25.

Applicants with Regulated Developments over one acre must comply with all IEPA NPDES requirements for construction activity discharging to Waters. A copy of any SWPPP or Notice of Intent prepared pursuant to the NPDES program must be kept on site during construction and made available upon request to City personnel.

PART 6 OPERATION AND MAINTENANCE REQUIREMENTS

6.0 APPLICABILITY

The Owner of any Regulated Development must submit an Operation and Maintenance (O&M) Plan, adhering to the requirements herein, to be implemented both during and after construction activity. A copy of the O&M Plan must be available for review upon the request of a City field inspector. The Owner is responsible for performing long-term maintenance of BMPs and in informing future owners of such responsibility. The BMPs discussed in Parts 3, 4 and 5 require O&M activities in order to prevent their short-term failure and to ensure their long-term performance. For stormwater BMPs not included herein, proper O&M procedures must be included.

6.1 SUBMITTAL REQUIREMENTS

All new O&M Plans shall be submitted to the DOB for review and approval. All O&M Plans must include the following information:

- Contact information for Owner and entity (or entities) charged with maintenance responsibility both during and after construction activity.
- Site map showing the locations of all BMPs that will be constructed at the development. The map must, at minimum, include the following information: (1) discharge points and outfall locations; (2) drainage patterns; (3) stormwater runoff flow direction; (4) expected maximum depths and limits of surface ponding; (5) structural controls used to control stormwater flows; and (6) locations of all selected BMPs on site.
- A summary statement that explains how rate control and volume control requirements are met for the project.
- Operations and maintenance practices – the specific activities required for the operations and maintenance of the BMPs. See Section 6.2 of this chapter.
- Implementation schedule – a schedule for conducting the O&M activities.
- Employee training – Procedures that will be used to train new employees regarding the O&M plan requirements.

Proposed modifications to the O&M Plan must be submitted to DOB for review and approval. The existing and proposed O&M Plans and a copy of the original DOB approval form are required for the modification and must be submitted simultaneously with the proposed amendments.

6.2 OPERATIONS AND MAINTENANCE PRACTICES

In addition to implementing the specific requirements of the O&M plan, the owner or responsible party shall also conduct the following practices:

O&M Plan	Minimum Design Requirements
	O&M Plan must be signed by the owner and notarized using the Operation and Maintenance Plan Owner's Certification Statement, Appendix II-A, Sheet A.108. A copy of the O&M plan must be provided to each new owner before the consummation of a sale, and the O&M Plan must be signed by the new owner, notarized, and submitted to the City to be kept on record.
	O&M Plan procedures and practices must be reviewed and assessed annually.
	Access routes including roadways and sidewalks shall be inspected annually and maintained as needed
	Drainage structures and flow restrictors must be inspected and cleaned semi-annually.
	Volume control BMPs shall be inspected semi-annually and after significant rainfall events exceeding 1.5 inches
	The Owner shall keep an updated log book documenting the performance of the required O&M activities for perpetuity. Log books must be produced upon the request of a City inspector.
	Vegetation shall be maintained on a regular basis.
	Pest control measures shall be implemented to address insects and rodents.
	Signage and fencing shall be installed and maintained where necessary to protect property and the public.
	Underground vaults must include design measures to facilitate cleaning and maintenance. Confined space safety procedures must be followed.

CHAPTER IV – PROHIBITION OF ILLICIT CONNECTIONS

PART 1 GENERAL

1.0 APPLICABILITY

Pursuant to the City’s NPDES permit for storm water discharges, the construction, use, maintenance, or continued existence of illicit connections to any storm sewer system is prohibited. This prohibition expressly includes, without limitation, illicit connections made in the past, without regard to whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

PART 2 DEFINITIONS

2.0 ILLICIT CONNECTION

An illicit connection is any drain or conveyance, whether on the surface or subsurface, that allows an illegal discharge to enter a storm sewer system. Illicit connections include, but are not limited to, any conveyances that allow any non-storm-water discharge, including sewage, process wastewater, or wash water, to enter a storm sewer system or any connections to a storm sewer system from indoor drains and sinks, without regard to whether said drain or connection had been previously allowed, permitted, or approved by a government agency. Illicit connections include, without limitation, any drain or conveyance connected from a commercial or industrial land use to a storm sewer system that has not been documented in plans, maps, or equivalent records and approved by the City.

2.1 ILLEGAL DISCHARGE

Unless otherwise approved by a NPDES permit, an illegal discharge is any direct or indirect non-storm-water discharge to a storm sewer system that is not water line flushing, fire hydrant flushing, landscape irrigation water, rising ground water, ground water infiltration, pumped ground water, discharge from a potable water source, foundation drains, air conditioning

condensate, irrigation water, (except for wastewater irrigation), springs, water from crawl space pumps, footing drains, storm sewer cleaning water, water from individual residential car washing, routine external building washdown that does not use detergents, flows from riparian habitats and wetlands, dechlorinated pH neutral swimming pool discharges, residual street wash water, discharges or flows from fire fighting activities, dechlorinated water reservoir discharges, and pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed). Any discharge other than those permitted under these regulations is deemed to be a discharge of waste.

PART 3 REQUIREMENTS

3.0 REQUIREMENT TO ELIMINATE OR SECURE APPROVAL FOR ILLICIT CONNECTIONS

The DWM may require, by written notice, that a person responsible for an illicit connection to a storm sewer system comply with the requirements of this Article to eliminate or secure approval for the connection by a specified date, without regard to whether the connection or discharges to it had been established or approved prior to the effective date of these Regulations. If, subsequent to eliminating a connection found to be in violation of these Regulations, the responsible person can demonstrate to DWM that an illegal discharge will no longer occur, said person may request City approval to reconnect. The reconnection or reinstallation of the connection shall be at the responsible person's expense.

3.1 REQUIREMENT TO ELIMINATE ILLEGAL DISCHARGES

The DWM may require, by written notice, that a person who is responsible for an illegal discharge, immediately, or by a specified date, discontinue the discharge and, as necessary, take measures to eliminate the source of the discharge to prevent the occurrence of future illegal discharges.

APPENDIX I Stormwater Ordinance

MUNICIPAL CODE OF CHICAGO

CHAPTER 11-18

STORMWATER MANAGEMENT

11-18-010 Title and purpose.

This chapter shall be known and may be cited as the “Chicago Stormwater Management Ordinance”. It is hereby declared to be the policy of the City to promote programs that minimize the negative stormwater impacts of new development and redevelopment.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-020 Definitions.

For the purposes of this chapter, unless the context requires otherwise, the following terms, regardless of whether or not they are capitalized, shall have the definitions set forth below:

Applicant. A person applying for a Stormwater Management Plan approval or an amendment thereto or variance therefrom. An Applicant must be the Owner or Developer of the Regulated Development specified in the Plan.

Average Dry-Weather Flow. Non-stormwater flow that consists of either (a) sanitary flow as quantified in 35 Ill. Admin. Code, Subtitle C, Chapter II, Part 370, Appendix B (“Table Number 2 – Commonly Used Quantities of Sewage Flows From Miscellaneous Type Facilities”), as amended, or (b) industrial process water flow as quantified by determining the cubic feet per second released during the average of seven consecutive 24-hour periods.

Best Management Practice (BMP). A measure approved by the commissioner and used to control the adverse stormwater-related effects of development.

Building commissioner. The commissioner of buildings or his designee.

Commissioner. The commissioner of water management or his designee.

Developer. Any person who manages, organizes, oversees, plans or supervises the creation of a Regulated Development.

Drainage Area. Any location from which or through which stormwater moves to a drainage system.

Existing Conditions. The condition of a site in the ten years prior to the date of a Plan submission, as shown on historical aerial photographs or other verifiable documentation. If a site has been demolished and/or cleared within such ten-year period, its conditions prior to such demolition and/or clearing may be used as a basis for existing conditions.

Impervious Surface. A surface which substantially precludes the infiltration of water, such as concrete, asphalt, tile or compacted gravel.

Infiltration. The passage, movement or percolation of water into and through soil surfaces, including soil surfaces on roofs and in landscaped areas.

Owner. The owner, manager, agent or other person in charge, possession or control of a Regulated Development or any part thereof.

Plan. The Stormwater Management Plan required by this chapter.

Regulated Development or Development. Any construction activity, excavation or grading, commencing on or after January 1, 2008, that:

(a) disturbs a land area or substantially contiguous land areas of 15,000 or more square feet in the aggregate. Land areas separated by public right-of-way at the conclusion of development shall not be deemed “substantially contiguous” to each other for purposes of this definition. For purposes of calculating square footage pursuant to this

paragraph (a), “land area” shall include twenty-five percent of the square footage of the sidewalls of a building that directly connects to the sewer system via side gutters, and shall also include any average dry-weather flow based on a conversion rate of 1.0 cfs (cubic feet per second) into one acre (43,560 square feet), or

(b) creates an at-grade impervious surface of 7,500 or more substantially contiguous square feet, or

(c) results in any discharges of stormwater into any waters or separate sewer system.

For purposes of this definition, square footage shall be calculated based upon the project as a whole, regardless of whether construction proceeds in phases. A Regulated Development shall not include projects located entirely within the public right-of-way at the conclusion of development. With respect to a project located both on the public right-of-way and on private property at the conclusion of development, that portion of the project located on the public right-of-way will not be included in calculating the square footage thresholds of subparagraphs (a) and (b) of this definition. If a project includes Residential Development, the Residential Development will not be included in calculating the square footage thresholds of subparagraphs (a) and (b) of this definition.

Residential Development. A Regulated Development, or portion thereof, which upon completion will result in the subdivision of land into detached single-family or two-family dwellings.

Runoff. The water derived from precipitation falling onto a Regulated Development which is in excess of the infiltration capacity of the soils of that Development, which flows over the surface of the ground or is collected in any watercourse.

Stormwater. Water derived from any form of precipitation.

Stormwater Drainage System. Any and all natural and artificial means used in combination to conduct stormwater to, through, or from a Drainage Area to the point of infiltration or final outlet from a Regulated Development. A Stormwater Drainage System includes, but is not limited to, any of the following: conduits and appurtenance features, canals,

channels, ditches, streams, culverts, streets, storm sewers, detention basins, swales, vegetated areas and pumping stations.

Stormwater Management Plan. A detailed formulation of a program of action which describes a proposed or existing Stormwater Drainage System and environmental features applicable to a Regulated Development. The Plan shall include programs for grading and drainage, operations and maintenance, and soil, sediment and erosion control. These programs shall consist of written documentation, scaled maps and drawings with supporting engineering calculations.

Watercourse. Any channel, natural or artificial, lined or unlined, through which water flows or may flow.

Waters. All watercourses and all lakes, ponds, wetlands and other bodies of water, whether natural or artificial, that are located wholly or partly within or adjoining the territorial boundaries of the City.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-8-12, p. 38872, § 208)

11-18-030 Stormwater management plan – Required.

Every Regulated Development shall at all times have in place a Plan approved by the City. In addition to such other requirements as the commissioner may set forth by regulation, the Plan shall include the following:

(a) Provisions for Stormwater Management:

(1) *Rate Control.* Stormwater Drainage Systems shall manage the peak rate of discharge from the Regulated Development, incorporating the maximum permissible release rate. Provided, however, that Developments that create an at-grade impervious surface of less than 7,500 substantially contiguous square feet and that directly discharge to waters shall not be subject to the rate control requirements of this subparagraph (a)(1).

(2) *Volume Control.* Stormwater drainage systems shall reduce the volume of runoff from a Regulated Development by one of the following measures:

(A) capture one-half inch of runoff from all impervious surfaces in accordance with volume control BMPs; or

(B) for Developments that do not directly discharge to waters or to a municipal separate storm sewer system, achieve a fifteen percent reduction in impervious surfaces from existing conditions.

(b) Provisions for sediment and erosion control.

(c) Provisions for operations and maintenance.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-040 Stormwater management plan – Exceptions.

(a) A Plan shall not be required for Residential Development.

(b) The volume control requirements of a Plan shall not apply to the following:

(1) Developments that do not directly discharge to waters or to a municipal separate storm sewer system and that will upon completion of development have less than fifteen percent impervious surfaces.

(2) Developments consisting of surfaces at an airport that are intended for aircraft operation.

(3) Developments taking place at any facility that is operating under a permit issued pursuant to the National Pollution Discharge Elimination System, 40 C.F.R. Part 122, as amended, for industrial or municipal discharges.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-050 Stormwater management plan – Submission, approval and compliance.

(a) The submission of the Plan required by this chapter shall be made by the Applicant to the building commissioner in such form(s) and format(s) as the commissioner may require. As part of the Plan submission, the Applicant shall provide such information regarding the site and its proposed uses as the application may require. The Plan submission shall be submitted as part of the sewer permit review process required by

Chapter 11-16 of the Code. The building commissioner shall be the custodian of all such submissions.

(b) The Plan shall be valid only upon approval by the building commissioner.

(c) Before a Plan may be approved, the Applicant must certify to the building commissioner that the Applicant has met or will meet, in addition to the requirements of this chapter, all other city, county, state, and federal requirements related to floodplains, wetlands and water quality.

(d) Following Plan approval and completion of construction, the Owner shall provide to the building commissioner, in such time frame as established by regulation, as-built drawings of the Development in such form(s) and format(s) as the commissioner of water management may require. Consistent with applicable law, the building commissioner shall treat such as-built drawings as confidential trade secrets, and shall provide the Owner with a copy of any appeal, received by the building commissioner, of the building commissioner's notice of denial provided to a third party seeking inspection and copies of such drawings.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-8-12, p. 38872, § 209)

11-18-060 Stormwater management plan – Amendment.

A Regulated Development shall be developed, operated and maintained in compliance with its approved Plan until such time as the City approves an amendment or other modification of the Plan for that Regulated Development. The submission of a request for amendment shall be made to the building commissioner in such form(s) and format(s) as the commissioner of water management may require. The building commissioner shall review any request for amendment and shall notify the Applicant of the result of such review. An amendment may only be granted if the building commissioner determines that the amendment will not have a detrimental effect on the Plan.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-8-12, p. 38872, § 210)

11-18-070 Change of ownership.

(a) Upon a change of ownership of a Regulated Development, each new Owner of the Regulated Development or any part thereof shall comply with the Plan approved for that

Regulated Development until such time as the building commissioner approves an amendment or other modification of the Plan for that Development.

(b) A change of ownership of a Regulated Development shall not be considered to be an amendment. However, the Owner of a Regulated Development for which a Plan is required or has been approved shall notify each new Owner of the applicability of the Plan to the Regulated Development, and provide each new Owner with a copy of the Plan, before consummation of the sale of the Development. A violation of this subsection (b) shall be punishable by a fine of \$500.00.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-8-12, p. 38872, § 211)

11-18-080 Stormwater management plan – Fees.

A non-refundable fee for review of a Plan submission or variance request shall be remitted to the building commissioner as part of the Plan submission or variance request. The fee for review of a Plan submission, or variance request based upon Section 11-18-090(b)(2), (3) or (4), shall be as follows:

(a) For Regulated Developments affecting less than 50,000 square feet – \$1,000.00.

(b) For Regulated Developments affecting 50,000 or more square feet – \$3,000.00.

The fee for review of a variance request based upon Section 11-18-090(b)(1) shall be 50% greater than the amounts specified in (a) and (b) above.

(c) For amendments to a Plan submitted within one year of Plan approval, the fee shall be \$350.00 per submission. For amendments submitted over one year after Plan approval, the fee shall be \$500.00 per submission.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-8-12, p. 38872, § 212)

11-18-090 Variance.

(a) Upon written petition of the Applicant demonstrating that exceptional circumstances exist, the commissioner may grant a variance, in whole or in part, from the requirements of Section 11-18-030. To the extent that the Applicant can comply with Section 11-18-030, the Applicant must do so.

(b) Exceptional circumstances justifying the application of this section shall exist only where the Applicant can clearly demonstrate, to the satisfaction of the commissioner, that one of the following four circumstances exists:

(1) The Applicant cannot comply with Section 11-18-030 because of the site's exceptional physical conditions or circumstances. To demonstrate that such conditions or circumstances exist, the Applicant must provide supporting documentation. At a minimum, the Applicant must show that the site is designed to minimize the peak rate of discharge and volume of stormwater from the Development. Such showing must include a BMP feasibility evaluation for each building, parking area, landscaped area and each other significant footprint at the site. The evaluation must include all necessary technical computations and analyses (examples include engineering, architectural and horticultural analyses) to assess fully the applicability of pertinent BMPs and the extent to which they can be applied to comply with Section 11-18-030.

(2) The Applicant cannot comply with Section 11-18-030 without causing a public nuisance.

(3) The Applicant cannot comply with Section 11-18-030 without violating the Building Code or the Fire Code, as those terms are defined in Section 1-4-090 of the code, or a state or federal law.

(4) The Regulated Development is a registered landmark and compliance with Section 11-18-030 would violate the Regulated Development's landmark status.

(c) Applications for a variance shall be in a form prescribed by the commissioner. All applications for a variance shall bear the notarized signature and certification of a professional architect, engineer or geologist licensed in the State of Illinois.

(d) In applying for a variance, an Applicant may propose, and the commissioner may consider, alternative measures to accomplish the stormwater management goals of this chapter.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-100 Site inspections.

To enable the commissioner, or his designee, to monitor compliance with this chapter, the Owner shall permit access during reasonable hours to those areas of a Regulated Development affected by the Plan.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-16-11, p. 13798, Art. II, § 6)

11-18-110 Regulations.

The commissioner is authorized to promulgate regulations to effectuate the purposes of this chapter. Any regulations so promulgated shall be considered as an integral part of the Chicago Stormwater Management Ordinance and shall be enforceable, and their violation subject to the same penalties, as set forth in this chapter.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-120 Chapter requirements not exclusive.

The requirements of this chapter shall be in addition to, and shall not relieve any person from compliance with, all other applicable provisions of the code.

(Added Coun. J. 12-13-06, p. 95586, § 1)

11-18-130 Enforcement and penalties.

(a) Except as otherwise specifically provided in this chapter, the commissioner, and his respective designee, are authorized to enforce this chapter and any regulations promulgated hereunder, including the issuance of citations for violations.

(b) Owners, developers and any other persons who violate any provision of this chapter shall be jointly and severally liable for each such violation.

(c) The failure to obtain a plan approval if required by this chapter shall subject the violator to a civil penalty of \$5,000.00 to \$10,000.00. Except as otherwise specifically

provided, other violations of this chapter shall be punishable by a civil penalty of \$100.00 to \$1,000.00 for each such violation. In addition to any penalties imposed for violations of this chapter, violations of any Plan requirement or condition shall be punishable by a penalty of not less than \$100.00 and not more than \$1,000.00 for each such violation. Each day a violation continues shall be considered to be a separate violation. In addition to the civil penalties specified herein, the City may recover as an additional civil penalty its attorneys' fees and three times the amount of all costs and expenses incurred by the City in abating or remediating a violation of this chapter.

(d) In addition to any other remedies, penalties or means of enforcement provided in this chapter, if the commissioner, on due investigation, makes a determination of noncompliance, he may request the corporation counsel to make application on behalf of the City to the Circuit Court of Cook County for such other order as the Court may deem necessary or appropriate to secure compliance. The corporation counsel may then institute proceedings on behalf of the City, as provided by law.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-16-11, p. 13798, Art. II, § 6)

11-18-140 Cease and desist orders.

(a) The commissioner may issue a cease and desist order to stop any person from proceeding with any activity regulated under this chapter when the commissioner has reason to believe that such activity is in violation of this chapter, or that the activity endangers human or animal health, endangers the environment, or has the potential to cause or worsen flooding or wasteful use of water. The commissioner may enforce a cease and desist order pursuant to this section or pursuant to section 11-18-130(d).

(b) Prior to imposing the penalty specified by this section, the commissioner(s) issuing the cease and desist order shall serve the respondent with a copy of the order, stating the nature and location of the violation, the date by which the respondent must cease and desist the illicit activity, the amount of the applicable penalty for noncompliance, the respondent's right to request an administrative hearing to contest the merits of the order, and the time and manner in which a hearing may be requested. Service of the cease and desist order shall be in the manner set forth in Section 2-14-074 of this code.

(c) (1) Within 10 days of service of the cease and desist order, the respondent may submit to the commissioner(s) a written request for a hearing to be conducted by the City's department of administrative hearings. Upon receipt of a timely request for a hearing, either or both of the commissioners shall institute an enforcement action with the department of administrative hearings. Notice of the administrative hearing shall be given to the respondent in the manner set forth in Section 2-14-074 of this code.

(2) In the event the respondent fails to comply with a cease and desist order or fails to request a hearing within the 10-day period provided in subsection (c)(1) of this section, the commissioner(s) issuing the order may institute an action to enforce the order with the department of administrative hearings. Notice of the administrative hearing shall be given to the respondent in the manner set forth in Section 2-14-074 of this code.

(d) Upon the initiation of an enforcement action pursuant to subsection (c) of this section, the department of administrative hearings shall appoint an administrative law officer who shall conduct the hearing within 30 days of receiving; the request. Chapter 2-14 of the code shall apply to any hearing conducted pursuant to this section. The cease and desist order shall remain in effect until the department of administrative hearings has taken final action on the matter. In addition to imposing fines and penalties consistent with this section, the administrative hearing officer shall have the authority to affirm, vacate or modify the cease and desist order.

(e) The penalty specified by this section shall be imposed either upon expiration of the time period in which the respondent may seek review by the department of administrative hearings, or upon the administrative law officer's finding adverse to the respondent, as applicable.

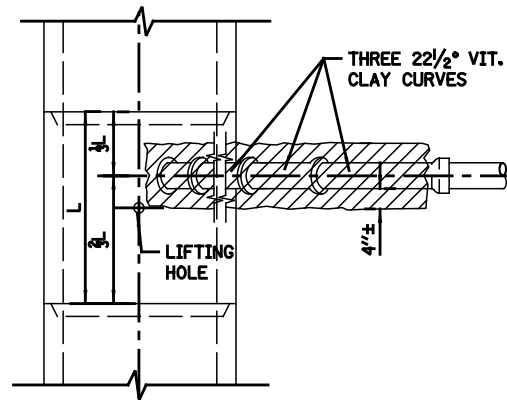
(f) Violations of an order issued under this section shall be punishable by a penalty of \$10,000.00. Each day that the violation continues beyond the specified cessation date shall be deemed a separate offense.

(Added Coun. J. 12-13-06, p. 95586, § 1; Amend Coun. J. 11-16-11, p. 13798, Art. II, § 6)

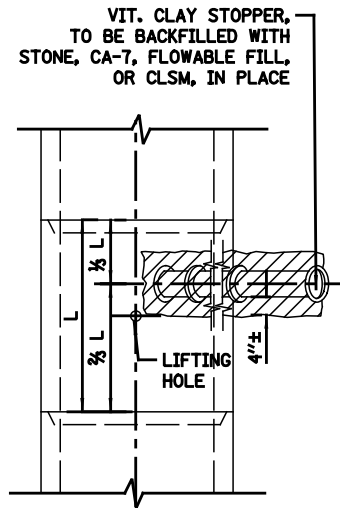
APPENDIX II-A Standard Details

- A.1 Typical Drain Connections for Existing Drains (RCP Sewer Main)
Typical Drain Stacks for Future Use (RCP Sewer Main)
Typical Drain Connections for Existing Drains (VCP Sewer Main)
Typical Drain Stacks for Future Use (VCP Sewer Main)
Lifting Hole Plug Detail for Concrete Pipe
Detail of Tapered Hole
Sewer Trench Detail
- A.2 Typical Drain Connections for Existing Drains (DIP)
Typical Drain Stacks for Future Use (DIP)
DIP Drain Connections for Monolithic Concrete Sewers
DIP Drain Connections for Reinforced Concrete Pipe Sewers
Brick Sewer Drain Connections
- A.3 Heavyweight Manhole Frame
Lightweight Manhole Frame
Standard CB/MH Lid
ADA Manhole Lid
Standard Lid for Infiltration Systems
Infiltration Solid Lid for Catch Basin
Detail of Frame Adjustment
Solid Lid for Manholes
- A.4 Flat Top Slab Details
- A.5 Type “A” Manhole Precast Bases and Rings
- A.6 Reinforcement for Type “A” Precast Manhole Bases
- A.7 Reinforcement Bar List for Type “A” Precast Manhole Bases
- A.8 Type “A” Precast Manhole for Sewers 21" Diameter and Smaller
- A.9 Type “B” Manhole
- A.10 Reinforcement for Type “B” Manhole Bases
- A.11 Type “B” Manhole Configurations
- A.12 Modified Type “B” Manhole
- A.13 Type “C” Single Drop Manhole
- A.14 Type “C” Double Drop Manhole
- A.15 Bases for Type “C” Drop Manhole
- A.16 Precast Tumbling Basin
- A.17 Concrete Collar/Connection Details
- A.18 Standard Drainage Structures for Public Streets—CB and Inlet Details
Standard Drainage Structures for Public Alleys
Drainage Structures Restrictors
- A.19 Drainage Structures for Private Development—CBs & Restrictors
Underdrain detail
- A.20 Ladder Rungs
- A.21 Abandoned Sewer Structure Details

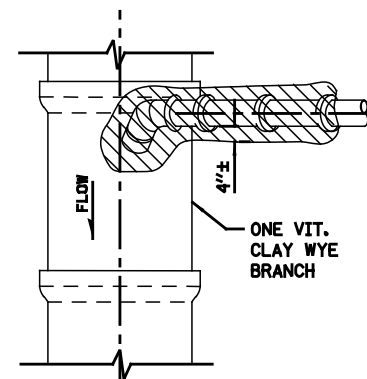
A.100.1	Traps – Interceptors – Separators – Basins
A.100.2	UPC Grease Interceptor Sizing Worksheet
A.100.3	Grease Interceptor Sizing Worksheet
A.100.4	Grease Separators—Sizing for Commercial Sinks
A.100.5	(continued)
A.100.6	Grease Basin Standard
A.100.7	Large Capacity Grease Interceptor
A.101	Grease Separator
A.102	Precast Grease Basin
A.102.1	Sand/Oil Interceptor Sizing Worksheet
A.102.2	Oil/Grease Trap/Interceptor
A.102.3	Lint Interceptor Sizing Calculator for Gravity Drain Laundry Machines
A.102.4	Lint Basin Standard
A.102.5	Lint Basin Standard
A.102.6	Precast Grease/Lint Basin
A.103	Precast Lint Basin
A.103.1	Triple Garage Basin
A.104	Triple Garage Basin
A.105	Drainlayer's License Classifications
A.106	Typical Cleanout to Finished Floor
A.107	Storm Outfall Sign on Waterways
A.108	Operations and Maintenance Plan Owner's Certification Statement
A.109	Right of Way As-Builts - Record Drawings Form



PLAN

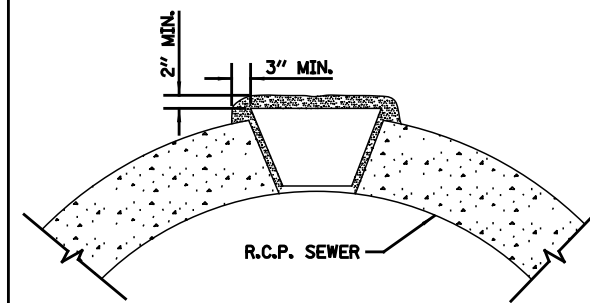


PLAN



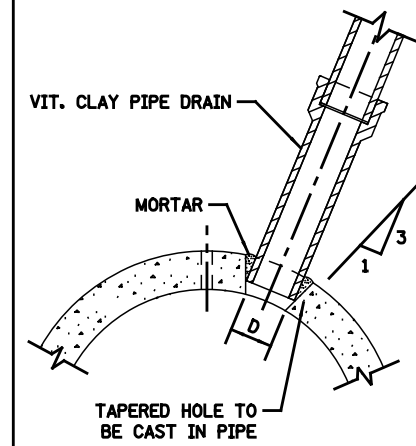
PLAN

NOTE:
PLUG TO BE COATED WITH MORTAR AND
DRIVEN INTO PLACE WITH A WOODEN
MALLET AND THEN SEALED WITH MORTAR.



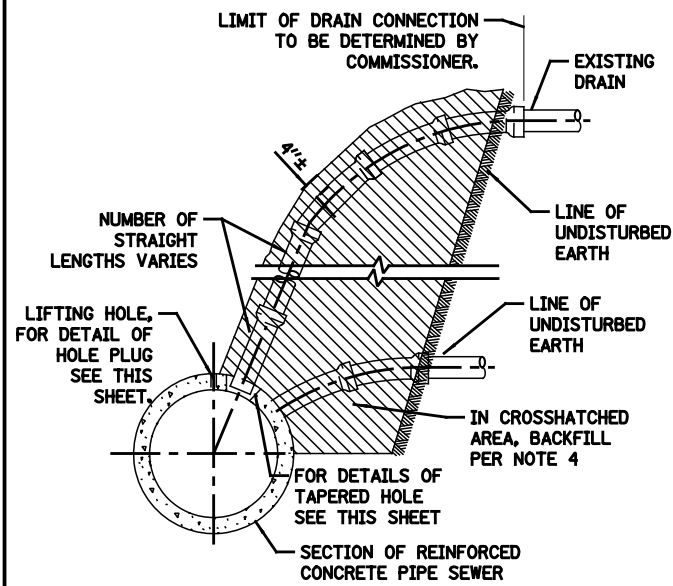
LIFTING HOLE PLUG DETAIL
FOR CONCRETE PIPE

NOTE:
1. ALL PLUG MATERIALS MUST COMPLY WITH
1042.16 OF THE IDOT SSRBC.
2. LIFT HOLES ON COMBINED SEWERS ARE
PROHIBITED WHEN THE WATER TABLE IS
WITHIN 2 FEET OF THE PIPE INVERT.

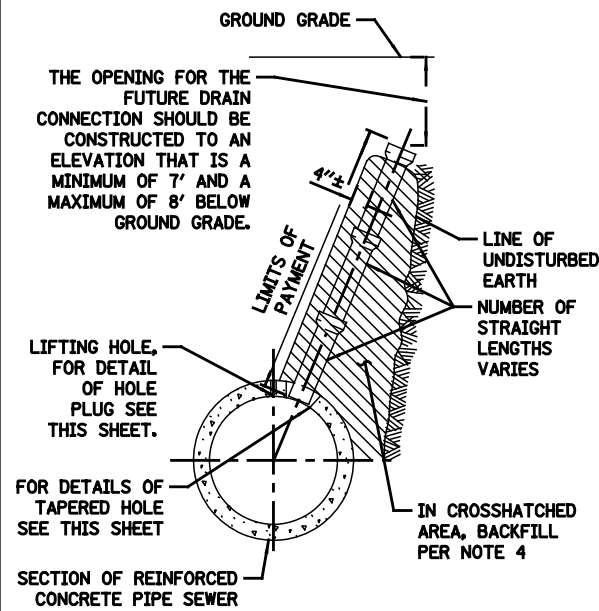


DETAIL OF TAPERED HOLE

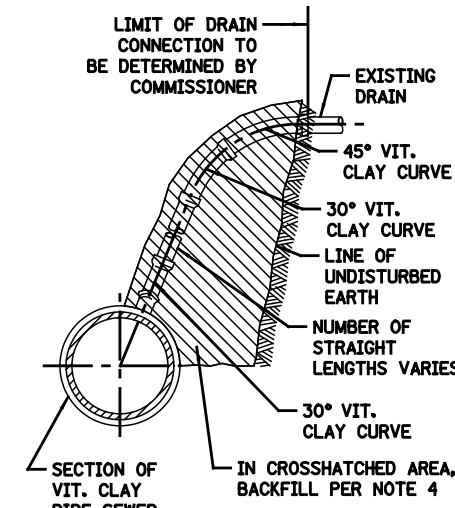
SIZE OF DRAIN	"D"
6"	6 7/8"
8"	9 1/8"
10"	11 1/8"
12"	13 1/2"
15"	17"
18"	20 1/4"
21"	23 3/8"



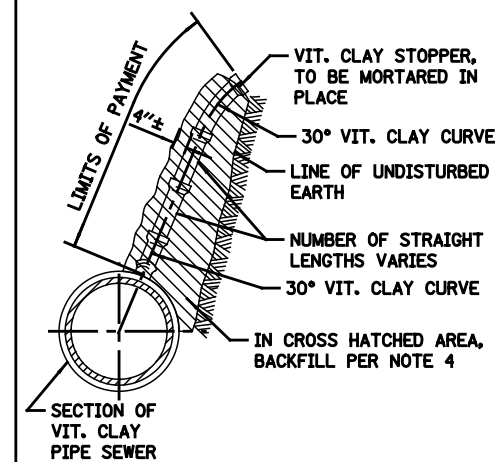
TYPICAL DRAIN CONNECTIONS
FOR EXISTING DRAINS



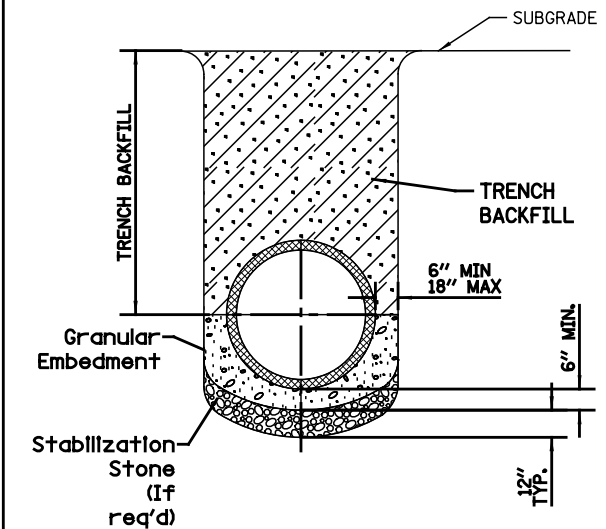
TYPICAL DRAIN STACKS
FOR FUTURE USE



TYPICAL DRAIN CONNECTIONS
FOR EXISTING DRAINS



TYPICAL DRAIN STACKS
FOR FUTURE USE



NOTE:
1. FOR TRENCH BACKFILL, REFER TO IDOT SSRBC, ARTICLE 1003.04.
2. FOR GRANULAR EMBEDMENT, USE CA-11, CRUSHED GRAVEL, CRUSHED STONE, OR CRUSHED CONCRETE.
3. FOR STABILIZATION STONE, 12" OF CA-1 STONE IS ONLY REQUIRED WHEN UNSTABLE MATERIAL IS ENCOUNTERED AT TRENCH BOTTOM.
4. AGGREGATE PLACED FOR TEMPORARY SURFACE RESTORATION WILL NOT BE PAID SEPARATELY AND SHALL BE INCIDENTAL TO THE CONTRACT.

SEWER TRENCH DETAIL

NOTES:
1. ALL DRAIN CONNECTION JOINTS MUST BE MADE AS SPECIFIED IN SPECIFICATIONS..
2. FOR DUCTILE IRON PIPE DRAIN CONNECTIONS SEE SHEET NO. A.2.
3. FOR BACKFILL OF HATCHED SUPPORT AREAS, USE CONCRETE. CA-11, FLOWABLE FILL, OR CLSM.

STANDARD REVISIONS	
DATE	DESCRIPTION
7/3/18	APPROVED PLAN

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES

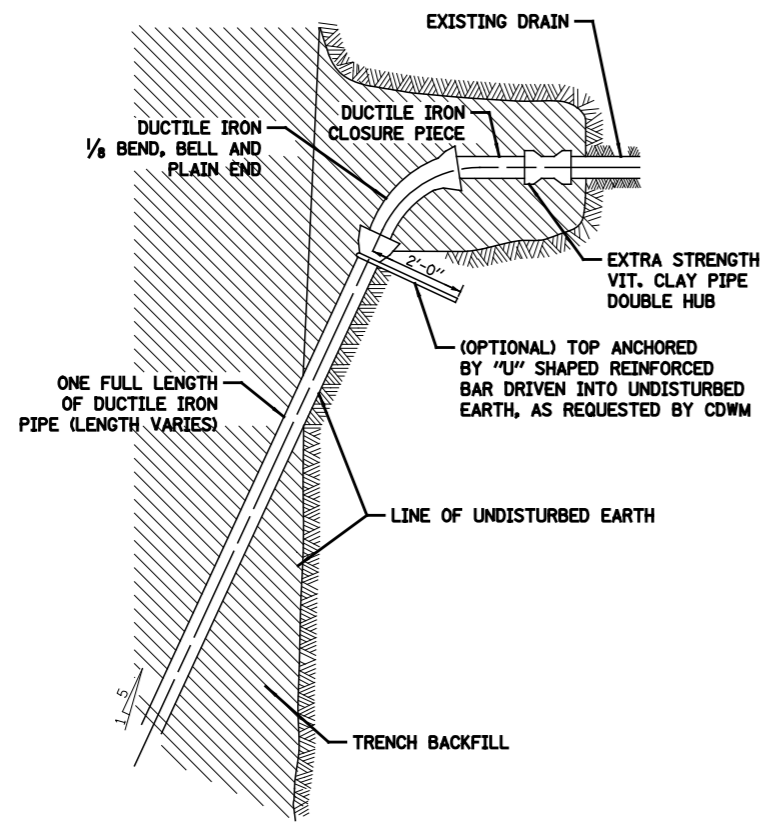
VITRIFIED CLAY PIPE
DRAIN CONNECTIONS
AND SEWER TRENCH DETAIL

Drawn:
Designed:
Checked:
Reviewed:

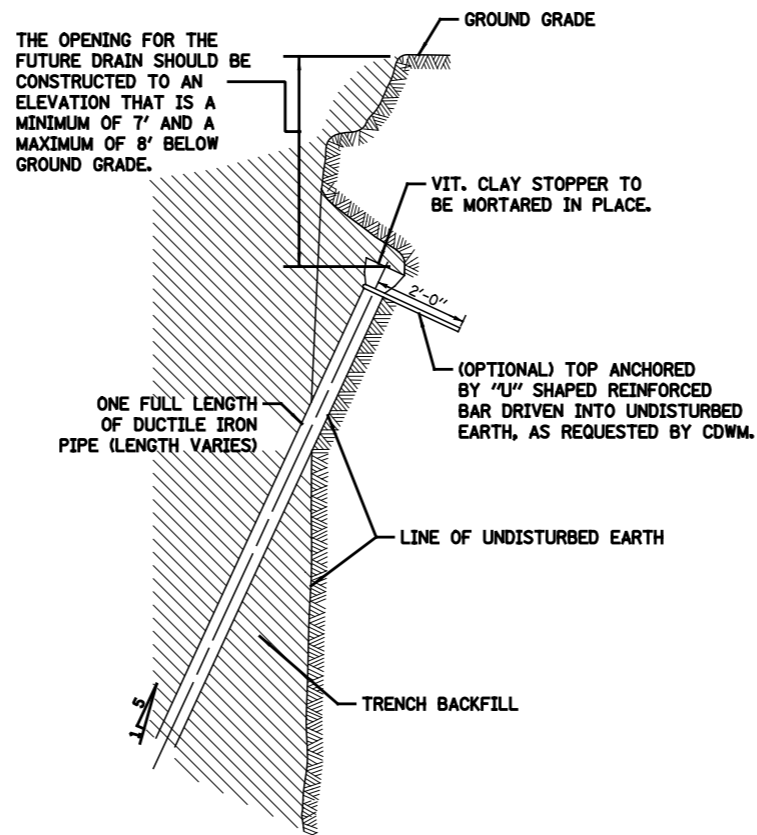
A.1

___ OF ___
PN ___

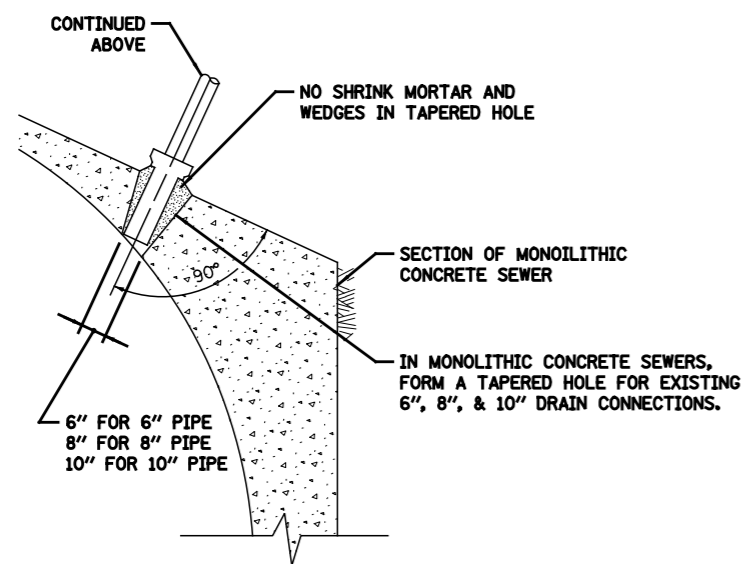
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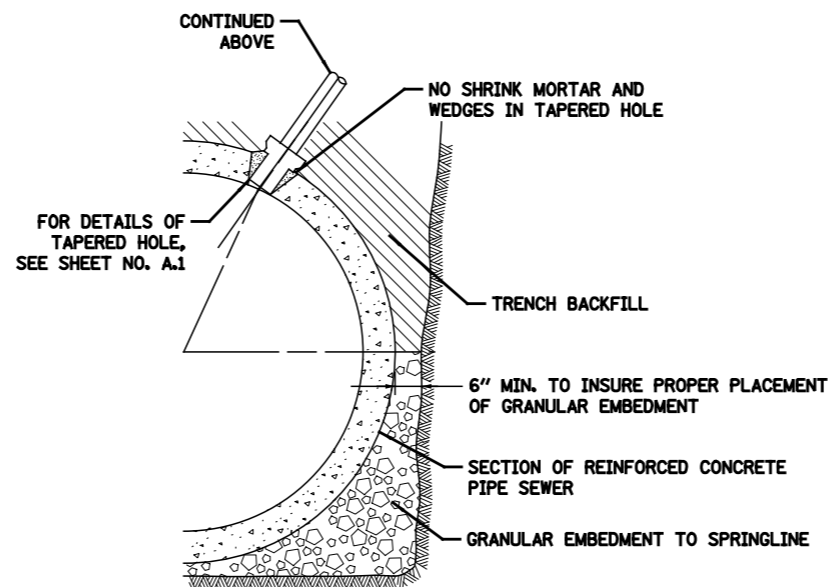
TYPICAL DRAIN CONNECTIONS FOR EXISTING DRAINS



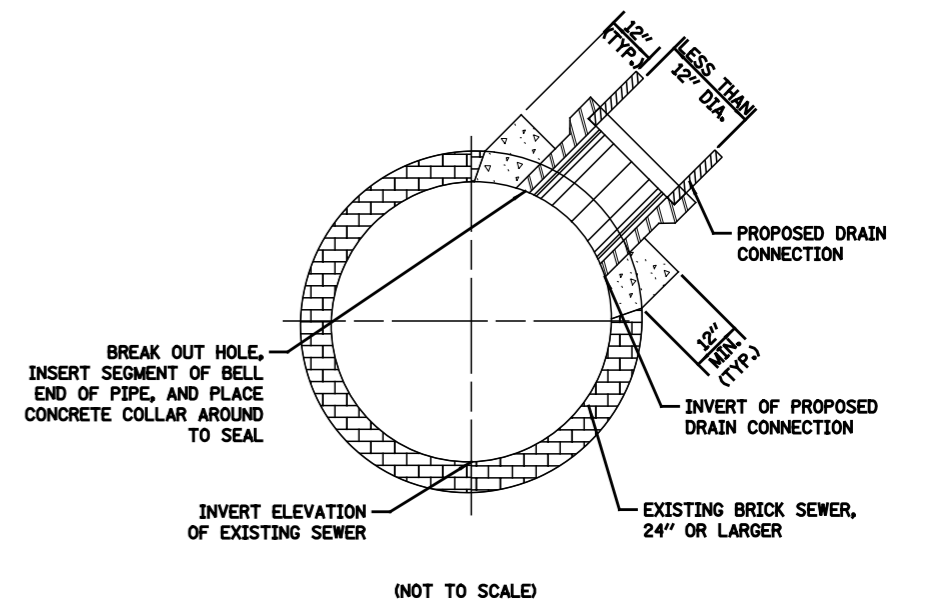
TYPICAL DRAIN STACKS FOR FUTURE USE



FOR MONOLITHIC CONCRETE SEWERS



FOR REINFORCED CONCRETE PIPE SEWERS



FOR BRICK SEWERS

DUCTILE IRON PIPE DRAIN CONNECTIONS

BRICK SEWER DRAIN CONNECTIONS

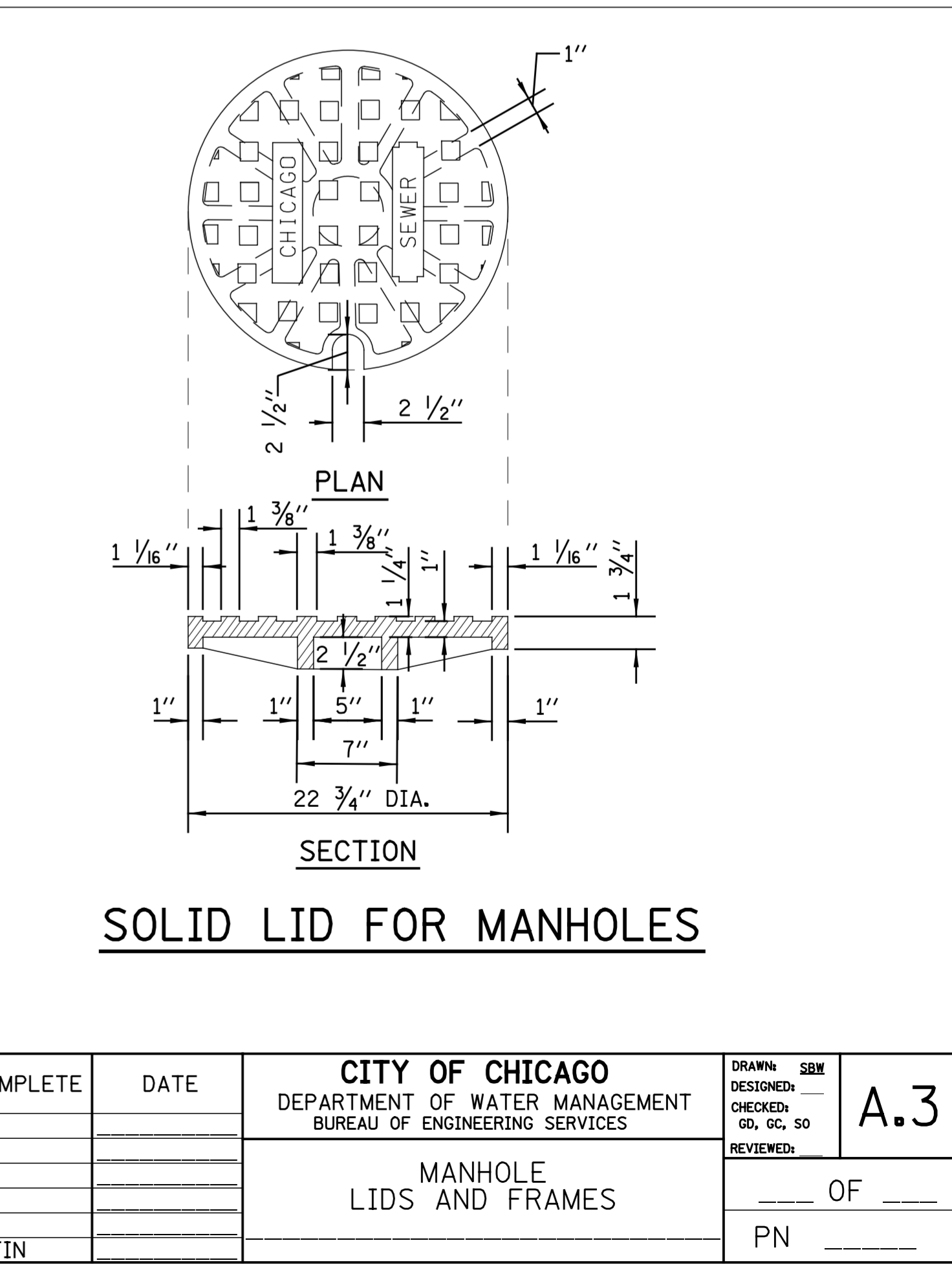
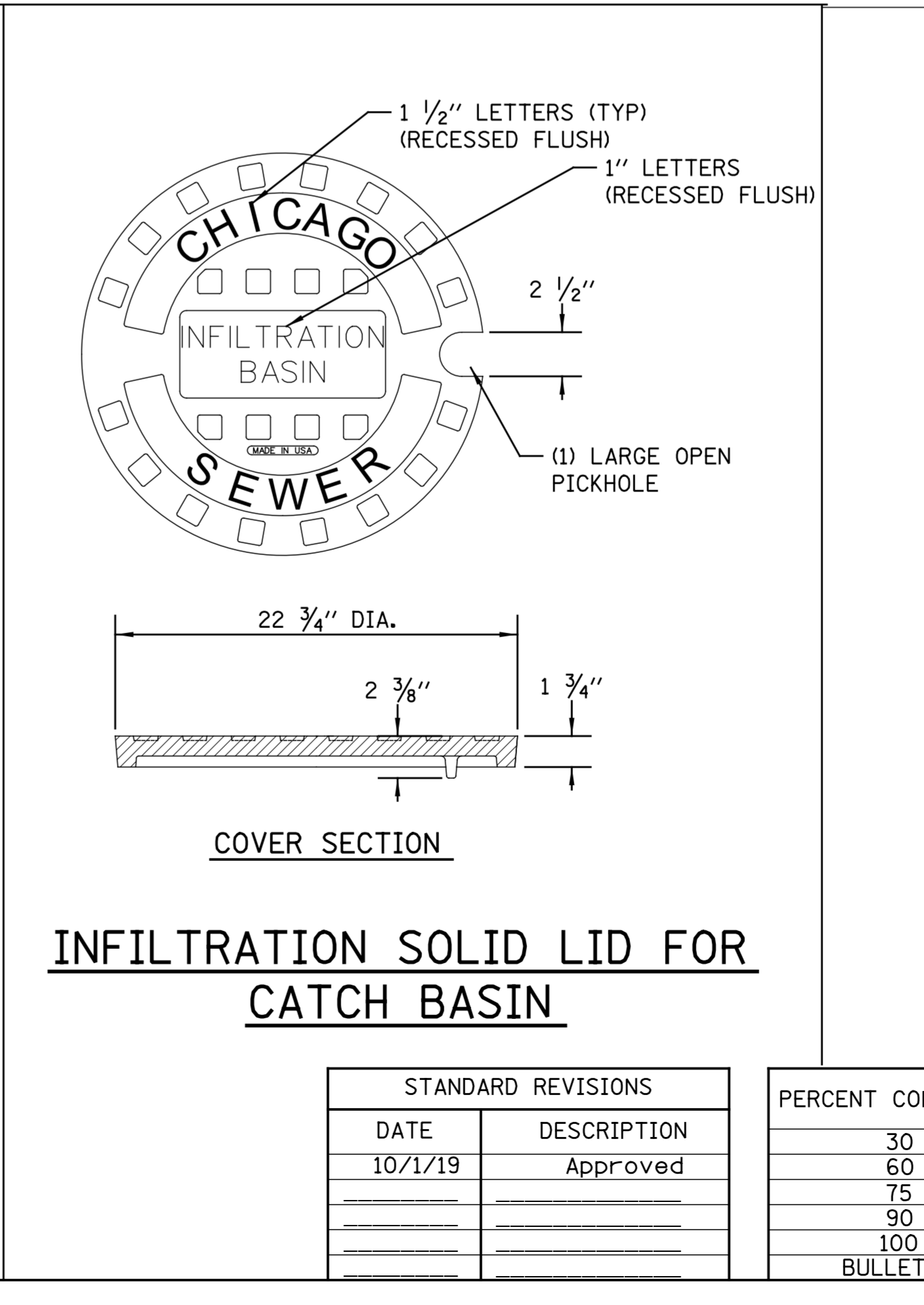
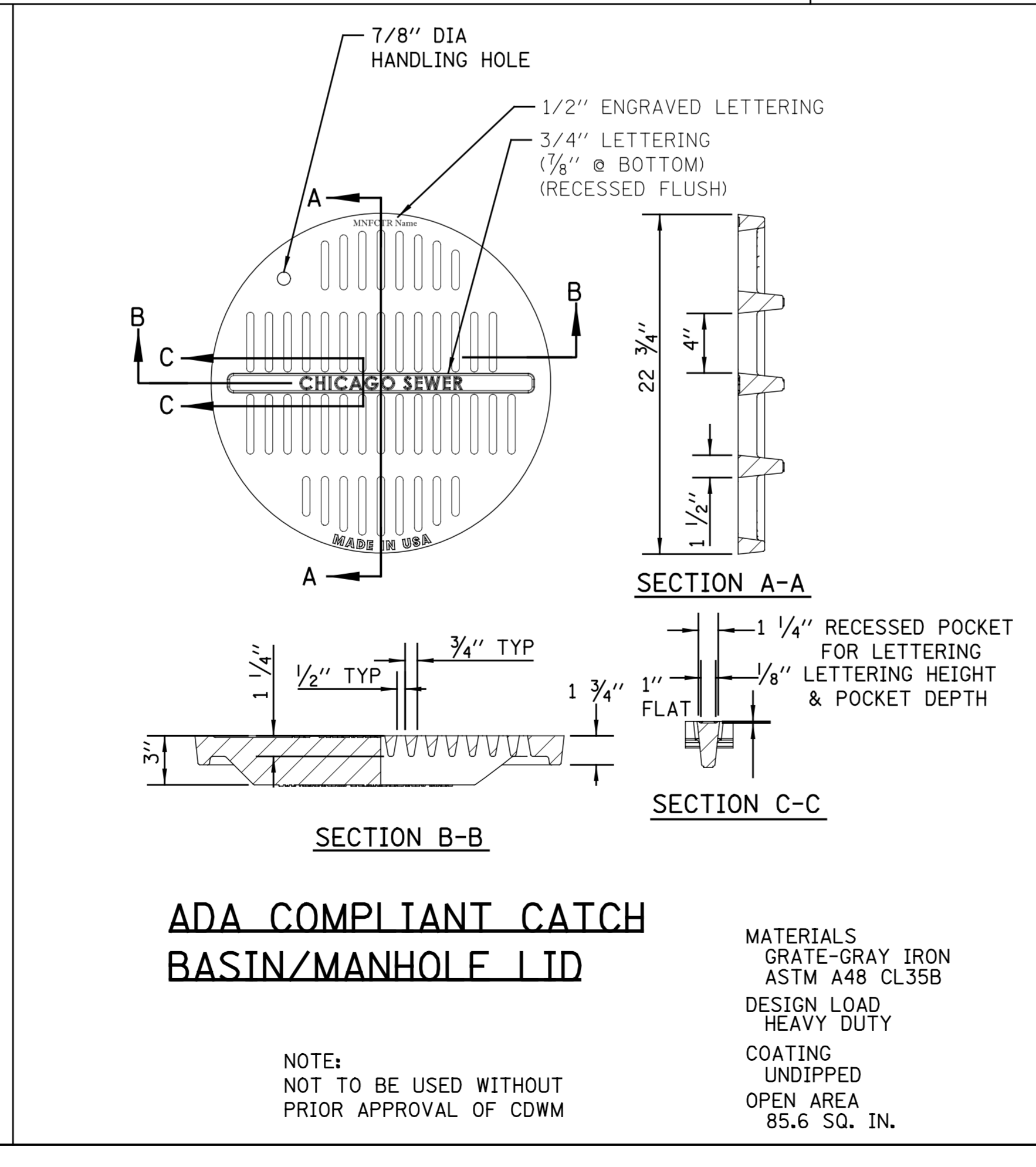
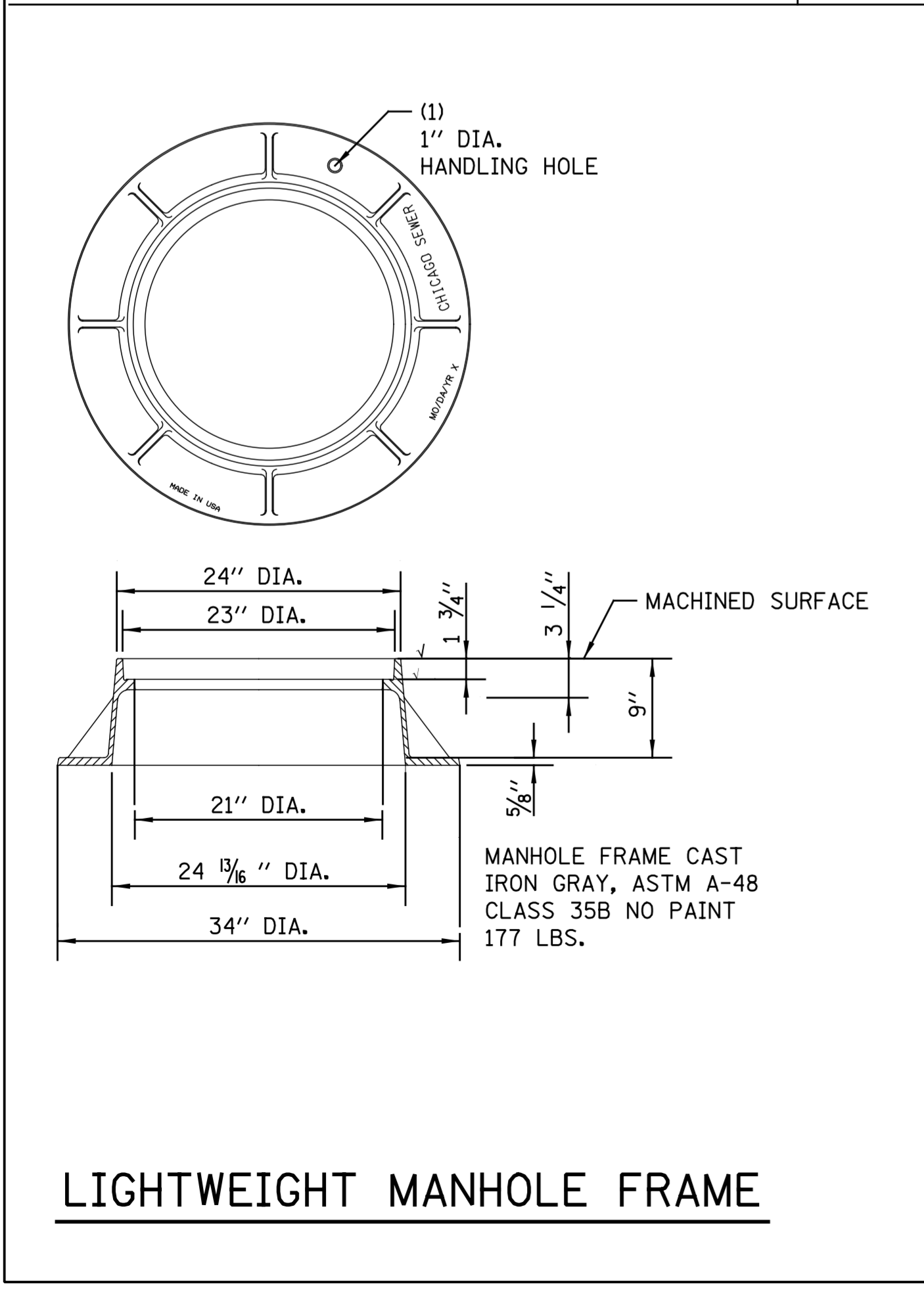
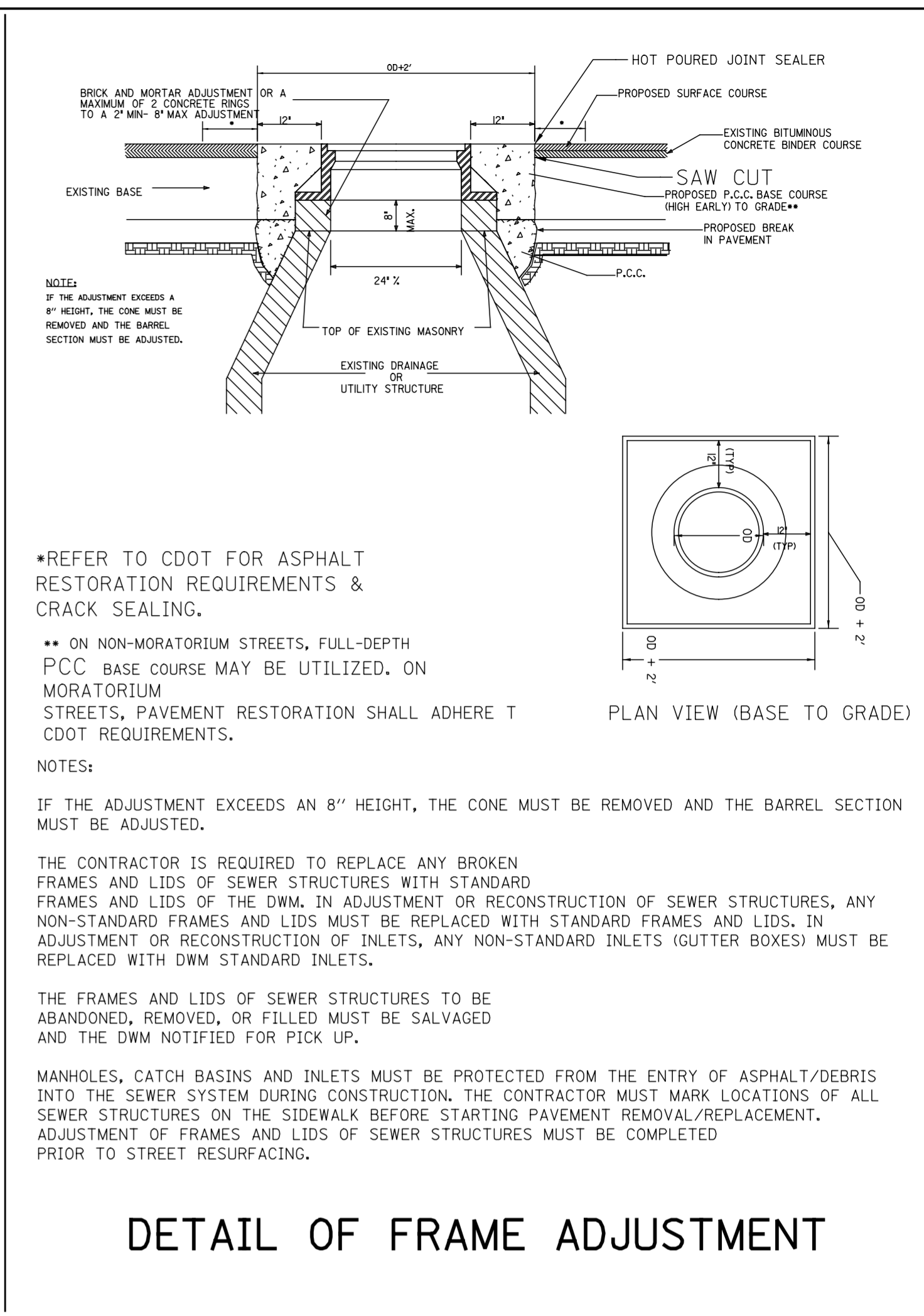
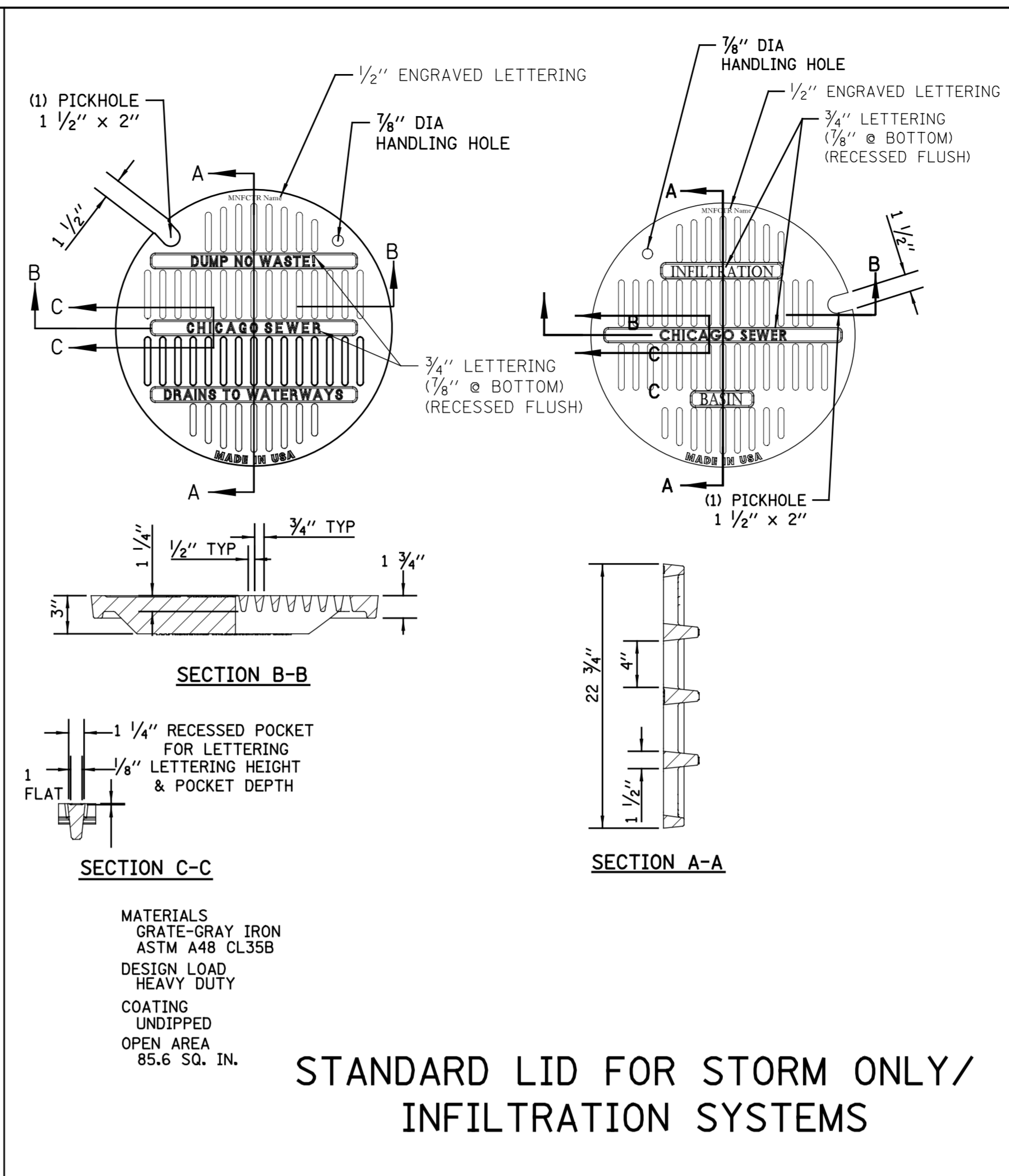
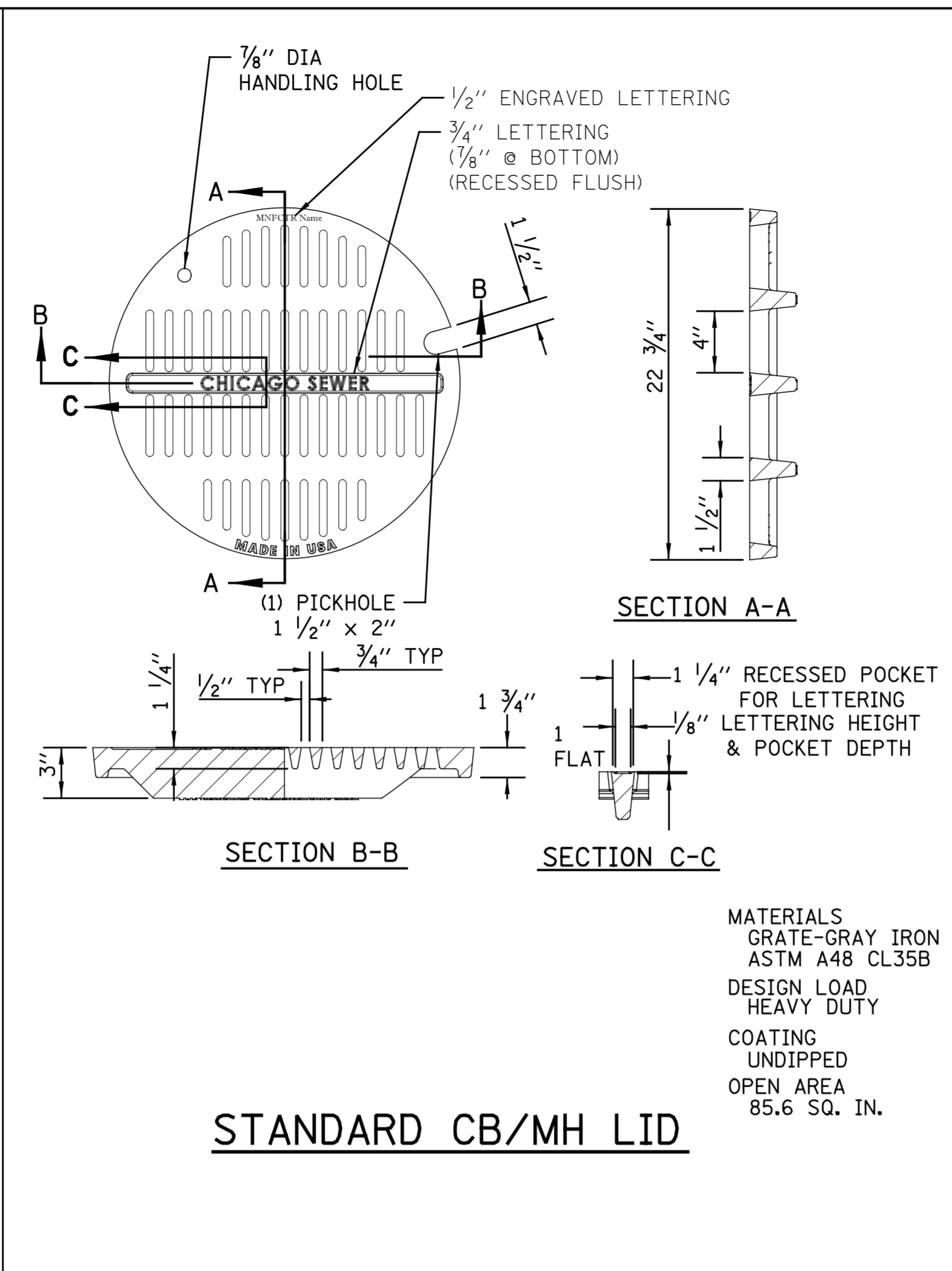
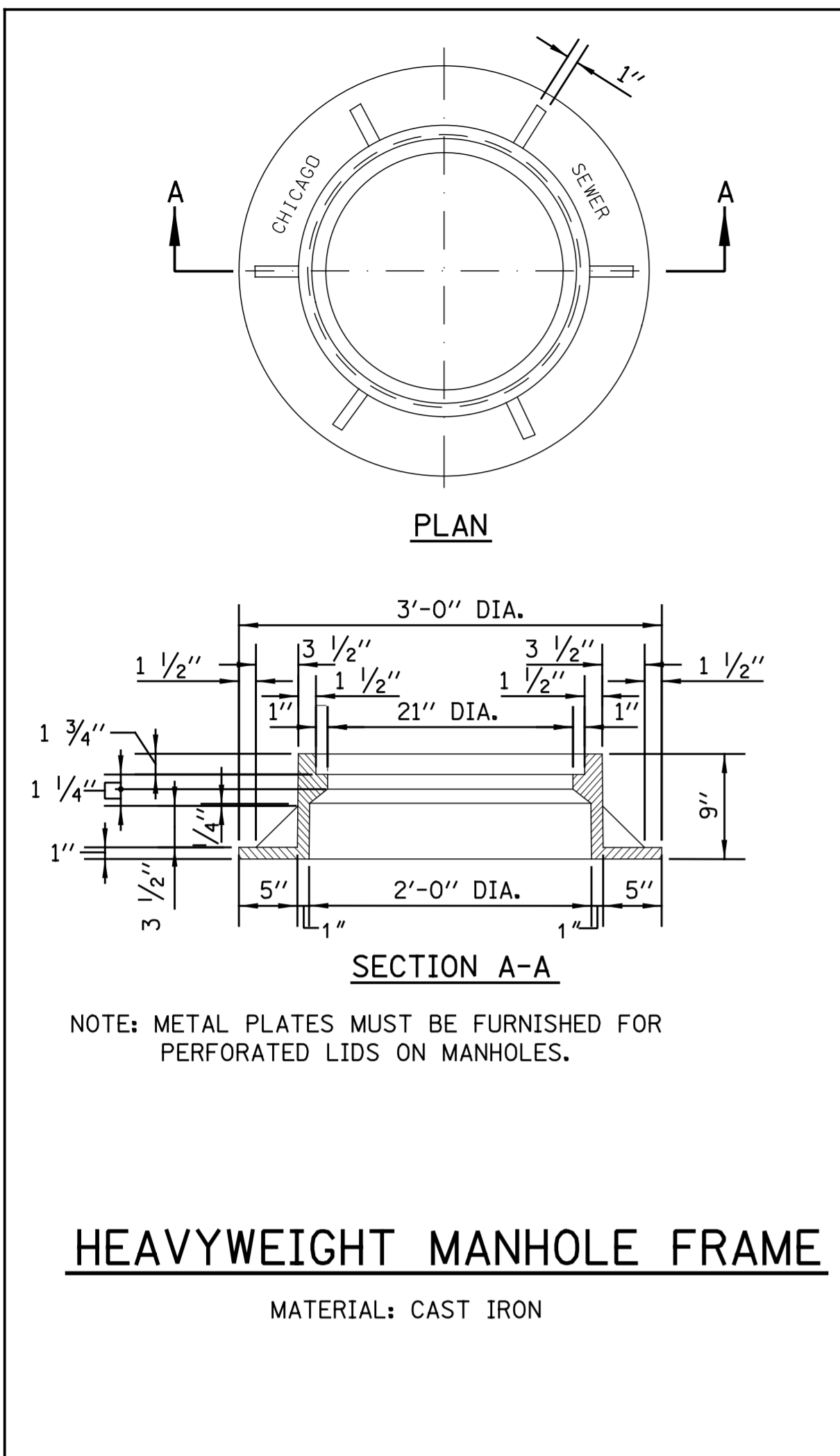
- NOTES:
1. DUCTILE IRON PIPE MUST BE BELL END WITH PUSH-ON JOINTS CONFORMING TO ANSI SPECIFICATIONS A21.51 WITH CLASS 52 THICKNESS.
 2. CONNECTIONS AND STACKS SHOWN MUST BE USED FOR 6", 8", & 10" DRAINS ONLY.
 3. FOR VITRIFIED CLAY PIPE DRAIN CONNECTION AND DRAIN STACK CONSTRUCTION, SEE SHEET NO. A.1.
 4. FOR TRENCH BACKFILL, REFER TO IDOT SSRBC, ARTICLE 1003.04.
 5. FOR GRANULAR EMBEDMENT, USE CA-11, CRUSHED GRAVEL, CRUSHED STONE, OR CRUSHED CONCRETE.

STANDARD REVISIONS	
DATE	DESCRIPTION
9/20/17	APPROVED PLAN

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES		DRAWN: <input type="checkbox"/> DESIGNED: <input type="checkbox"/> CHECKED: <input type="checkbox"/> REVIEWED: <input type="checkbox"/>
DUCTILE IRON PIPE DRAIN CONNECTIONS		A.2 OF PN

\$FILE\$
\$DATE\$



STANDARD REVISIONS	
DATE	DESCRIPTION
10/1/19	Approved

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES

**MANHOLE
LIDS AND FRAMES**

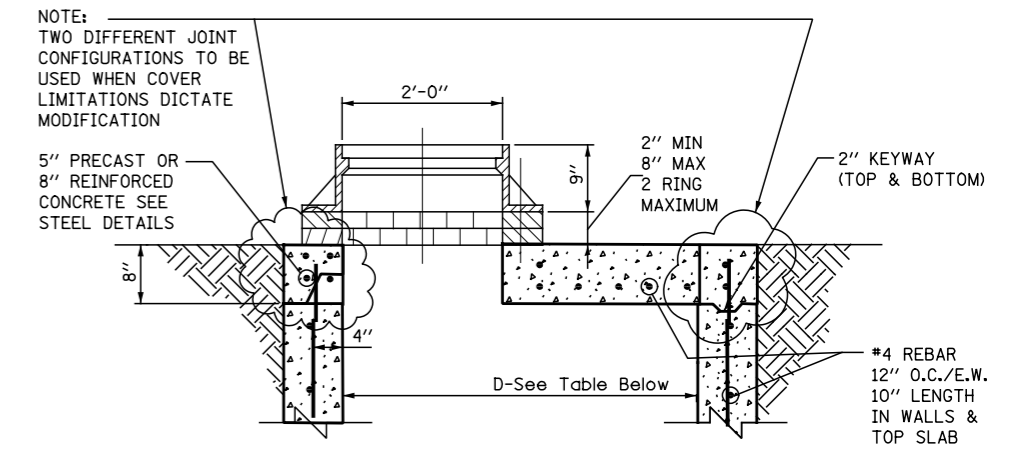
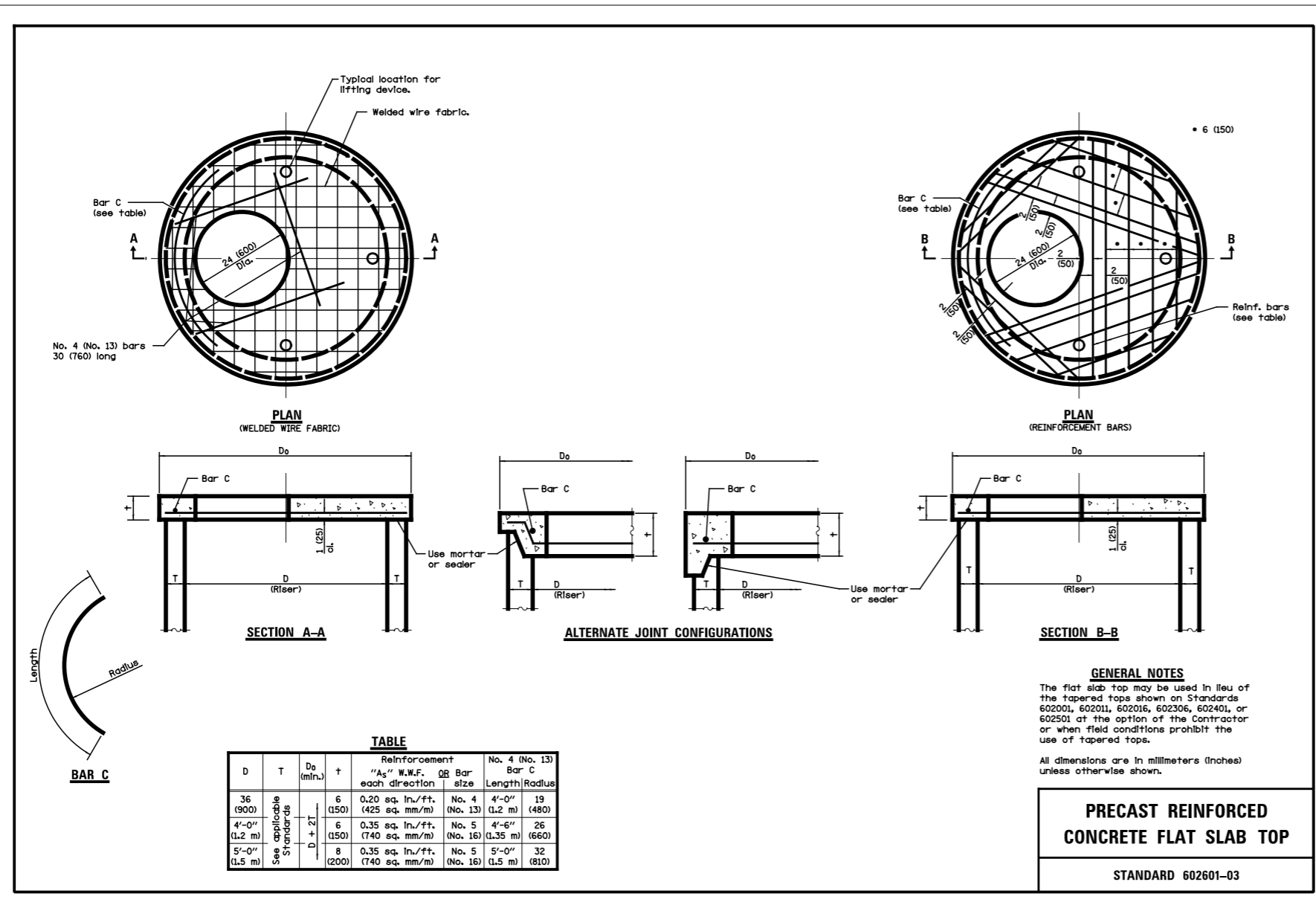
DRAWN: SBH
DESIGNED: SBH
CHECKED: GD, GC, SO
REVIEWED: SBH

A.3

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PN

\$FILE\$
\$DATE\$

SPECIAL DRAINAGE STRUCTURES FOR PUBLIC STREETS AND ALLEYS

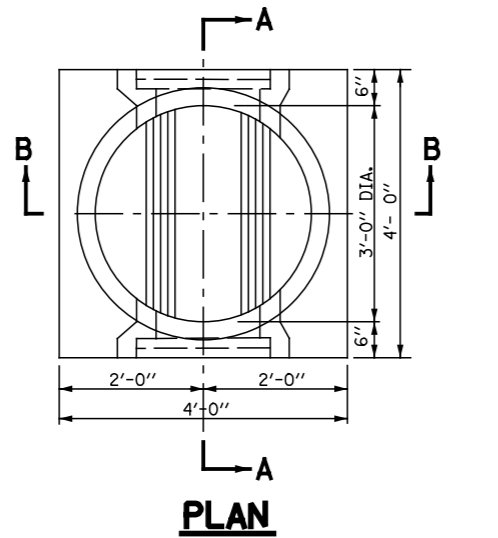


STANDARD FLAT TOP SLAB FOR CATCH BASINS

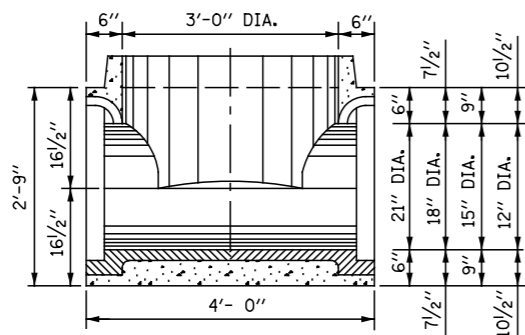
NOTES:
 FLAT TOP SLAB APPLICATION CAN ONLY BE USED WITH WRITTEN PERMISSION FROM CDWM.
 USE LATEST IDOT DETAIL, #602601

FILE \$
 DATE \$

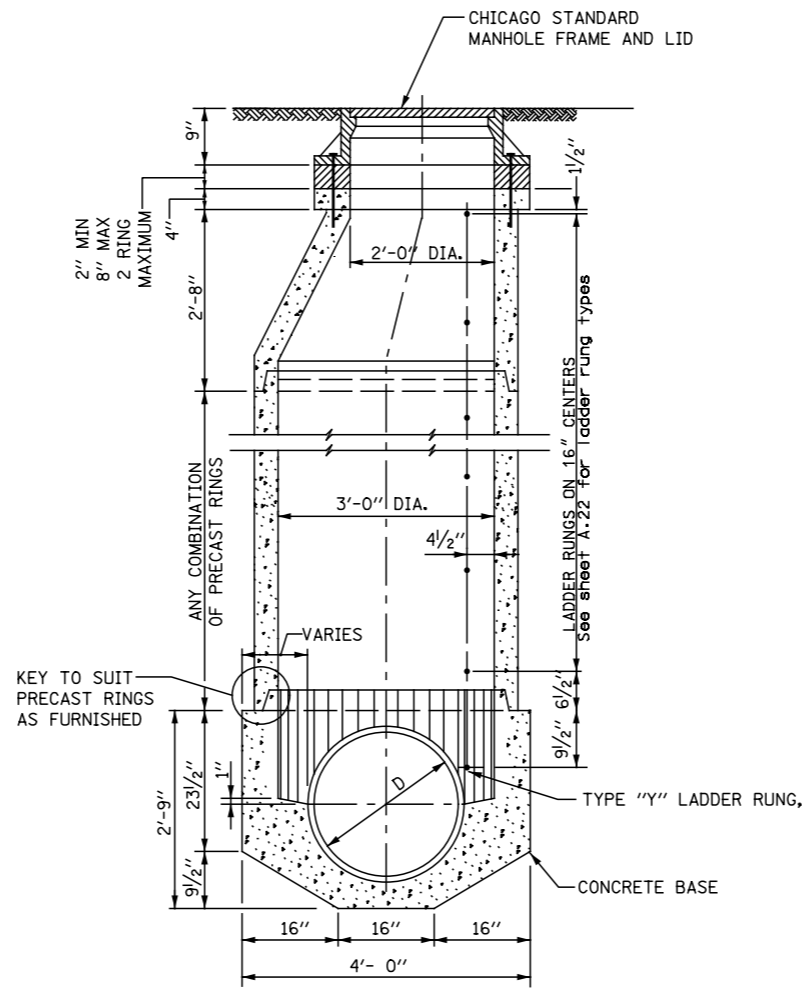
STANDARD REVISIONS		PERCENT COMPLETE	DATE	CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	DRAWN BY DESIGNED BY CHECKED BY REVIEWED BY	A.4 OF PN
DATE	DESCRIPTION					
9/5/17	APPROVED PLAN	30		FLAT TOP SLAB DETAILS		
		60				
		75				
		90				
		100				
		BULLETIN				



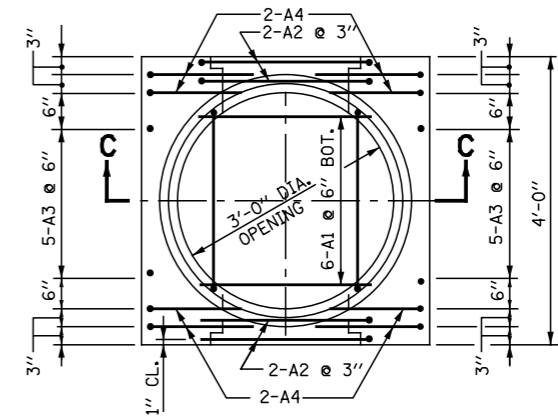
PLAN



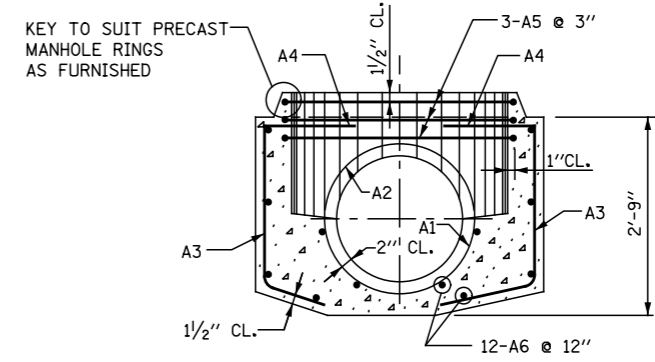
SECTION A-A



SECTION B-B



**PLAN
PRECAST BASE**



SECTION C-C

NOTE:
6" MINIMUM GRANULAR EMBEDMENT
UNDER ALL PRECAST MANHOLE BASES

SCHEDULE OF REINFORCEMENT

STRUCTURE	REINFORCEMENT BAR						BENDING DIMENSIONS																
	MARK	SIZE NO.	TYPE	LENGTH	NO. REED.	WEIGHT - LBS EACH	TOTAL	A	B	C	D	E	F	G	H	J	K	O	R				
BASES FOR TYPE "A" MANHOLES (PRECAST)	21" DIA.	21A1	6	9	3'-1"	6	4.63	28		3'-1"								11 1/4"		2'-1"	12 3/4"		
		21A2	6	T3	8'-8"	4	13.02	52												2'-0"	2'-1 1/2"		
		21A3	5	12	3'-3"	10	3.39	34			22"	17"							14 1/2"	8 3/4"			
		21A4	5	12	4'-6"	8	4.69	38		15"	22"	17"							14 1/2"	8 3/4"			
		21A5	5	T3	11'-11"	3	12.43	37												20"	3'-3 3/4"		
		21A6	4	STR	3'-8"	12	2.45	30															
		TOTAL						219															
		18" DIA.	18A1	6	9	2'-8 1/2"	6	4.07	24		2'-8 1/2"									9 3/4"	22"	11 1/4"	
	18A2		6	T3	7'-10 1/2"	4	11.83	47												2'-0"	22 1/2"		
	18A3		5	12	3'-3"	10	3.39	34			22"	17"								14 1/2"	8 3/4"		
	18A4		5	12	4'-6"	8	4.69	38		15"	22"	17"								14 1/2"	8 3/4"		
	18A5		5	T3	11'-11"	3	12.43	37													2'-0"	3'-3 3/4"	
18A6	4		STR	3'-8"	12	2.45	30																
	TOTAL						202																
	15" DIA.	15A1	6	9	2'-3 1/2"	6	3.44	21		23 1/2"									8 1/4"	19"	9 3/4"		
15A2		6	T3	7'-1"	4	10.64	42													2'-0"	19 1/2"		
15A3		5	12	3'-3"	10	3.39	34			22"	17"								14 1/2"	8 3/4"			
15A4		5	12	4'-6"	8	4.69	38		15"	22"	17"								14 1/2"	8 3/4"			
15A5		5	T3	11'-11"	3	12.43	37													20"	3'-3 3/4"		
15A6		4	STR	3'-8"	12	2.45	30																
	TOTAL						202																
	12" DIA.	12A1	6	9	1'-11"	6	2.88	17		23"									6 3/4"	16"	8 1/4"		
12A2		6	T3	6'-1"	4	9.14	37													2'-0"	16 1/2"		
12A3		5	12	3'-3"	10	3.39	34			22"	17"								14 1/2"	8 3/4"			
12A4		5	12	4'-6"	8	4.69	38			22"	17"								14 1/2"	8 3/4"			
12A5		5	T3	11'-11"	3	12.43	37													20"	3'-3 3/4"		
12A6		4	STR	3'-8"	12	2.45	30																
	TOTAL						193																

STANDARD REVISIONS	
DATE	DESCRIPTION
9/5/17	REVISION

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES

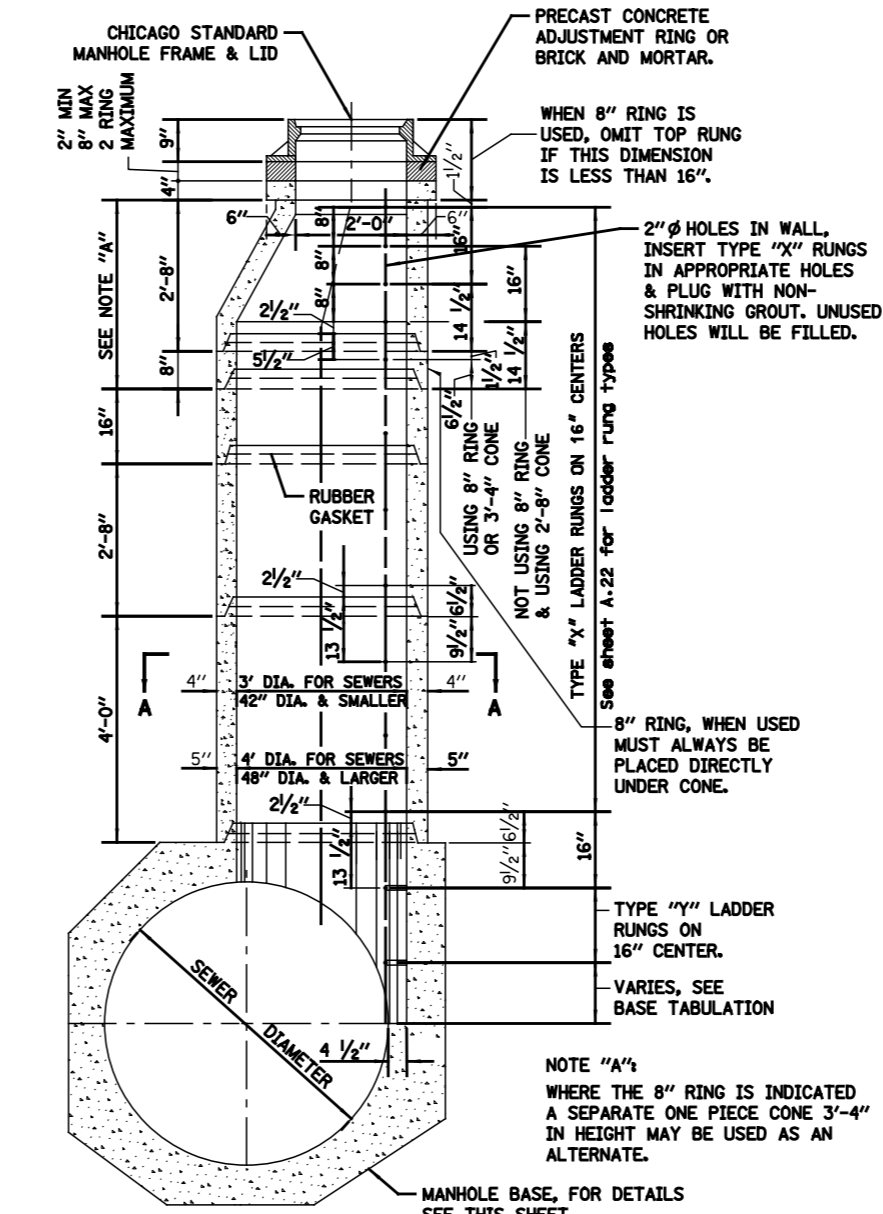
TYPE "A" PRECAST
MANHOLE FOR SEWERS
21" DIA. AND SMALLER

DATE DESIGNED: _____
CHECKED: _____
REVISION: _____

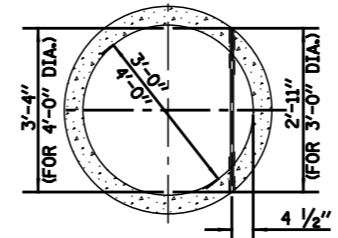
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PN _____

NUMBER OF PRECAST RINGS REQUIRED FOR MANHOLES OF VARIOUS HEIGHTS																										
TOTAL HEIGHT "H"	9" FRAME +2'-0" CORBEL -5'-5"				PRECAST RINGS				BRICK AND/OR MORTAR				TOTAL HEIGHT "H"	9" FRAME +2'-0" CORBEL -5'-5"				PRECAST RINGS				BRICK AND/OR MORTAR				
	4'-0"	2'-0"	1'-4"	0'-8"	4'-0"	2'-0"	1'-4"	0'-8"	4'-0"	2'-0"	1'-4"	0'-8"		4'-0"	2'-0"	1'-4"	0'-8"	4'-0"	2'-0"	1'-4"	0'-8"	4'-0"	2'-0"	1'-4"	0'-8"	
5'-0"	3'-5"																									
6'-0"	3'-5"																									
7'-0"	3'-5"																									
8'-0"	3'-5"																									
9'-0"	3'-5"																									
10'-0"	3'-5"																									
11'-0"	3'-5"																									
12'-0"	3'-5"																									
13'-0"	3'-5"																									
14'-0"	3'-5"																									
15'-0"	3'-5"																									
16'-0"	3'-5"																									
17'-0"	3'-5"																									
18'-0"	3'-5"																									
19'-0"	3'-5"																									
20'-0"	3'-5"																									
21'-0"	3'-5"																									
22'-0"	3'-5"																									
23'-0"	3'-5"																									
24'-0"	3'-5"																									
25'-0"	3'-5"																									
26'-0"	3'-5"																									
27'-0"	3'-5"																									
28'-0"	3'-5"																									
29'-0"	3'-5"																									
30'-0"	3'-5"																									
31'-0"	3'-5"																									
32'-0"	3'-5"																									
33'-0"	3'-5"																									
34'-0"	3'-5"																									
35'-0"	3'-5"																									
36'-0"	3'-5"																									
37'-0"	3'-5"																									
38'-0"	3'-5"																									
39'-0"	3'-5"																									
40'-0"	3'-5"																									
41'-0"	3'-5"																									
42'-0"	3'-5"																									
43'-0"	3'-5"																									
44'-0"	3'-5"																									
45'-0"	3'-5"																									
46'-0"	3'-5"																									
47'-0"	3'-5"																									
48'-0"	3'-5"																									
49'-0"	3'-5"																									
50'-0"	3'-5"																									

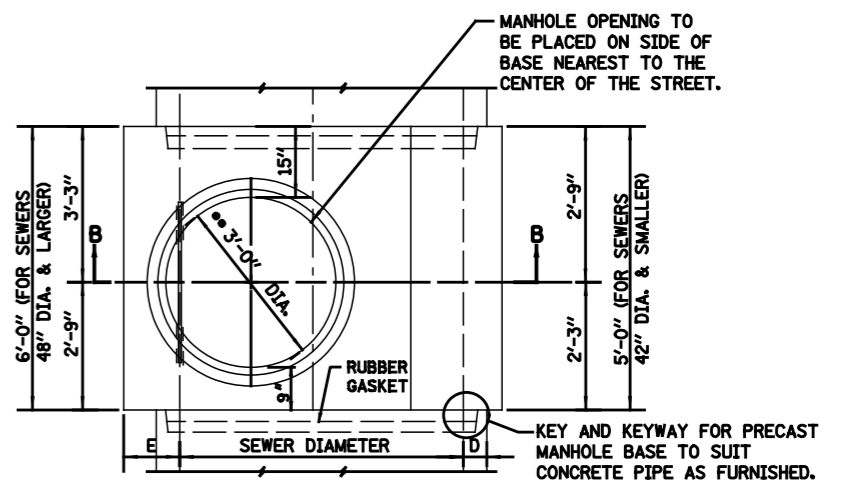


DETAIL OF PRECAST RINGS

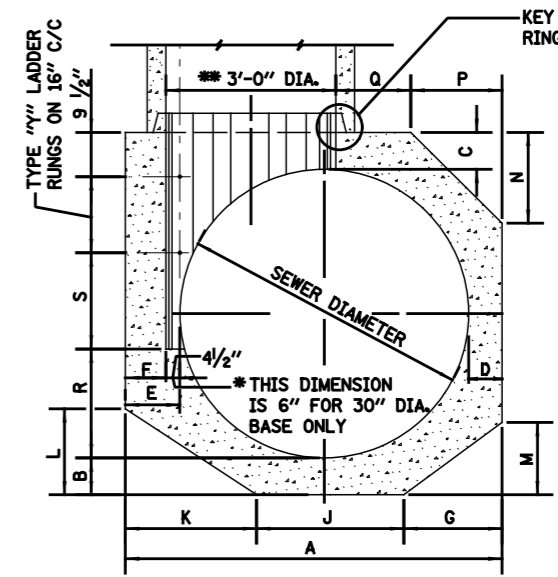


1"Ø LADDER RUNG, TYPE "X", LENGTH 2'-11" OR 3'-4" INSERTED INTO 2"Ø HOLE IN WALL & PLUGGED BY MANUFACTURER WITH NON-SHRINKING GROUT.

SECTION A-A



PLAN •• 3'-0" DIA. FOR SEWERS 42" DIA. & SMALLER
4'-0" DIA. FOR SEWERS 48" DIA. & LARGER



SECTION B-B
DETAIL OF PRECAST BASE

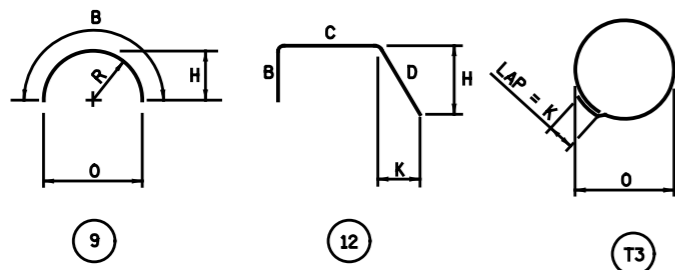
SEWER DIA.	DIMENSIONS OF PRECAST MANHOLE BASE														# "Y" RUNGS			
	A	B	C	D	E	F	G	J	K	L	M	N	P	Q		R	S	
36"	4'-4 1/2"	6"	6"	6"	10 1/2"	6"	16"	16"	20 1/2"	12 1/2"	9 1/2"	6"	6"	6"	10 1/2"	18"	14 1/2"	1
30"	4'-0"	6"	6"	6"	12"	6"	14"	14"	20"	12"	8 1/2"	6"	6"	6"	6"	15"	11 1/2"	1
24"	4'-0"	6"	6"	12"	12"	6"	16"	16"	16"	9 1/2"	9 1/2"	6"	6"	6"	6"	12"	8 1/2"	1

NOTES:
 PRECAST CONCRETE RINGS MUST CONFORM TO A.S.T.M. DESIGNATION C76 FOR "REINFORCED CONCRETE CULVERT, STORM DRAIN, AND SEWER PIPE", CLASS II, WALL B.
 STANDARD LENGTHS OF RINGS ARE: 4'-0", 2'-8", 1'-4", 0'-8" AND 0'-4" COLLAR.
 ALL REINFORCEMENT STEEL REQUIRED FOR PRECAST RINGS MUST BE INCLUDED IN THE PRICE BID FOR ALL MANHOLE ITEMS.
 ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE."
 A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

STANDARD REVISIONS		PERCENT COMPLETE	DATE	CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	DRAWN: [] CHECKED: [] REVIEWED: []
DATE	DESCRIPTION				
9/19/17	APPROVED PLAN	30		TYPE "A" MANHOLE PRECAST RISERS, BASES AND RINGS 24" AND LARGER	A.6 OF PN
		60			
		75			
		90			
		100			
		BULLETIN			

FILE\$
DATE\$

MARK NO.	REINFORCEMENT BAR				BENDING DIMENSIONS												
	SIZE	TYPE	LENGTH	NO. EACH	WEIGHT - LB	A	B	C	D	E	F	G	H	J	K	L	R
BASES FOR TYPE "A" MANHOLES (Precast)																	
36" DIA.																	
36A1	8	T3	12'-7"	6	16.90												
36A2	8	9	8'-0"	4	6.26												
36A3	8	12	4'-0"	4	4.89												
36A4	8	12	8'-0"	5	5.22												
36A5	8	12	8'-0"	5	5.00												
36A6	8	T3	11'-11"	3	12.49												
36A7	8	T3	8'-0"	3	6.91												
36A8	4	STR	4'-0"	18	3.12												
TOTAL					526												
30" DIA.																	
30A1	8	T3	11'-1"	6	16.65												
30A2	8	9	4'-0"	4	4.52												
30A3	8	12	4'-0"	4	4.17												
30A4	8	12	3'-10"	5	4.00												
30A5	8	12	3'-0"	5	3.48												
30A6	8	T3	11'-11"	3	12.49												
30A7	8	12	15'-1"	5	5.30												
30A8	4	STR	4'-0"	18	3.12												
TOTAL					292												
24" DIA.																	
24A1	8	9	3'-8"	6	6.13												
24A2	8	T3	9'-4"	7	14.02												
24A3	8	12	3'-4"	10	3.66												
24A4	8	12	3'-0"	10	3.59												
24A5	8	T3	11'-11"	3	12.49												
24A6	4	STR	4'-0"	12	3.12												
TOTAL					280												



NOTES:
 ALL DIMENSIONS ARE OUT TO OUT OF BAR.
 BENDING RADII "R" TO OUTSIDE OF BAR.
 NUMBERS IN CIRCLES DENOTE BAR TYPE.

PLACING OF CONCRETE- CONCRETE MUST BE PLACED IN ACCORDANCE WITH THE METHOD OUTLINED IN THE CITY OF CHICAGO STANDARD SPECIFICATIONS.
 CONSTRUCTION JOINTS - JOINTS NOT INDICATED ON THE DRAWINGS MUST BE SO MADE AND LOCATED AS NOT TO IMPAIR THE STRENGTH OF THE STRUCTURE AND MUST BE APPROVED BY THE COMMISSIONER. JOINTS MUST BE CONSTRUCTED IN ACCORDANCE WITH THE METHOD OUTLINED IN THE SPECIFICATIONS.

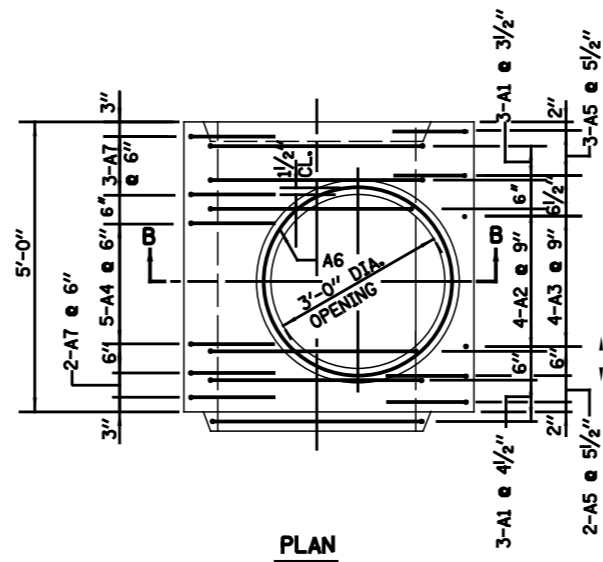
CONCRETE PROTECTION FOR REINFORCEMENT- ALL REINFORCING STEEL MUST HAVE CLEAR CONCRETE COVERING AS FOLLOWS (UNLESS OTHERWISE NOTED) :
 3" AT EXTERIOR SURFACES WHERE CONCRETE IS DEPOSITED AGAINST THE GROUND;
 2.5" AT SURFACES WHERE CONCRETE IS FORMED BUT SUBSEQUENTLY WILL BE IN CONTACT WITH SEWAGE; 2" AT ALL OTHER SURFACES.

REINFORCING STEEL- ALL REINFORCING BARS MUST BE ACCURATELY PLACED AND SECURELY SUPPORTED BY BAR SUPPORTS, SPACERS OR HIGH CHAIRS.
 ALL LAPS IN REINFORCING STEEL MUST BE BASED UPON THE 1989, ACI BUILDING CODE.
 UNLESS OTHERWISE NOTED, HOOKS AND BENDS ON BARS MUST CONFORM TO RECOMMENDED DETAILS AS GIVEN IN THE "MANUAL OF STANDARD PRACTICE", C.R.S.I. 1990.

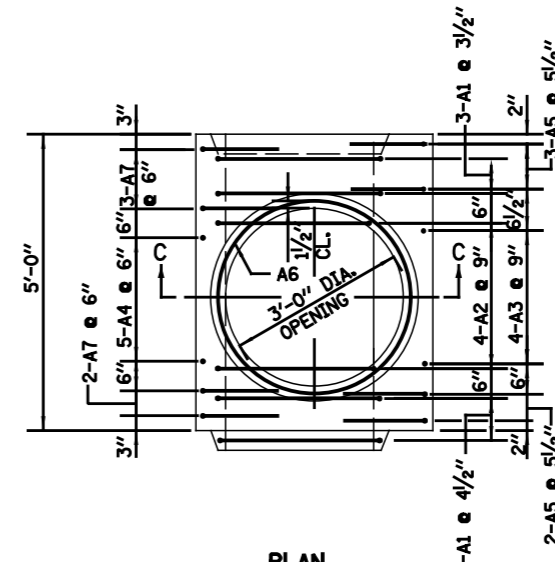
THE FOLLOWING ABBREVIATIONS ARE USED TO INDICATE THE LOCATION OF REINFORCING BARS:

T.	DENOTES	TOP	N.F.	DENOTES	NEAR FACE
BOT.	DENOTES	BOTTOM	F.F.	DENOTES	FAR FACE
I.F.	DENOTES	INSIDE FACE	E.F.	DENOTES	EACH FACE
O.F.	DENOTES	OUTSIDE FACE	E.W.	DENOTES	EACH WAY

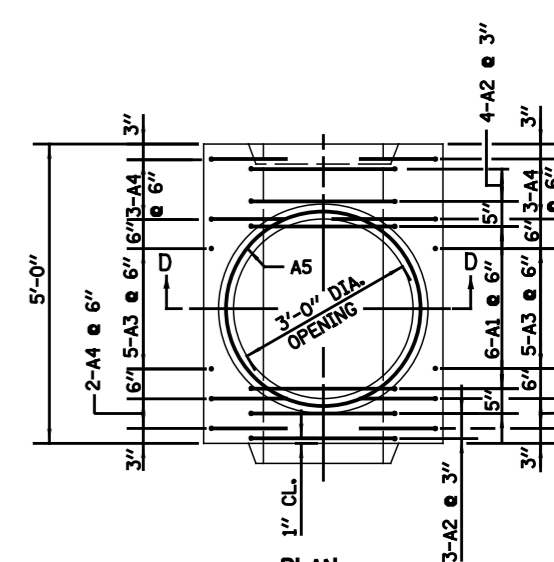
PLACING BAR SUPPORTS- ALL REINFORCING BARS MUST BE SUPPORTED, ANCHORED AND TIED AND MUST CONFORM TO THE "RECOMMENDED PRACTICE FOR PLACING REINFORCING BARS", 1986, PREPARED BY THE CONCRETE REINFORCING STEEL INSTITUTE.



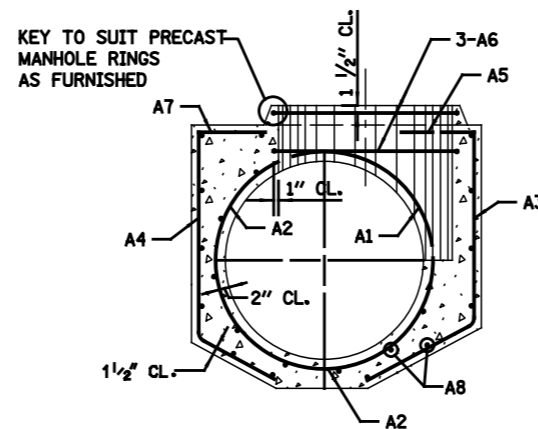
PLAN



PLAN

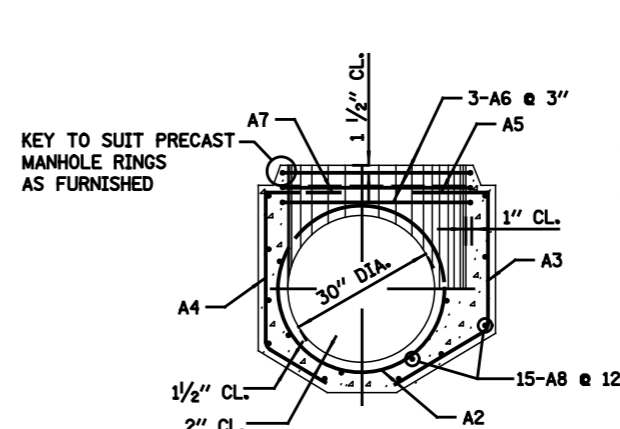


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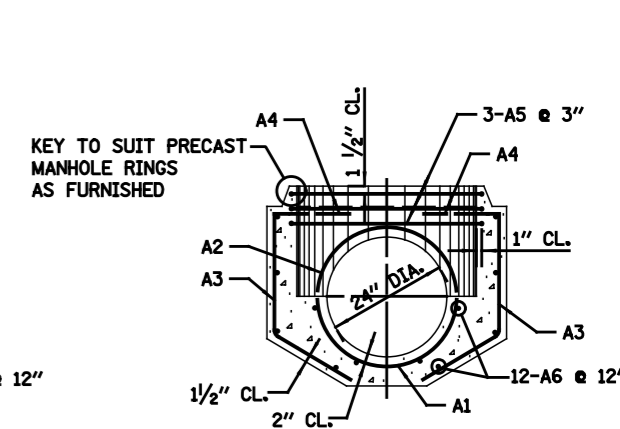
SECTION B-B

**MANHOLE BASE FOR SEWERS
36" DIA.**



SECTION C-C

**MANHOLE BASE
FOR 30" DIA. SEWERS**



SECTION D-D

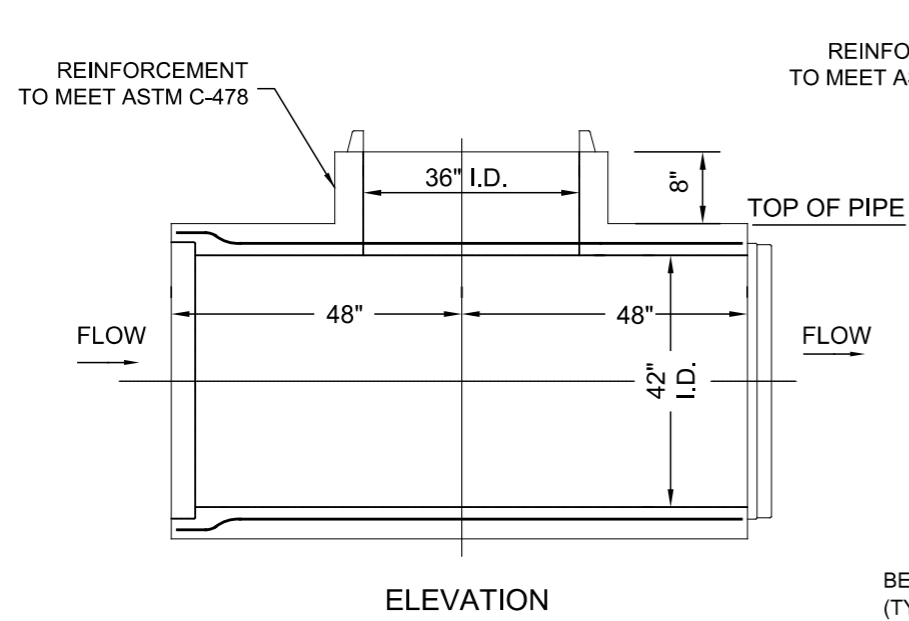
**MANHOLE BASE
FOR 24" DIA. SEWERS**

STANDARD REVISIONS	
DATE	DESCRIPTION
2/23/17	REVISION

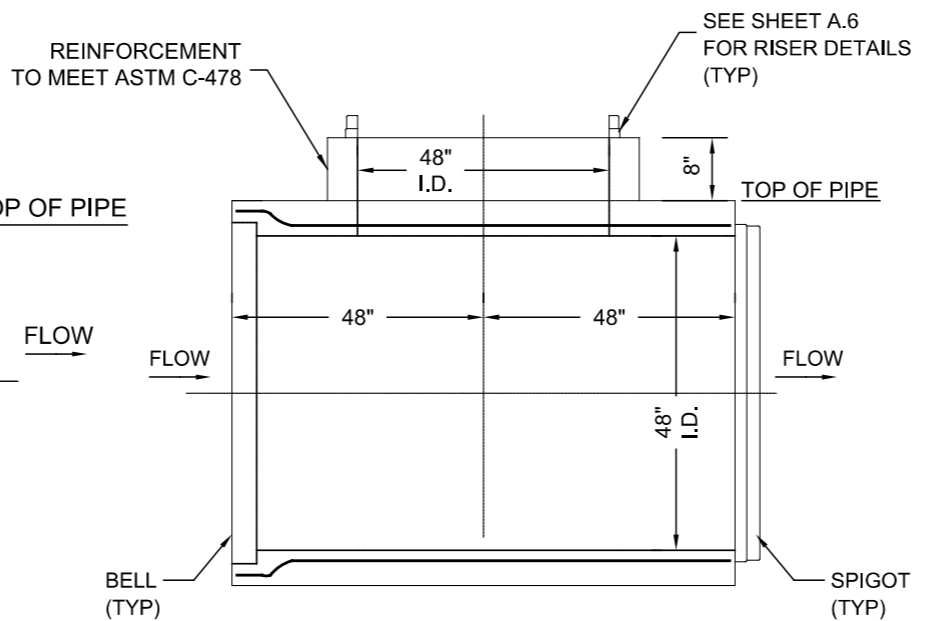
PERCENT COMPLETE	DATE
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BULLETIN	

CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
REINFORCEMENT FOR TYPE "A" PRECAST BASES AND RINGS 24" TO 36"	

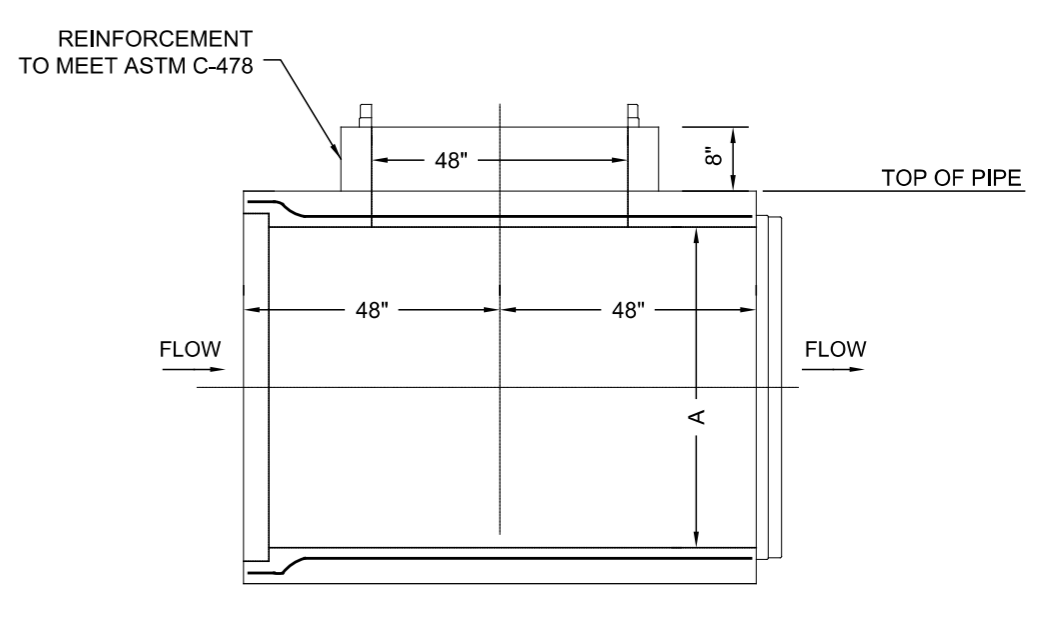
DRAWN BY	
DESIGNED BY	
CHECKED BY	
REVIEWED BY	
	A.7
	OF
	PN



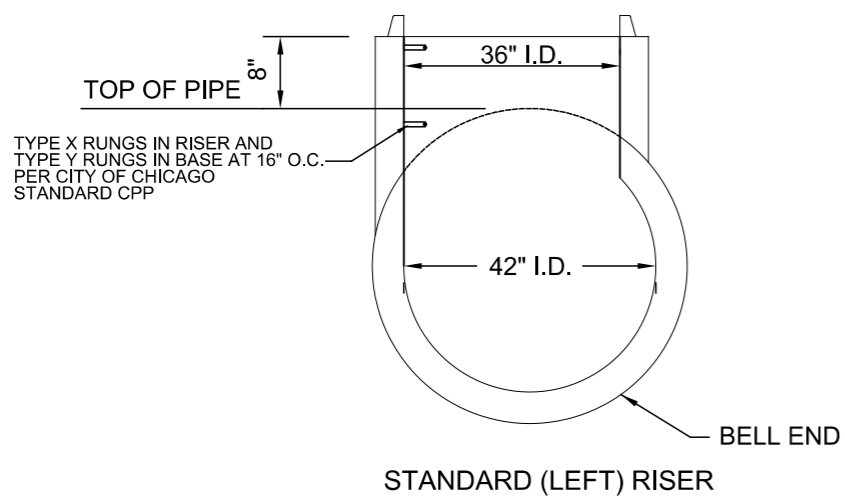
ELEVATION



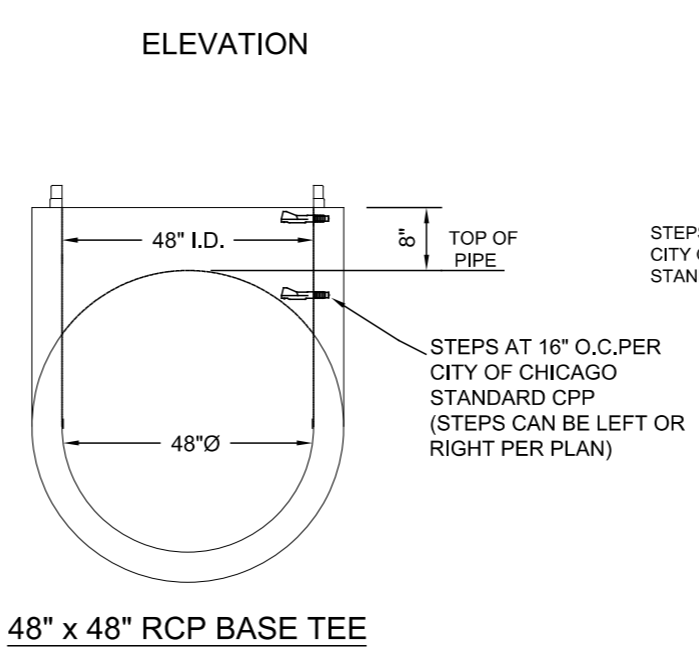
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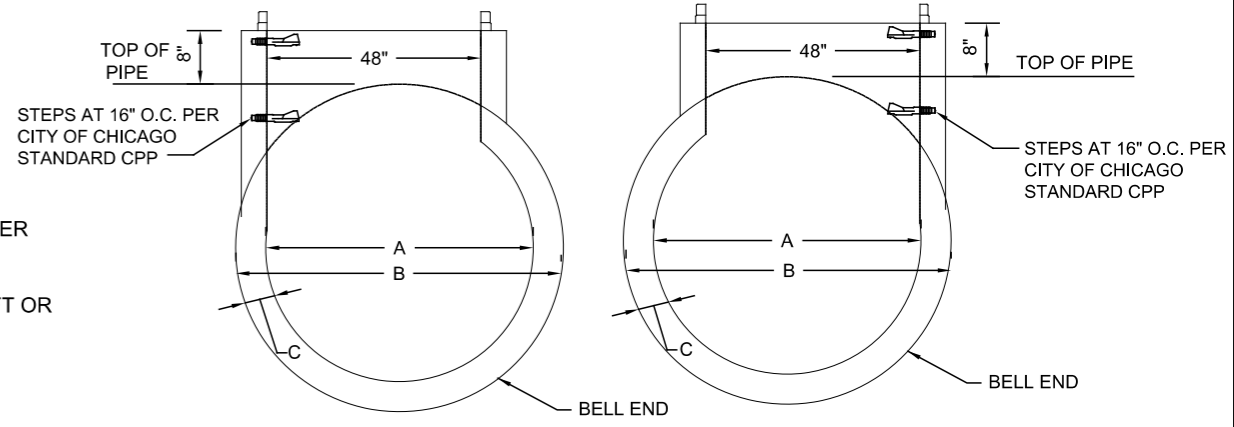
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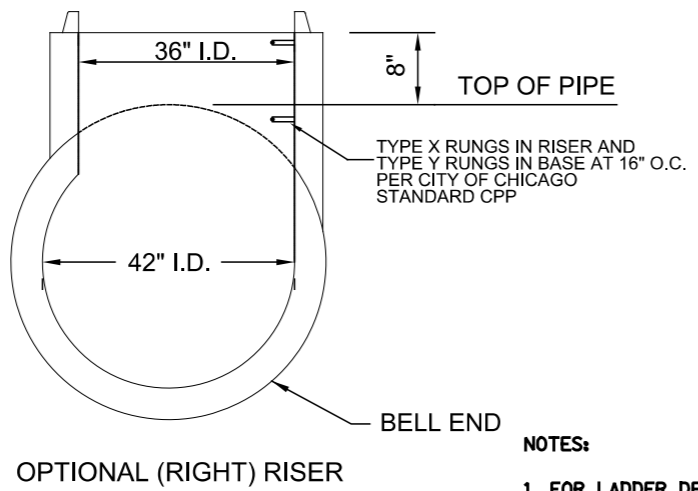
STANDARD (LEFT) RISER



48" x 48" RCP BASE TEE



STANDARD (LEFT) RISER OPTIONAL (RIGHT) RISER



OPTIONAL (RIGHT) RISER

42" x 36" RCP BASE TEE

NOTES:

1. FOR LADDER DETAILS, SEE DETAIL SHEET A.22
2. FOR RISER DETAILS, SEE DETAIL SHEET A.6
3. ALL BASE TEES SHALL BE ASTM C76 CLASS V.
4. THE BASE TEE MUST BE COMPATIBLE WITH THE ADJOINING PIPE, AND GASKET JOINTS COMPLYING WITH ASTM C-76 AND C-443, RESPECTIVELY.
5. ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE." A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

> 54" x 48" RCP BASE TEE

DIMENSIONS OF PRECAST MANHOLE BASE			
A	B	C	RUNGS
120"	142"	11"	6
108"	128"	10"	6
96"	114"	9"	5
84"	101 1/2"	8 3/4"	4
78"	94 1/2"	8 1/4"	4
72"	87 1/2"	7 3/4"	4
66"	80 1/2"	7 1/4"	3
60"	73 1/2"	6 3/4"	3
54"	66 1/2"	6 1/4"	3
48"	59 1/2"	5 3/4"	3
42"	52 1/2"	5 1/4"	3

STANDARD REVISIONS	
DATE	DESCRIPTION
4/4/19	APPROVED FINAL

PERCENT COMPLETE	DATE
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BULLETIN	

CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES

TYPE "A" BASE TEE
MANHOLE BASES
42" AND LARGER

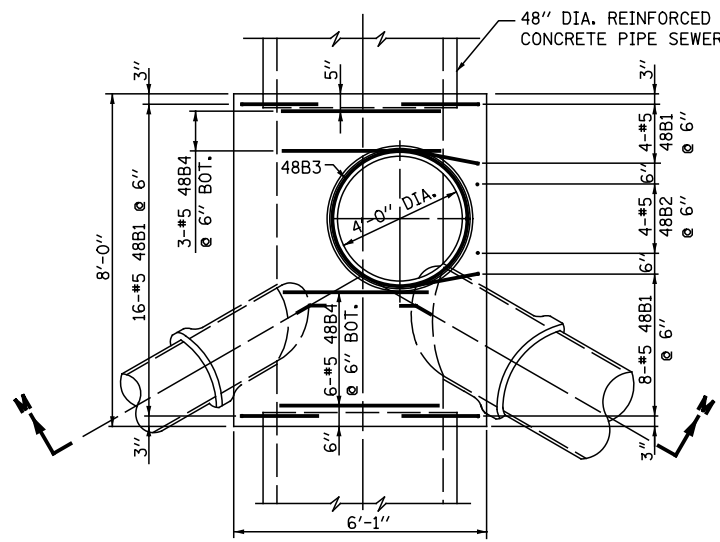
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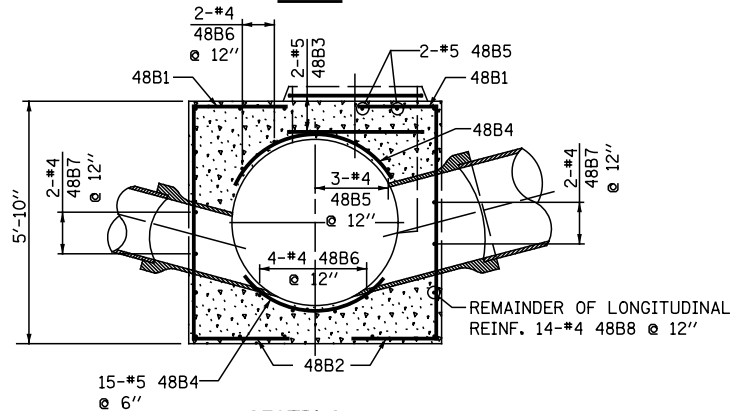
OF

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DATE\$

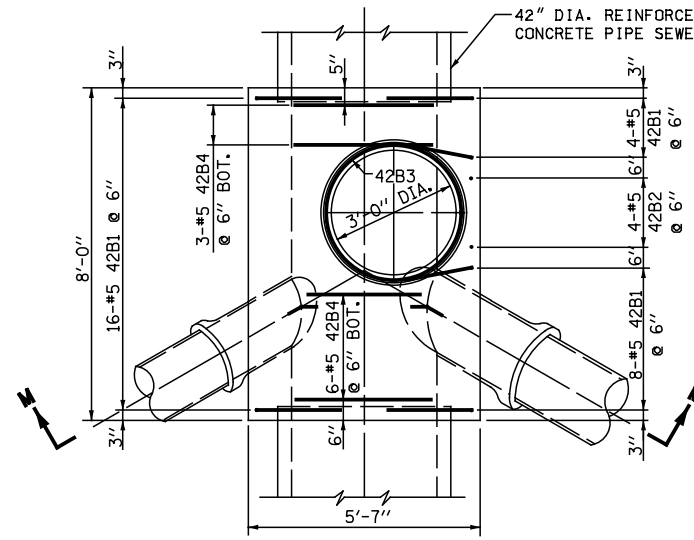


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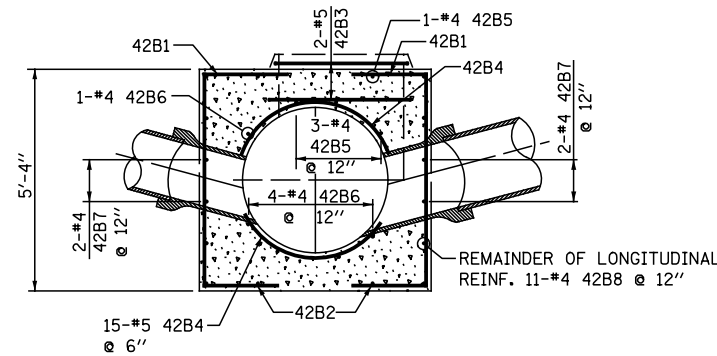


SECTION M-M

48" DIA. SEWER

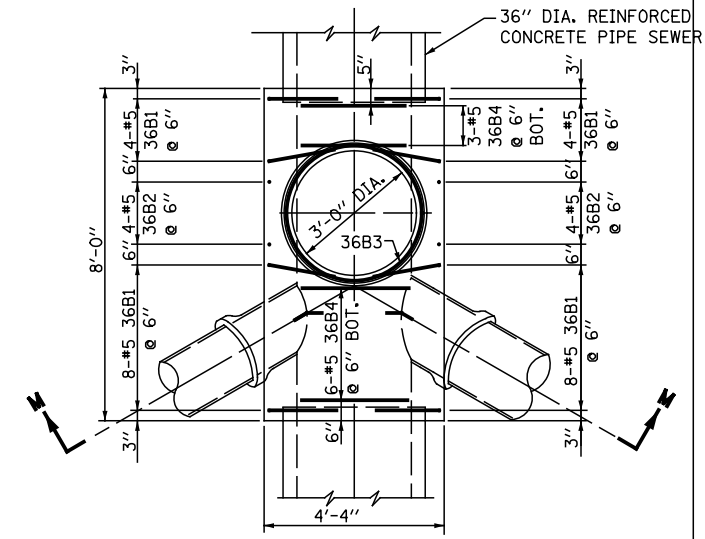


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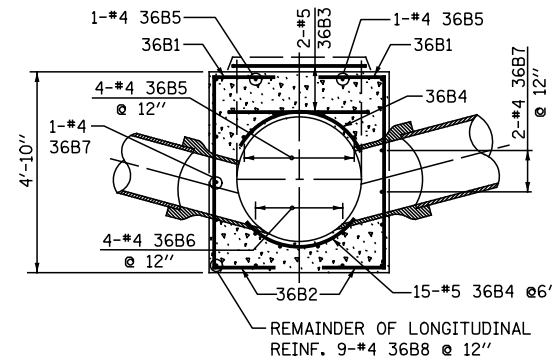


SECTION M-M

42" DIA. SEWER

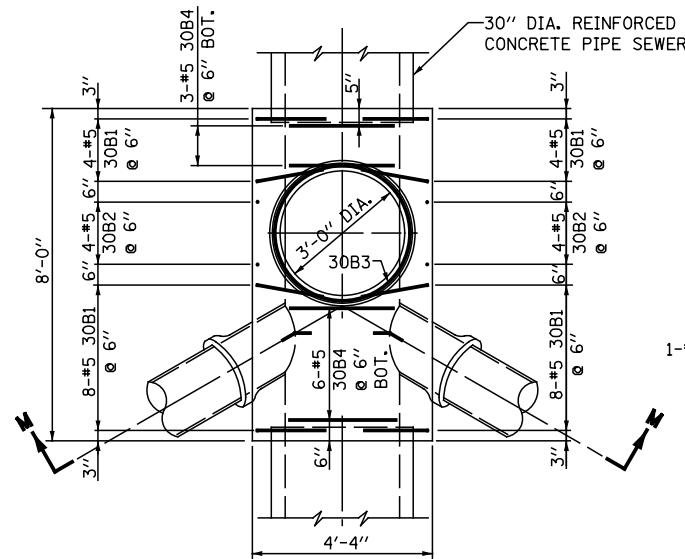


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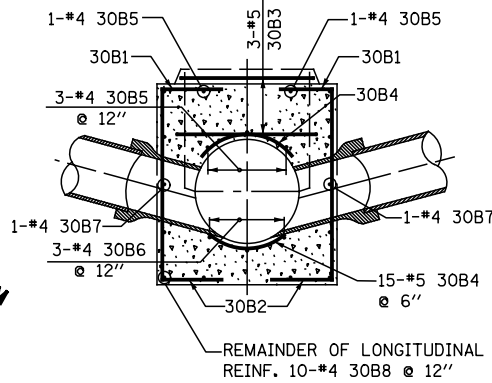


SECTION M-M

36" DIA. SEWER

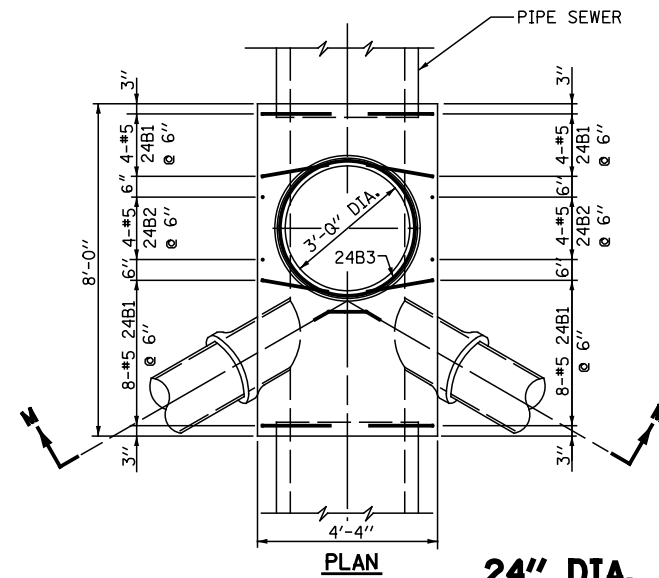


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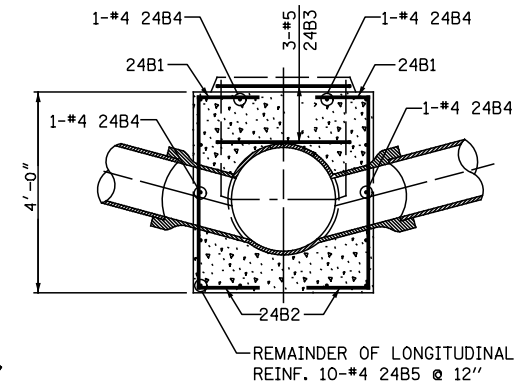


SECTION M-M

30" DIA. SEWER



PLAN



SECTION M-M

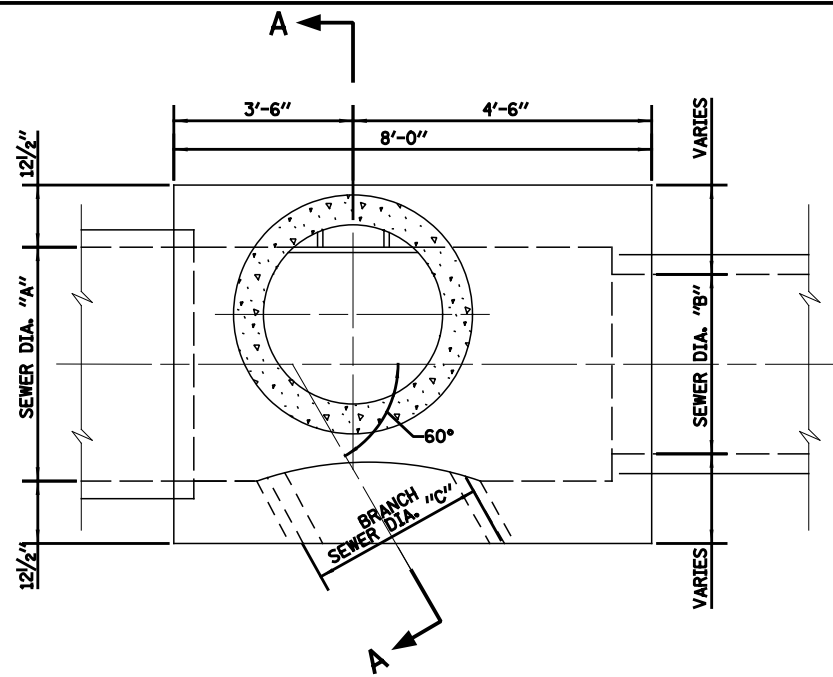
24" DIA. SEWERS & SMALLER

- NOTES:
1. CONTRACTOR MUST SUBMIT SHOP DRAWINGS OF ALL PROPOSED MANHOLE CONFIGURATIONS FOR APPROVAL PRIOR TO SUBMISSION OF MATERIAL ORDERS.
 2. CONNECTION BELLS MAY BE INSTALLED AT MANUFACTURER'S SITE, OR MORTARED IN PLACE IN THE FIELD. SEE SHEET A.11 FOR FURTHER CONFIGURATION DETAILS.
 3. BASES MUST BE PRECAST WITH THE CORRECT NUMBER OF PIPE OPENINGS, CORRESPONDING TO THE REPRESENTATION IN THE PLAN AND PROFILE SHEETS.
 4. PATCHING, BRICKING, OR OTHER MATERIAL METHODS OF CLOSING UNUSED HOLES WILL NOT BE ACCEPTED.
 5. ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE," A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

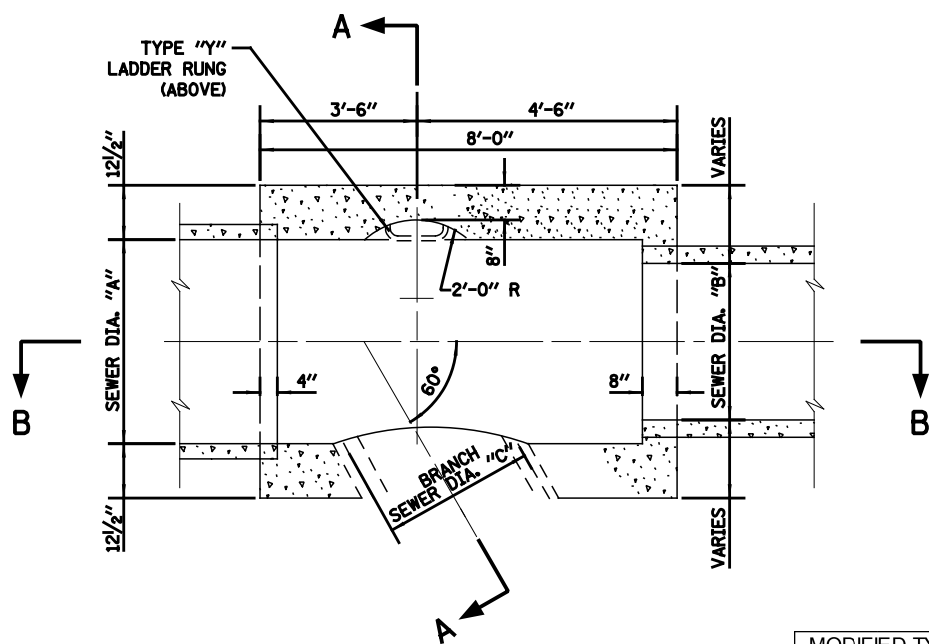
STANDARD REVISIONS	
DATE	DESCRIPTION
9/19/17	revision

PERCENT COMPLETE	DATE
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BULLETIN	

CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES		DRAWN BY CHECKED BY REVISIONS	A.10 OF PN
		REINFORCEMENT FOR TYPE "B" MANHOLE BASES	



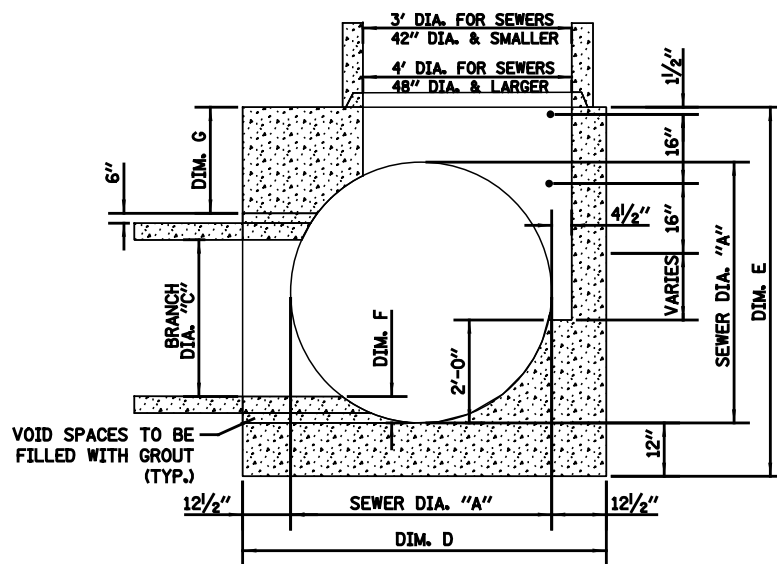
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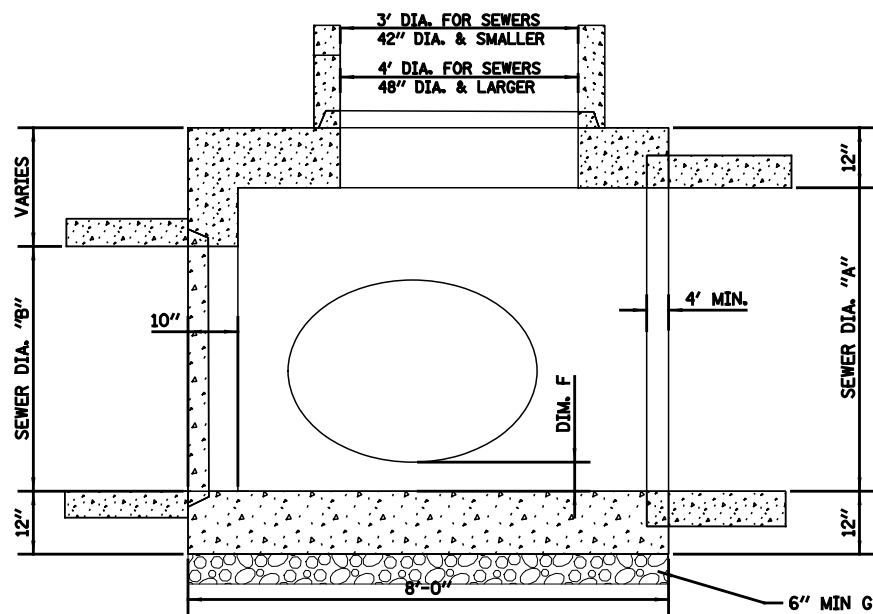
SECTIONAL PLAN

NOTES:

- CONTRACTOR MUST SUBMIT SHOP DRAWINGS OF ALL PROPOSED MANHOLE CONFIGURATIONS FOR APPROVAL PRIOR TO SUBMISSION OF MATERIAL ORDERS.
- CONNECTION BELLS MAY BE INSTALLED AT MANUFACTURER'S SITE, OR MORTARED IN PLACE IN THE FIELD. SEE SHEET A.11 FOR FURTHER CONFIGURATION DETAILS.
- BASES MUST BE PRECAST WITH THE CORRECT NUMBER OF PIPE OPENINGS, CORRESPONDING TO THE REPRESENTATION IN THE PLAN AND PROFILE SHEETS.
- PATCHING, BRICKING, OR OTHER MATERIAL METHODS OF CLOSING UNUSED HOLES WILL NOT BE ACCEPTED.
- 6" MINIMUM GRANULAR EMBEDMENT UNDER ALL PRECAST MANHOLE BASES
- ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE." A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT



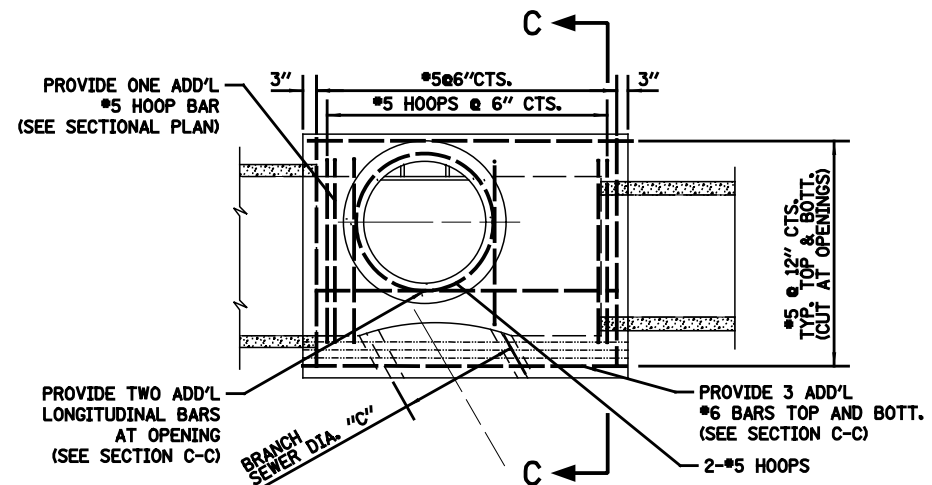
SECTION A-A



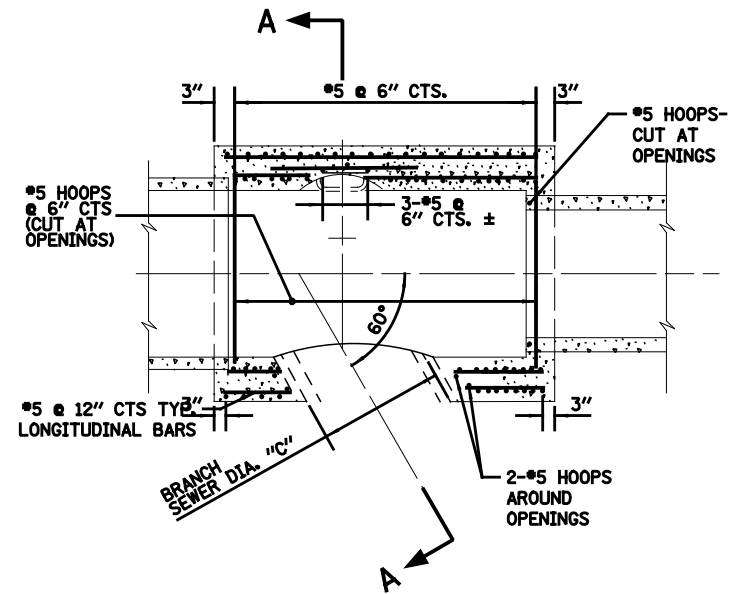
SECTION B-B

MODIFIED TYPE B MANHOLES FOR 42", 36", & 30" BRANCHES						
SEWER SIZE	BRANCH SIZE	DIMENSION				
A	B	C	D	E	F	G
60	60	42	85	84	6	18
60	60	36	85	84	6	24
60	60	30	85	84	6	30
54	54	42	79	78	6	12
54	54	36	79	78	6	18
54	54	30	79	78	6	24
48	48	42	73	78	6	12
48	48	36	73	72	6	12
48	48	30	73	72	6	18
42	42	36	67	72	6	12
42	42	30	67	66	6	12
36	36	36	58	66	6	12
36	36	30	58	66	6	12
30	30	30	55	66	6	12

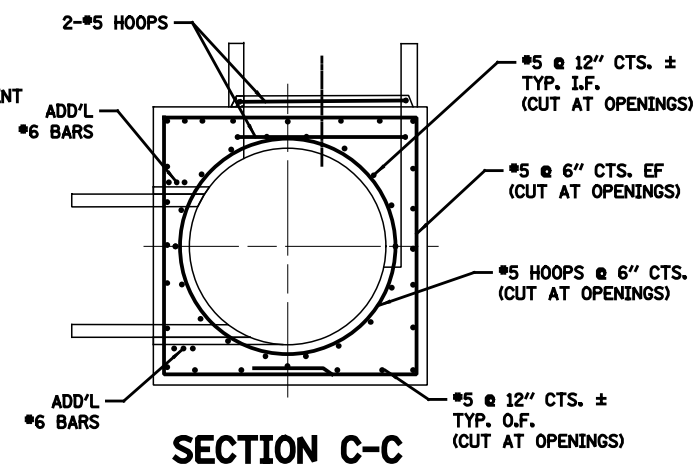
ALL MEASUREMENTS ARE IN INCHES
 NOTE: WHEN B IS SMALLER THAN A, GAP SHALL BE FILLED WITH CONCRETE DURING CASTING.
 SIMILAR REBAR DESIGN SHALL BE USE.



PLAN



SECTIONAL PLAN



SECTION C-C

STANDARD REVISIONS	
DATE	DESCRIPTION
3/7/19	REVISED

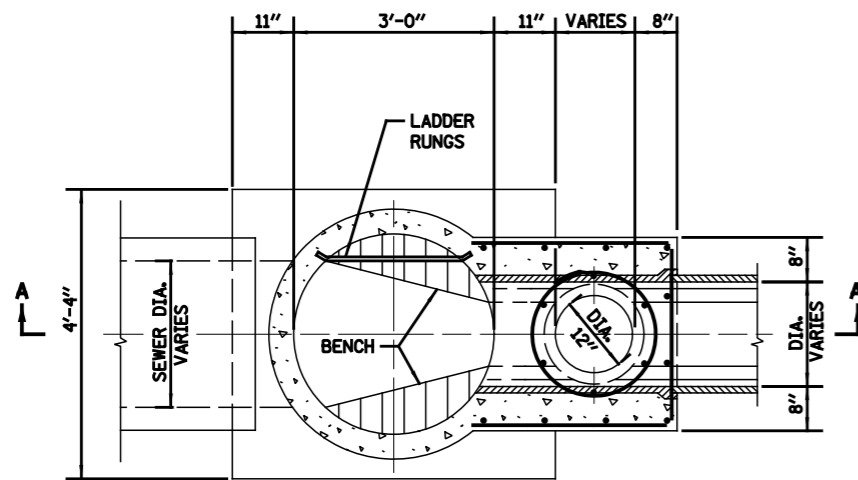
PERCENT COMPLETE	DATE
30	
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75	
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BULLETIN	

CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
MODIFIED TYPE "B" MANHOLE	

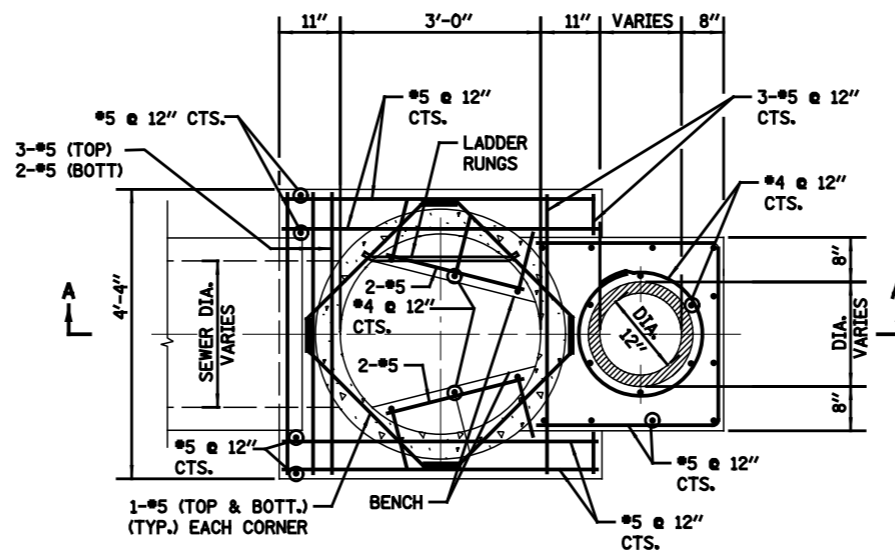
DRAWN	DATE	SCALE

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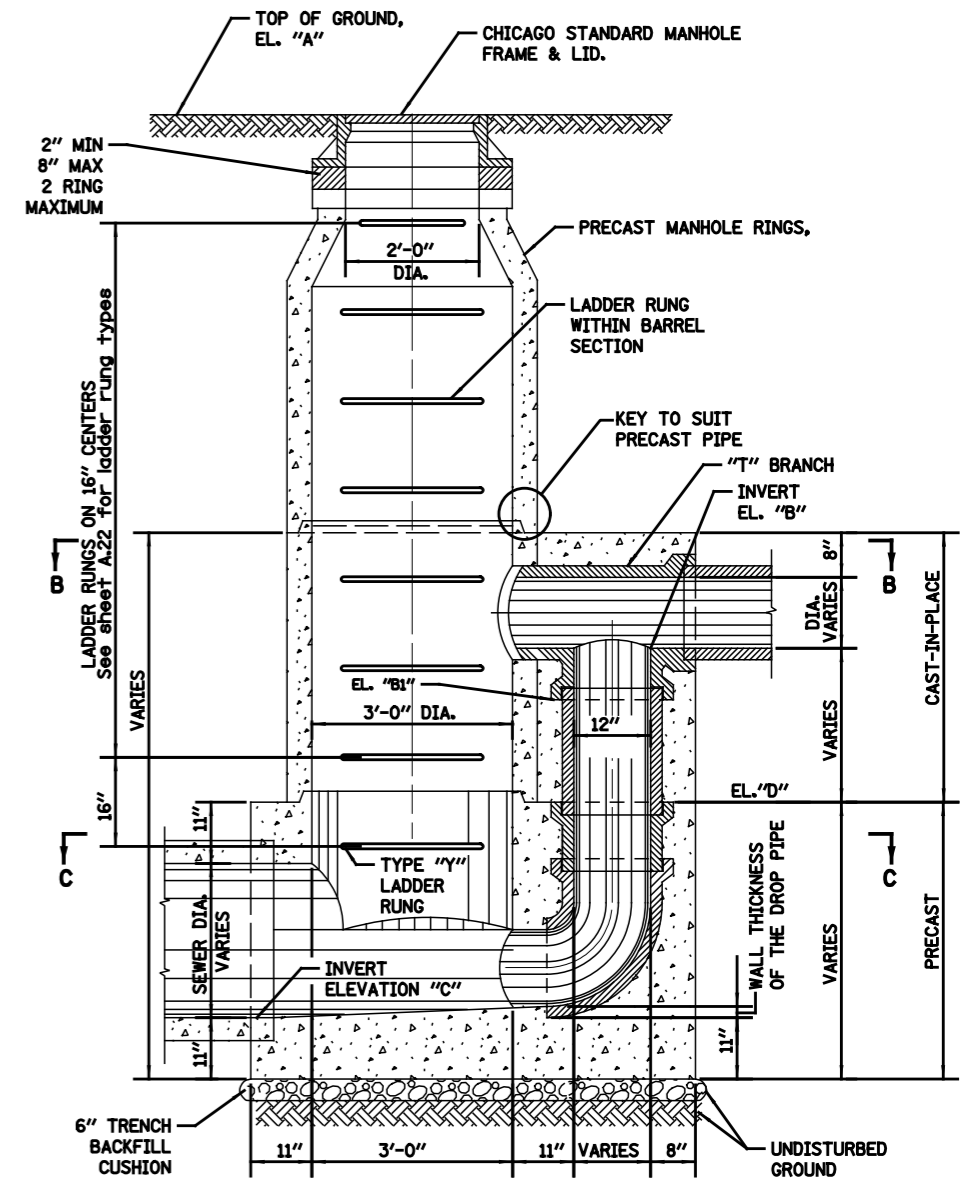
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SECTIONAL PLAN-B



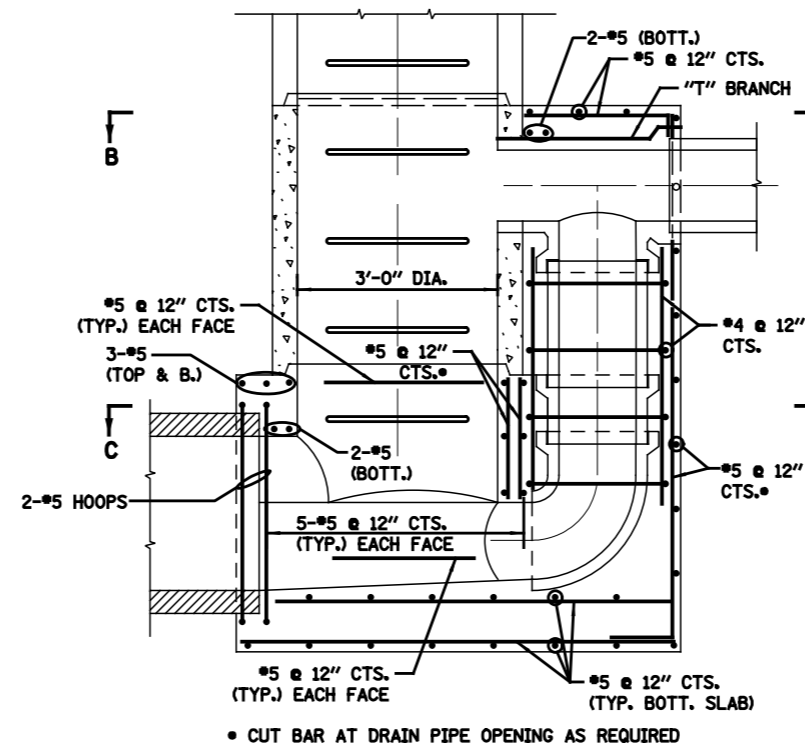
SECTIONAL PLAN-C



SECTION A-A

LOCATION	SHEET NO.	ELEVATION				
		"A"	"B"	"B1"	"C"	"D"

NOTE: Elevation B1 >= Elevation D



SECTION A-A

NOTE:
1. UNLESS OTHERWISE NOTED ALL PIPE AND FITTINGS 21" AND UNDER ARE STANDARD STRENGTH VCP.

2. FOR DESIGN ONLY- USE 12" DROP PIPE FOR THE FOLLOWING DEPTHS OF DWF:
6" DWF-42" LATERAL
7" DWF-36" LATERAL
8" DWF-24" LATERAL

3. ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE," A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

STANDARD REVISIONS	
DATE	DESCRIPTION
9/19/17	APPROVED

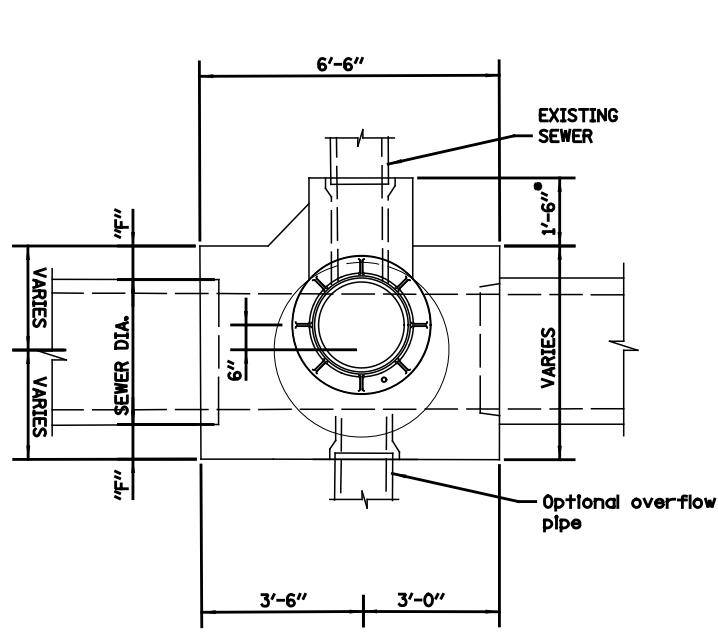
PERCENT COMPLETE	DATE
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BULLETIN	

CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
TYPE C SINGLE DROP MANHOLE	

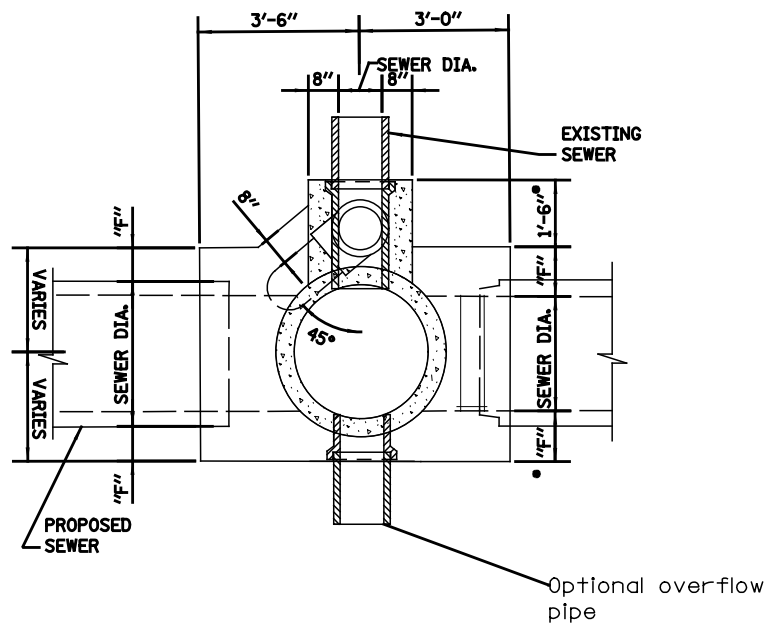
DRAWN	DESIGNED	CHECKED	REVIEWED

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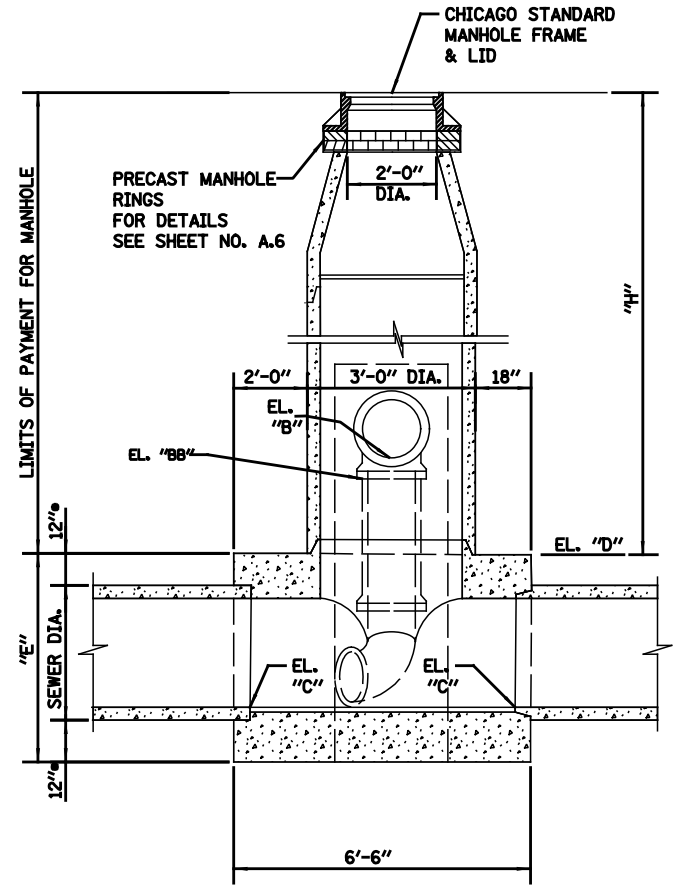


PLAN

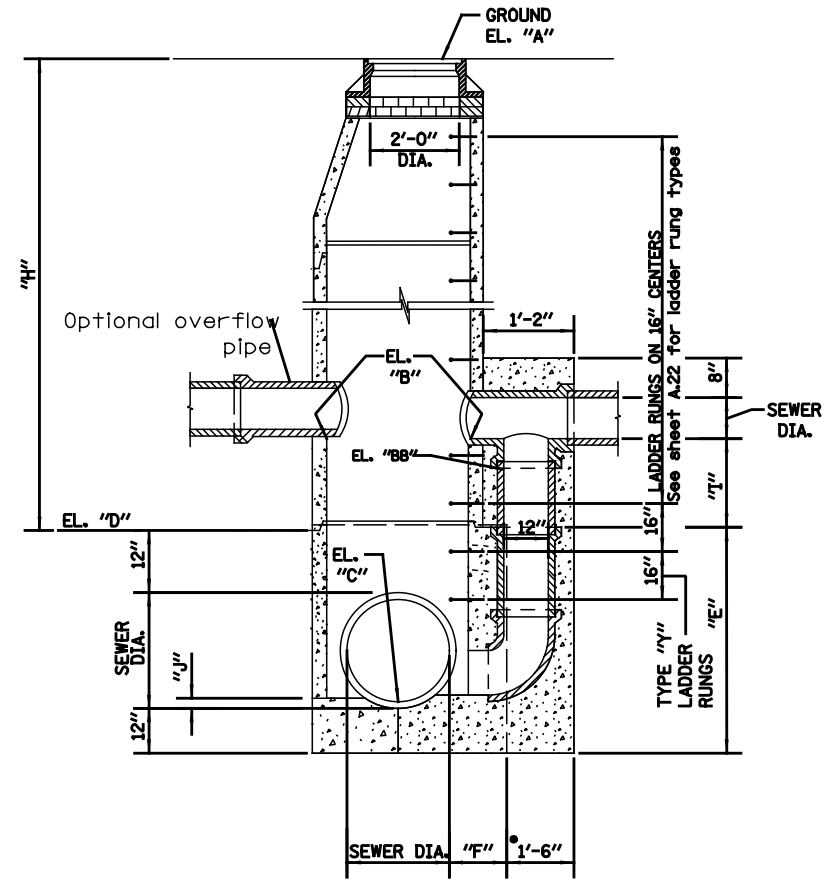


SECTIONAL PLAN

• 1'-8" FOR 24" DIA. SEWERS



SECTION A-A



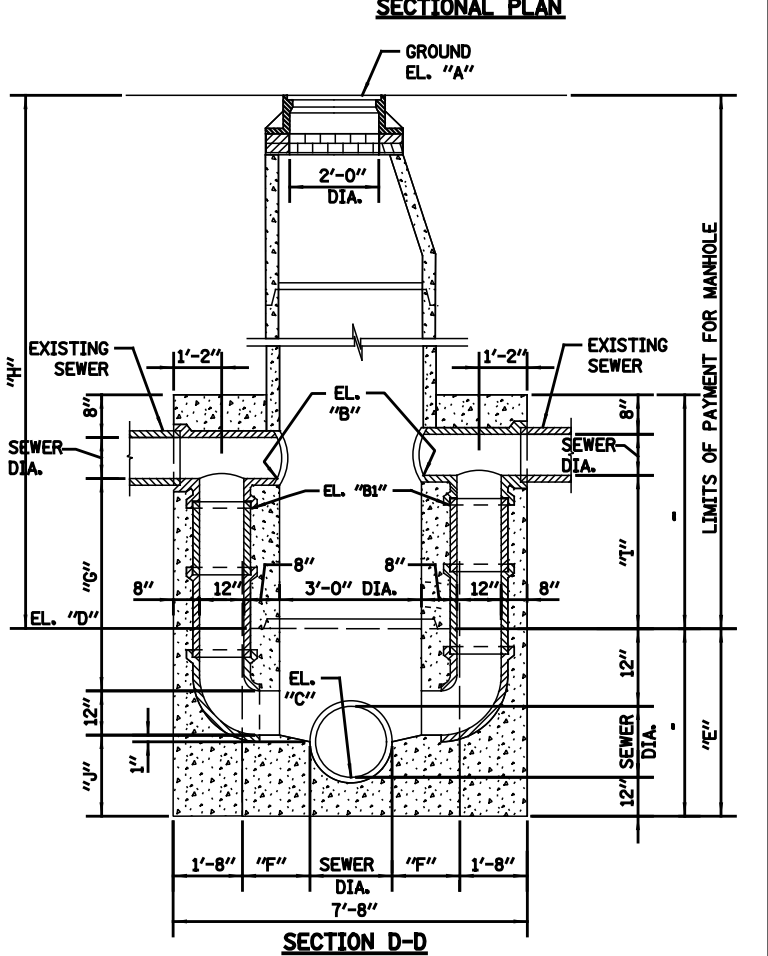
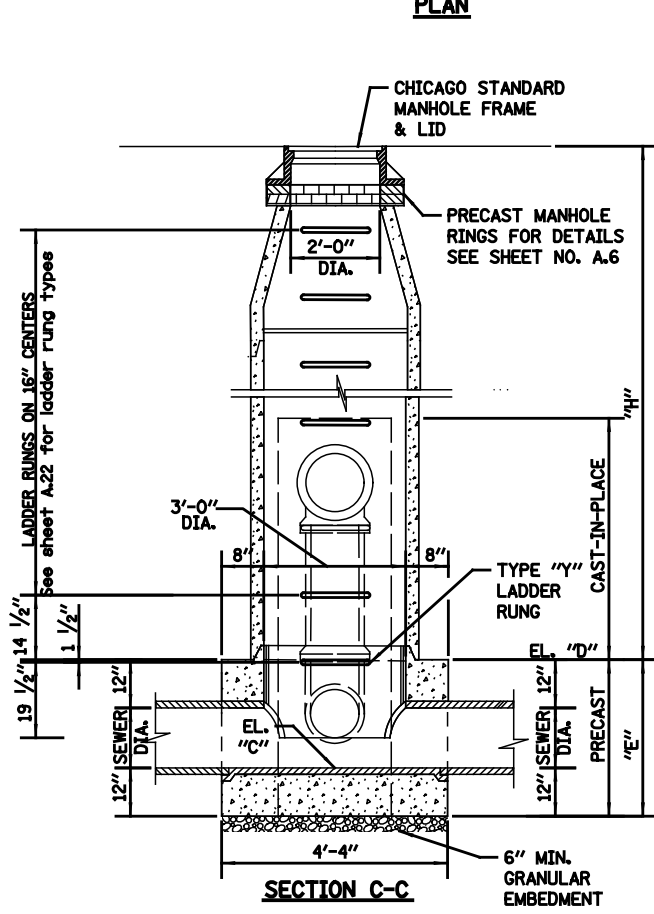
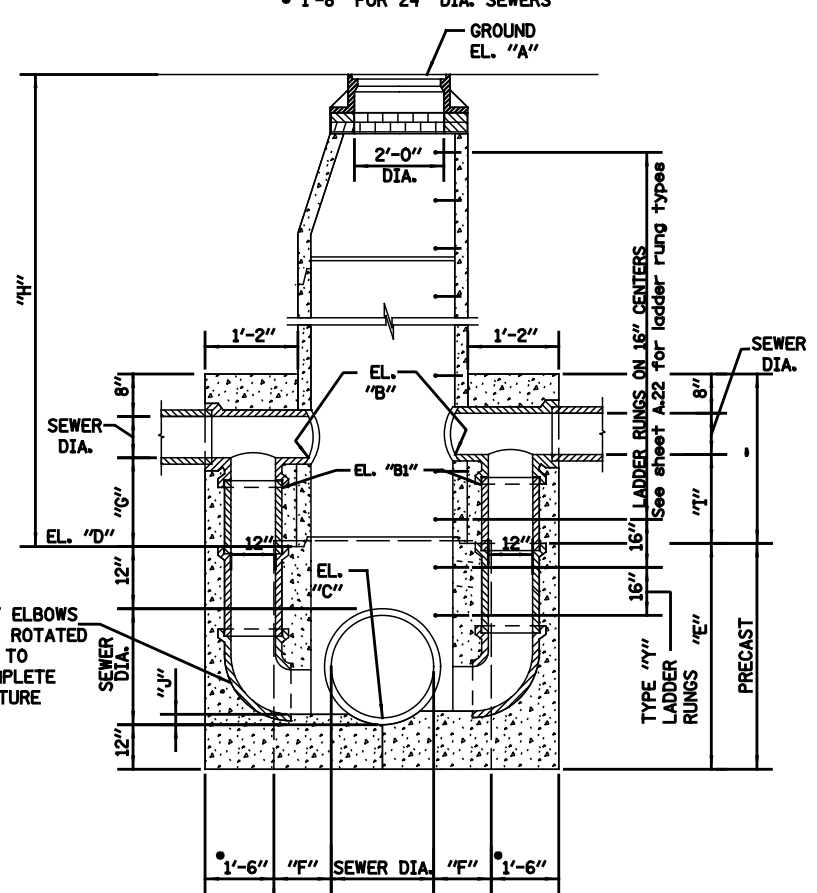
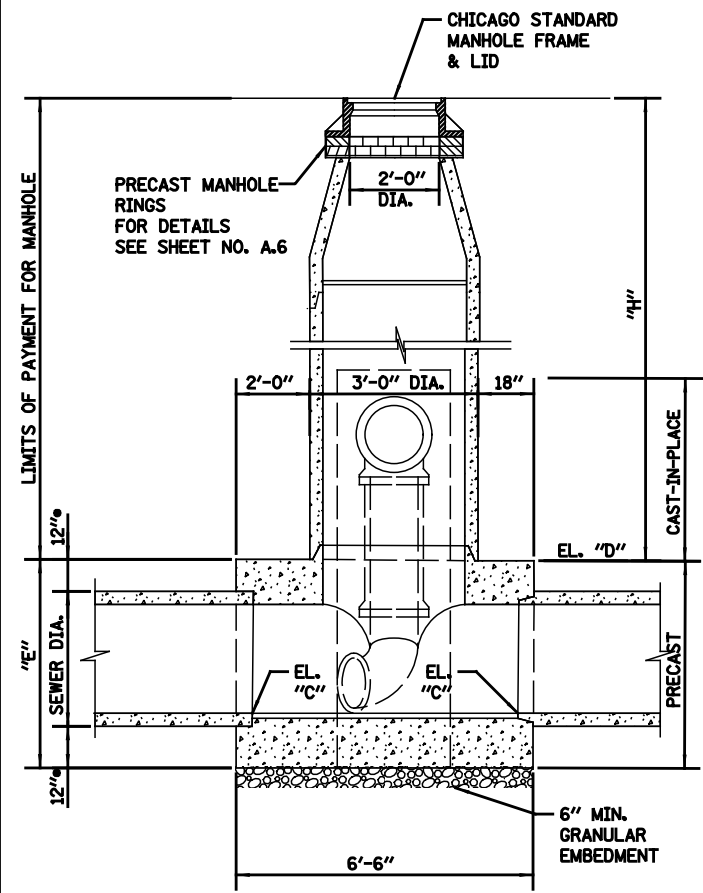
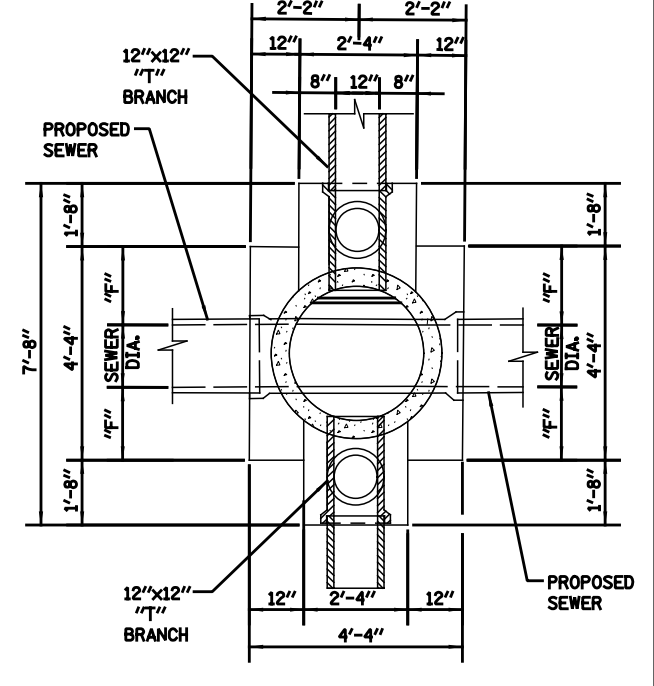
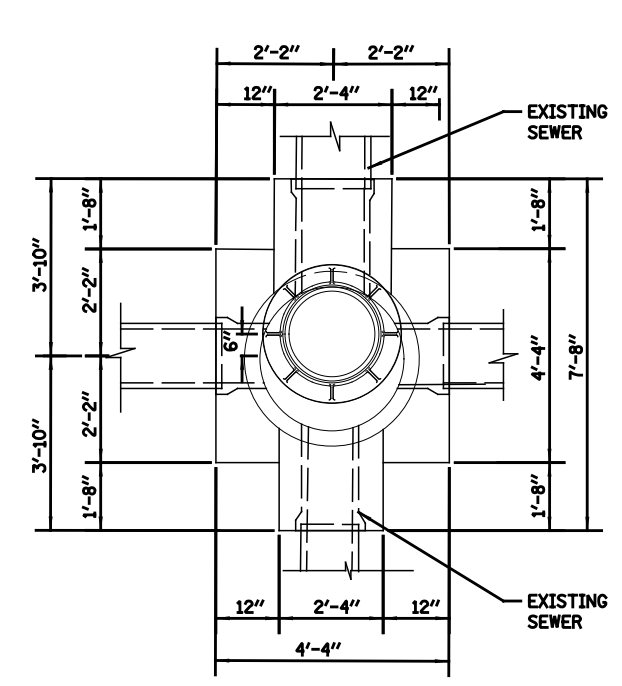
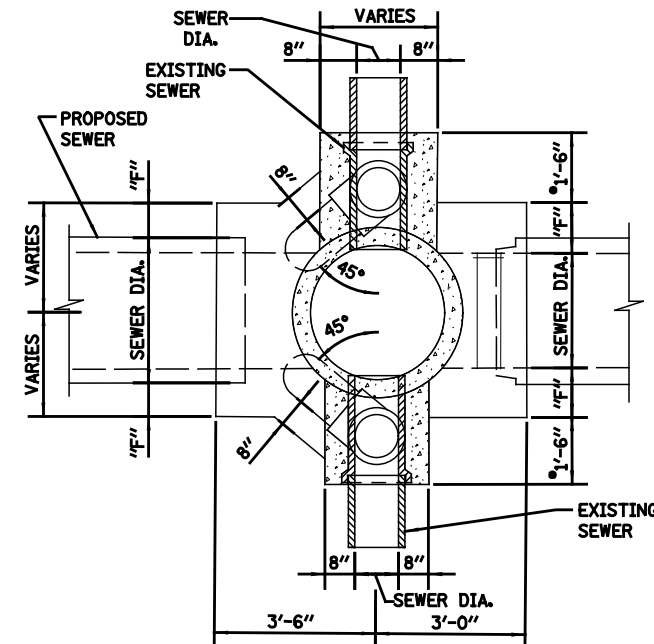
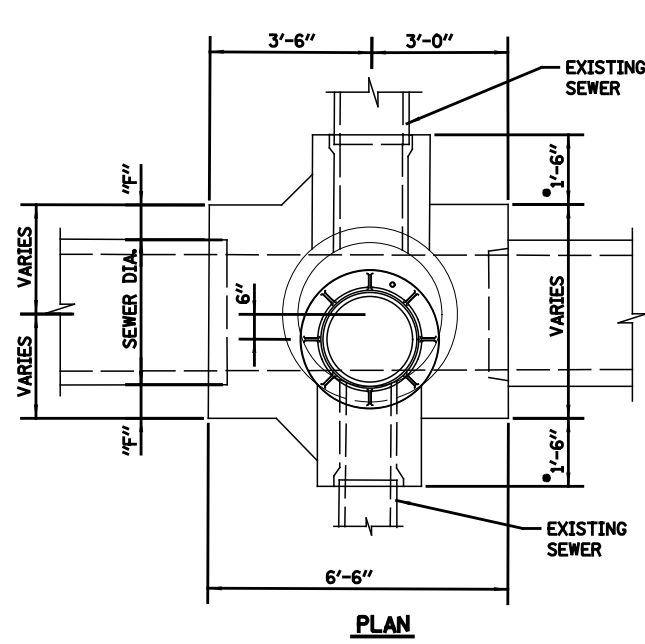
SECTION B-B

- NOTE:
- UNLESS OTHERWISE NOTED ALL PIPE AND FITTINGS 21" AND UNDER ARE STANDARD STRENGTH VCP.
 - FOR DESIGN ONLY- USE 12" DROP PIPE FOR THE FOLLOWING DEPTHS OF DWF:
 - 6" DWF-42" LATERAL
 - 7" DWF-36" LATERAL
 - 8" DWF-< 24" LATERAL
 - ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE," A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

LOCATION	SHEET NO.	ELEVATION				
		"A"	"B"	"BB"	"C"	"D"

NOTE: Elevation BB >= Elevation D

STANDARD REVISIONS		PERCENT COMPLETE	DATE	CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	DRAWN DESIGNED CHECKED REVIEWED	A.14
DATE	DESCRIPTION					
9/19/17	APPROVED	30		TYPE C SINGLE DROP MANHOLE	OF	PN
		60				
		75				
		90				
		100				
		BULLETIN				



**FOR CONCRETE PIPE SEWERS
24" DIA. TO 48" DIA.**

**FOR VITRIFIED CLAY PIPE SEWERS
21" DIA. & SMALLER**

NOTE: Elevation B1 >= Elevation D

- NOTE:
1. UNLESS OTHERWISE NOTED ALL PIPE AND FITTINGS 21" AND UNDER ARE STANDARD STRENGTH VCP.
2. FOR DESIGN ONLY- USE 12" DROP PIPE FOR THE FOLLOWING DEPTHS OF DMF:
6" DMF-42" LATERAL
7" DMF-36" LATERAL
8" DMF-24" LATERAL
3. ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE." A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT

LOCATION	SHEET NO.	ITEM NO.	ELEVATION					DIMENSIONS								
			"A"	"B"	"B1"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"			

STANDARD REVISIONS	
DATE	DESCRIPTION
9/19/17	APPROVED

PERCENT COMPLETE	DATE
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BULLETIN	

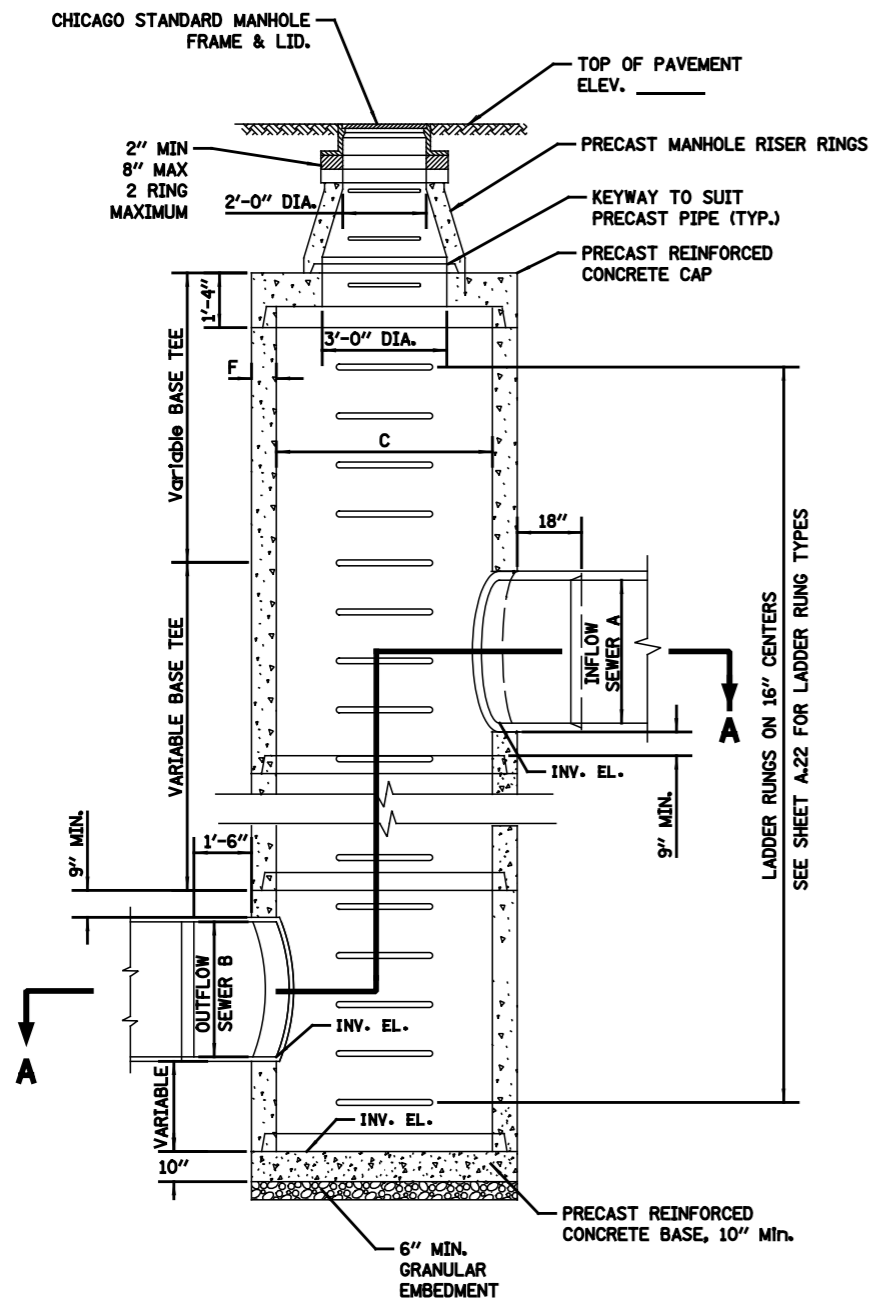
CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
TYPE C DOUBLE DROP MANHOLE	

DRAWN	CHECKED	REVIEWED

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PN _____

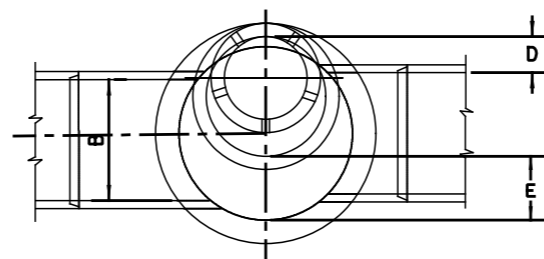
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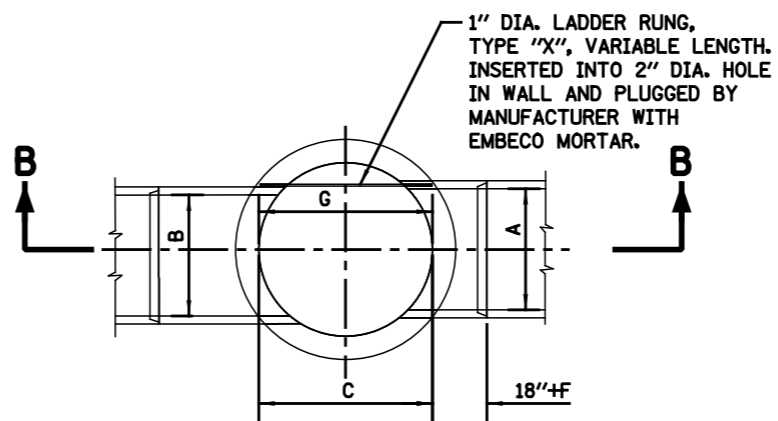
SECTION B-B
SCALE: N.T.S.

PRECAST COMPONENT TABLE							
BASE TEE				WALL THICKNESS	CAP & BASE		LADDER RUNG LENGTH
A	B	C*	D	F	C	E	G
60	60	84	12	8	84	48	48.5
54	54	84	12	7 1/2	78	42	46.5
48	48	72	12	7	72	36	44
42	42	60	9	6	60	24	40
36	36	60	12	6	60	24	40
30	30	48	9	5	48	12	35
24	24	48	12	5	48	12	35

NOTE: ALL MEASUREMENTS ARE IN INCHES
*DIAMETERS >84" UP TO 144" ARE AVAILABLE IN 1' INCREMENTS



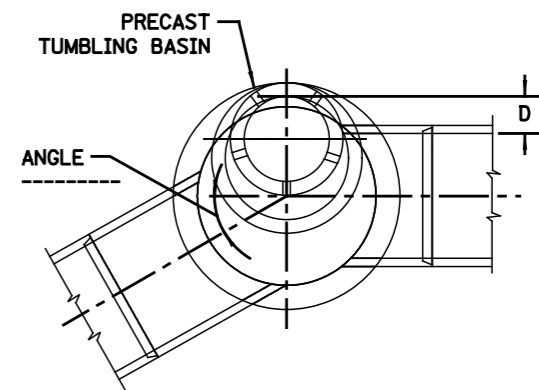
PLAN



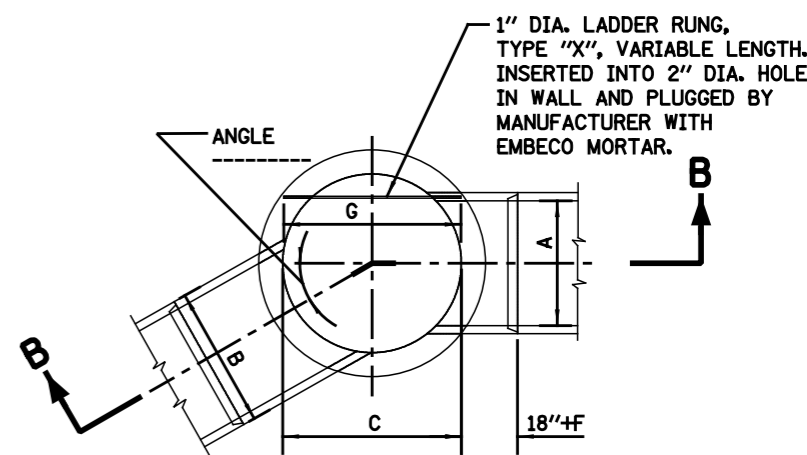
SECTIONAL PLAN A-A

OPTION: W/O BEND

SCALE: N.T.S.



PLAN



SECTIONAL PLAN A-A

OPTION: WITH BEND

SCALE: N.T.S.

NOTES:

- FOR CONTRACTOR'S RESPONSIBILITY REGARDING STRUCTURAL DRAWING, SEE SPECIFICATIONS, BOOK 3.
- ALL PIPE AND FITTINGS 24 INCHES IN DIAMETER AND LARGER MUST BE CLASS III, IV AND V REINFORCED CONCRETE PIPE AS SPECIFIED IN THE SPECIFICATIONS FOR "REINFORCED CONCRETE CULVERT STORM DRAIN, AND SEWER PIPE," A.S.T.M. DESIGNATION C76, TABLE III, IV AND V, WALL B OR WALL C WITH CIRCULAR OR ELLIPTICAL REINFORCEMENT;
- FOR ADDITIONAL INFORMATION, SEE SPECIFICATIONS, BOOK 3.

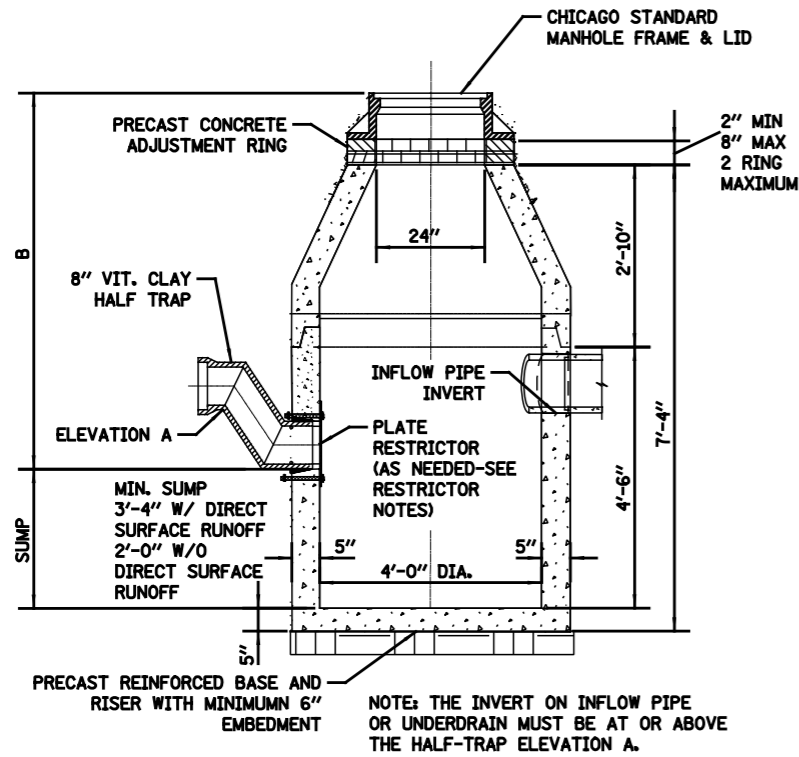
STANDARD REVISIONS	
DATE	DESCRIPTION
9/19/17	Approved Plan

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

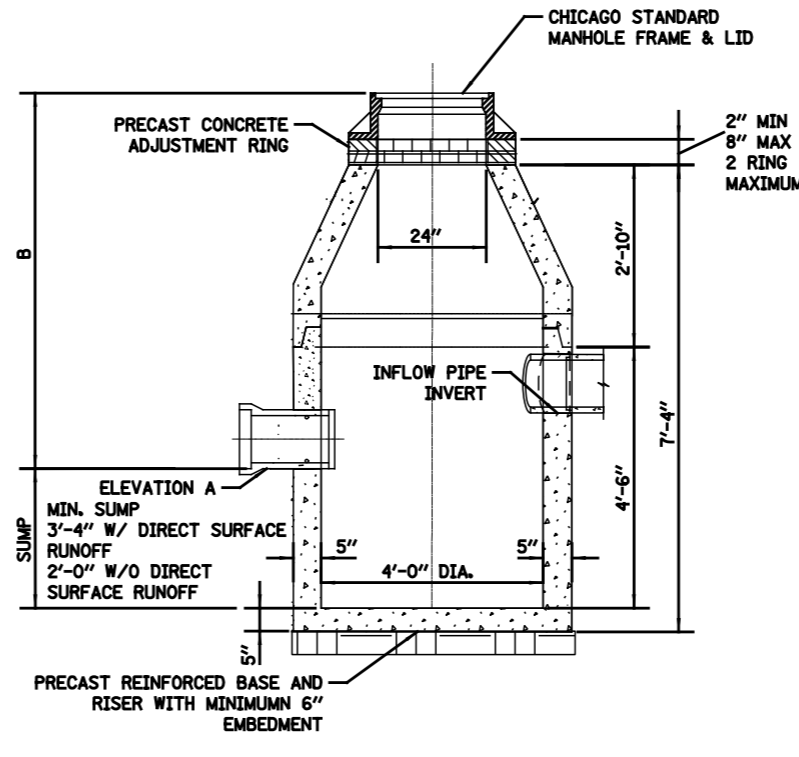
CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
PRECAST TUMBLING BASIN DETAILS	

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CHECKED: AK	
REVIEWED: AK	OF
PN	

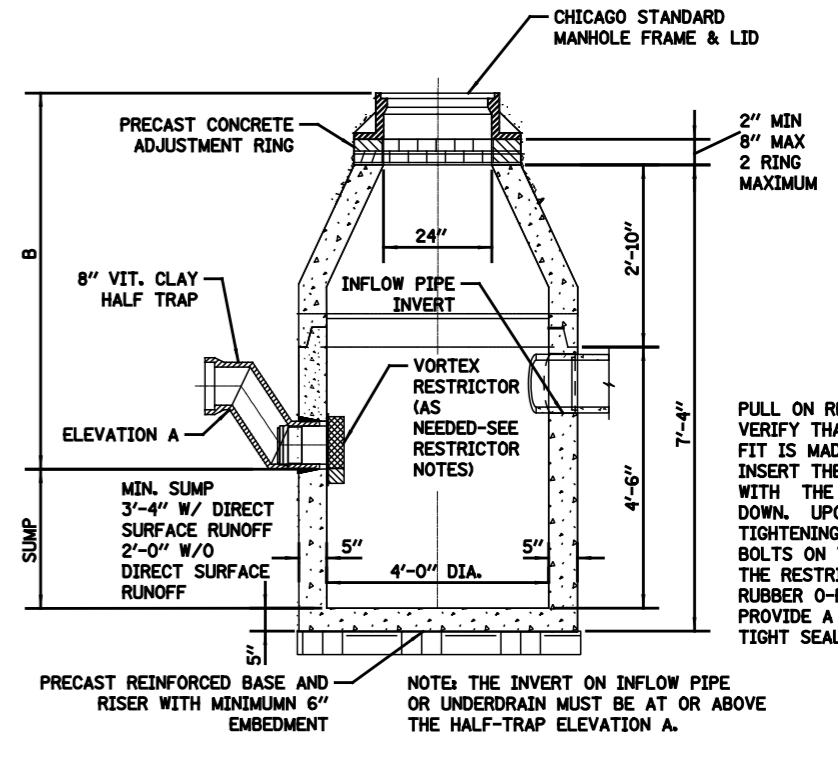
STANDARD DRAINAGE STRUCTURES FOR PRIVATE DEVELOPMENT



**PLATE RESTRICTOR CATCH BASIN
CONICAL SECTION
N.T.S.**



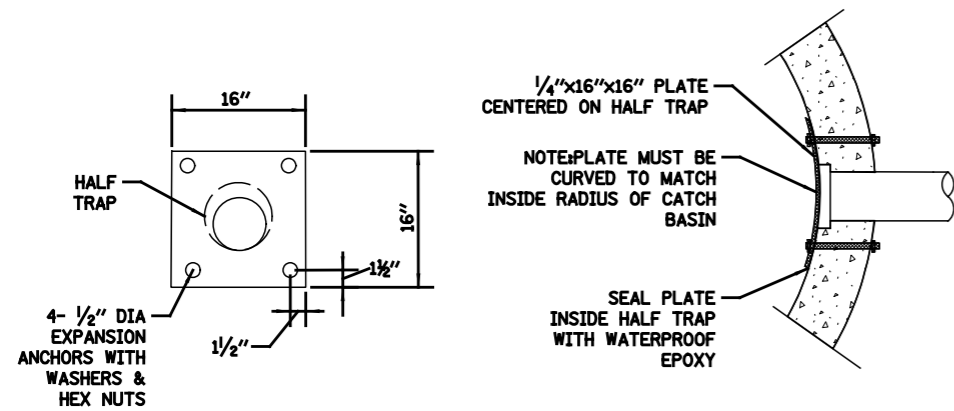
**STANDARD CATCH BASIN
CONICAL SECTION
N.T.S.**



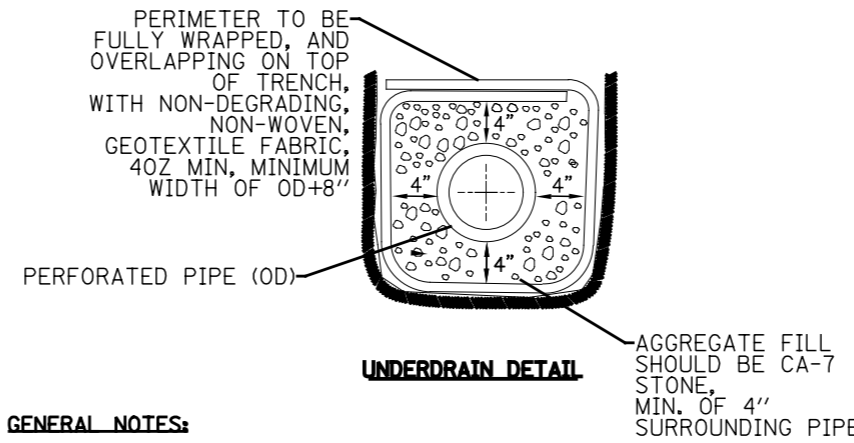
**VORTEX RESTRICTOR CATCH BASIN
CONICAL SECTION
N.T.S.**

PULL ON RESTRICTOR TO VERIFY THAT A TIGHT FIT IS MADE. INSERT THE RESTRICTOR WITH THE OPENING DOWN. UPON TIGHTENING OF THE 2 BOLTS ON THE FACE OF THE RESTRICTOR, THE RUBBER O-RINGS WILL PROVIDE A WATER-TIGHT SEAL.

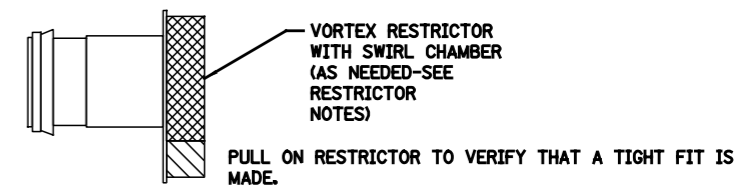
NOTE: THE INVERT ON INFLOW PIPE OR UNDERDRAIN MUST BE AT OR ABOVE THE HALF-TRAP ELEVATION A.



- NOTES:**
1. THE RESTRICTOR MUST BE INSTALLED IN CATCH BASINS OR MANHOLES WITH 2' MIN. SUMPS.
 2. PLATE AND FASTENERS MUST BE FABRICATED IN STAINLESS STEEL, DUCTILE IRON, OR EQUIVALENT WATERPROOF/WEATHER PROOF MATERIALS.
 3. MIN. ORIFICE SIZE= 2.5" DIA.
 4. IF B < 4 FEET, THEN USE A FLAT TOP SLAB CATCH BASIN AS NECESSARY.



- GENERAL NOTES:**
1. CATCH BASIN TO CATCH BASIN CONNECTIONS ARE ALLOWED IN PRIVATE SITES & ALLEYS. ONLY THE DOWNSTREAM CATCH BASIN IS REQUIRED TO HAVE A HALF-TRAP.
 2. IF B < 4 FEET, THEN USE A FLAT TOP SLAB CATCH BASIN AS NECESSARY.
 3. FOR TRENCH BACKFILL, REFER TO IDOT SSRBC, ARTICLE 1003.04.
 4. FOR GRANULAR EMBEDMENT, USE CA-11, CRUSHED GRAVEL, CRUSHED STONE, OR CRUSHED CONCRETE.
 5. FOR STABILIZATION STONE, 12" OF CA-1 STONE IS ONLY REQUIRED WHEN UNSTABLE MATERIAL IS ENCOUNTERED AT TRENCH BOTTOM.
 6. INLETS AND 3' DIAMETER CATCH BASINS ARE TO BE USED ONLY WITH PRIOR APPROVAL OF THE DEPT OF WATER MANAGEMENT- ENGINEERING SERVICES, SEWER SECTION, AND THE DEPT. OF BUILDINGS STORMWATER REVIEWER.

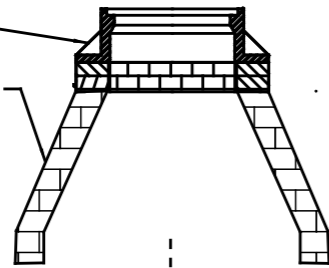


- NOTES:**
1. IF B < 4 FEET, THEN USE A FLAT TOP SLAB CATCH BASIN AS NECESSARY.
 2. THE RESTRICTORS CAN BE OBTAINED FROM DWM CENTRAL DISTRICT AT 3901 S. ASHLAND AVE. THE CONTRACTOR SHOULD ARRANGE FOR PICK UP BY CONTACTING 312-747-8736 (7AM TO 3PM, M-F). CONTRACTOR MUST CALL 48 HOURS IN ADVANCE OF PICK UP DATE AND TIME.

FILES \$
DATE \$

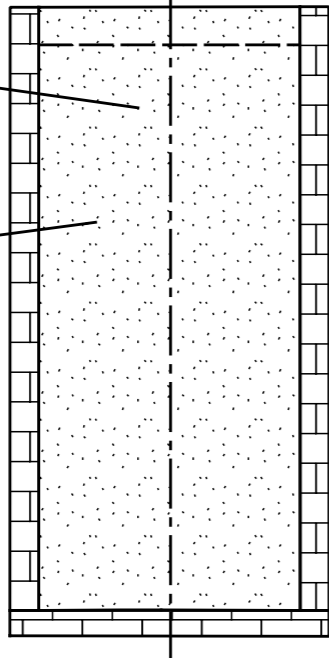
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DATE	DESCRIPTION					
10/27/17	APPROVED PLAN	30		DRAINAGE STRUCTURE DETAILS PRIVATE DEVELOPMENT	CHECKED: <u> </u>	REVISED: <u> </u>
		60			A.21 OF PN	
		75				
		90				
		100				
		BULLETIN				

REMOVE FRAME, LID AND
ADJUSTING RINGS
REMOVE CONE SECTION



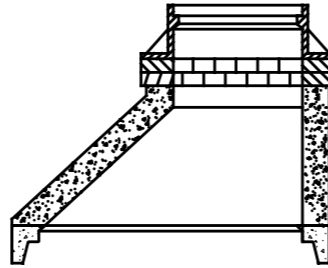
FILL WITH SAND OR
CLSM/FLOWABLE FILL

SEAL ALL OPENINGS
WITH BRICK
AND MORTAR

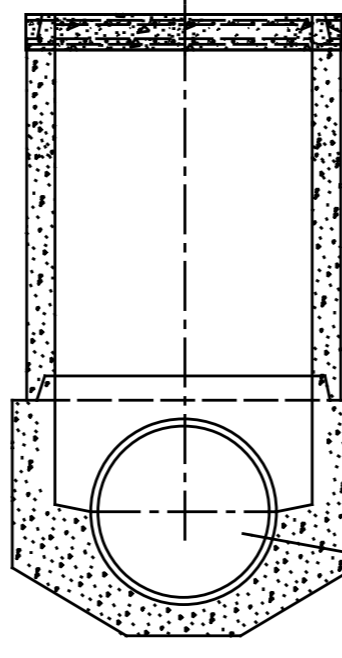


ABANDON CATCH BASIN

REMOVE FRAME, LID AND
ADJUSTING RINGS
REMOVE CONE SECTION



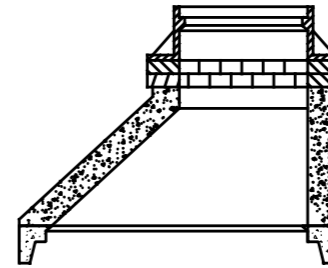
REINFORCED FLAT
TOP SLAB (SEE NOTE BELOW)
USE MORTAR
OR SEALER



MAINTAIN FLOW
IF PIPE IS NOT
ABANDONED

ABANDON MANHOLES

REMOVE FRAME, LID AND
ADJUSTING RINGS

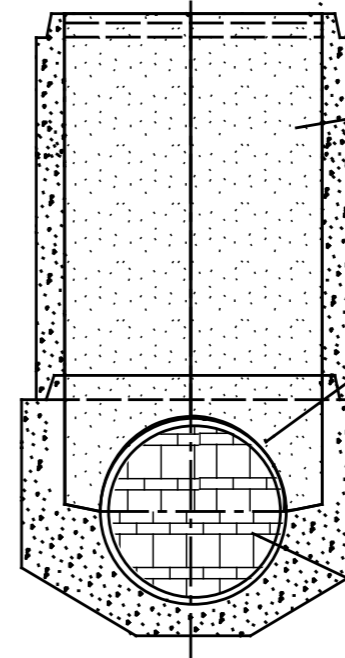


REMOVE CONE SECTION

FILL WITH SAND OR
CLSM/FLOWABLE FILL

FILL WITH CLSM/FLOWABLE
FILL TO 6" ABOVE
SEWER CROWN

SEAL ALL OPENINGS WITH BRICK
AND MORTAR IF PIPE TO BE ABANDONED
IS LESS THAN 24"



HMA SURFACE COURSE
MIX "D", 1 1/2",
TYPE TO MEET
STREET CLASSIFICATION
P.C. CONCRETE BASE COURSE,
DEPTH BASE TO GRADE
SUB-BASE GRANULAR MATERIAL,
TYPE B, 6" MIN.

#5 TIE BARS, 18" LONG,
DRILLED AND GROUTED
INTO EXISTING BASE, 30"
C/C AS REQUIRED (TYP.)

TRENCH BACKFILL

REINFORCED FLAT
TOP SLAB

USE MORTAR
OR SEALER

IN PAVEMENT AREA

4" TOPSOIL

TRENCH BACKFILL

REINFORCED FLAT
TOP SLAB

USE MORTAR
OR SEALER

IN LANDSCAPE AREA

NOTE
REINFORCED FLAT TOP SLAB.
SEE IDOT STD. 602601-03 OR CURRENT
MODIFIED WITH NO ACCESS HOLE

STANDARD REVISIONS	
DATE	DESCRIPTION
10/15/15	APPROVED PLAN

PERCENT COMPLETE	DATE
30	
60	
75	
90	
100	
BULLETIN	

CITY OF CHICAGO	
DEPARTMENT OF WATER MANAGEMENT BUREAU OF ENGINEERING SERVICES	
ABANDONED SEWER STRUCTURE DETAILS	

DRAWN		
CHECKED		
REVIEWED		

A.23

OF

PN

Traps – Interceptors – Separators - Basins

The following diagrams are examples and/or samples of traps, interceptors, separators and / or basins for external use only. Point of use / internal traps, interceptors, separators and / or basins must be submitted, reviewed and approved by the Department of Building's current processes. The Sewer Permit Section of the Department of Buildings and the Sewer Design Section of the Department of Water Management have the right to request information, review, approve or inspect any product under Article X, Section 18-29-1000 of the Municipal Code, as well as the right to add or remove any of these samples referenced. All products must be properly selected, sized, installed and operated based upon the manufacturer's requirements and as intended to address the specific need.

All traps, interceptors, separators, and/or basins must satisfy Section 18-29, Article 10, Traps, Separators, and Interceptors, Section 11-4, Article 6, Waste Control, of the Municipal Code of the City of Chicago, and in Title 77, Chapter I, Subchapter R, Part 890, Section 890.510 Of The Illinois Plumbing Code Grease Interceptor Requirements.

EXAMPLES ONLY

As defined in the Uniform Plumbing Code - Appendix H, Grease Interceptors are designed to control and prevent harmful substances from entering the sanitary drainage system. This worksheet was designed to assist the engineer in choosing the proper grease interceptor.

No. of Meals Per Peak Hour	Waste Flow Rate	Retention Time	Storage Factor	Calculated Liquid Capacity	Grease Interceptor
0.00	0	0.0	1.00	0	
Step 1	Step 2	Step 3	Step 4	Step 5	Step 6

1	<p>Number of Meals Per Peak Hour (Recommended Formula):</p> <p>Seating Capacity <input type="text"/> x Meal Factor <input type="text"/> =</p> <table border="0"> <tr> <td>Establishment Type</td> <td>Min Per Meal</td> <td>Meal Factor</td> </tr> <tr> <td>Fast Food</td> <td>45</td> <td>1.33</td> </tr> <tr> <td>Restaurant</td> <td>60</td> <td>1</td> </tr> <tr> <td>Leisure Dining</td> <td>90</td> <td>0.67</td> </tr> <tr> <td>Cafeteria / Hospital</td> <td>120</td> <td>0.5</td> </tr> </table>	Establishment Type	Min Per Meal	Meal Factor	Fast Food	45	1.33	Restaurant	60	1	Leisure Dining	90	0.67	Cafeteria / Hospital	120	0.5	<p>Meals per Peak Hour</p> <p>0.00</p>
	Establishment Type	Min Per Meal	Meal Factor														
Fast Food	45	1.33															
Restaurant	60	1															
Leisure Dining	90	0.67															
Cafeteria / Hospital	120	0.5															

2	<p>Waste Flow Rate:</p> <p>Condition</p> <p>With a Dishwashing Machine</p> <p>Without a Dishwashing Machine</p> <p>Single Service Kitchen</p> <p>Waste Disposer Only</p>	<p>Flow Rate:</p> <p>6 gallons</p> <p>5 gallons</p> <p>2 gallons</p> <p>1 gallon</p>	<p>Waste Flow Rate</p> <p><input type="text"/></p>
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3	<p>Retention Time:</p> <table border="1"> <tr> <td>Type of Kitchen</td> <td>Time</td> </tr> <tr> <td>Commercial Kitchen</td> <td>2.5 hours</td> </tr> <tr> <td>Single Service Kitchen</td> <td>1.5 hours</td> </tr> </table>	Type of Kitchen	Time	Commercial Kitchen	2.5 hours	Single Service Kitchen	1.5 hours	<p>Retention Time</p> <p><input type="text"/></p>
	Type of Kitchen	Time						
Commercial Kitchen	2.5 hours							
Single Service Kitchen	1.5 hours							

4	<p>Storage Factor</p> <table border="1"> <tr> <td>Restaurant Opens</td> <td>Restaurant Closes</td> <td>Hours of Operation (8 Hour Min.)</td> </tr> <tr> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td colspan="2"></td> <td>= 0.00</td> </tr> </table> <p>For Single Service Kitchens, Storage Factor is 1.50 (Midnight is 12:00 AM)</p> <p>Kitchen Type</p> <table border="0"> <tr> <td>1. Fully Equipped Commercial</td> <td>Storage Factor:</td> </tr> <tr> <td>Hours of Operation</td> <td></td> </tr> <tr> <td>8 hours</td> <td>1.00</td> </tr> <tr> <td>12 hours</td> <td>1.50</td> </tr> <tr> <td>16 hours</td> <td>2.00</td> </tr> <tr> <td>24 hours</td> <td>3.00</td> </tr> <tr> <td>2. Single Service</td> <td>1.50</td> </tr> </table>	Restaurant Opens	Restaurant Closes	Hours of Operation (8 Hour Min.)	<input type="text"/>	<input type="text"/>	<input type="text"/>			= 0.00	1. Fully Equipped Commercial	Storage Factor:	Hours of Operation		8 hours	1.00	12 hours	1.50	16 hours	2.00	24 hours	3.00	2. Single Service	1.50	<p>Storage Factor</p> <p>1.00</p>
	Restaurant Opens	Restaurant Closes	Hours of Operation (8 Hour Min.)																						
<input type="text"/>	<input type="text"/>	<input type="text"/>																							
		= 0.00																							
1. Fully Equipped Commercial	Storage Factor:																								
Hours of Operation																									
8 hours	1.00																								
12 hours	1.50																								
16 hours	2.00																								
24 hours	3.00																								
2. Single Service	1.50																								

5	<p>Calculated Liquid Capacity:</p> <p>Multiply the values obtained from steps 1, 2, 3 and 4. The result is the approximate grease interceptor size for this business.</p>	Notes:
----------	--	--------

6	<p>Select Grease Interceptor:</p> <p>Using the approximate required liquid capacity from step 5, select appropriate size grease interceptor.</p>	Notes:
----------	---	--------

THIS WORKSHEET IS INTENDED FOR ESTIMATING THE SIZE OF A GREASE INTERCEPTOR ONLY!

Grease Interceptor Sizing Worksheet

Complete table below and submit with project plans. This worksheet is intended for estimating the size of a grease interceptor only. The final determination for the size of the grease interceptor will be made by the appropriate personnel.

Date		Business	
Address		Calculated by	
Pipe Size (2, 3,4,6)		Flow Rate (GPM)	
Meals/Day		Restaurant type (low/med/high)	
Flatware (yes/no)		Monthly grease production (lbs)	
Grease Interceptor Manufacturer		Model No.	

Pipe Size (Nominal)	Full Pipe Flows	Half Pipe Flows
2	18	9
3	51	26
4	110	55
6	314	157

Flow rates per American Society of Plumbing Engineers (ASPE)

Step 1 -size by flow rate (GPM): select grease interceptor with a rating that is equal to or greater than the half pipe flow of the according drain-line pipe size.

Step 2 -calculate grease production for pump-out cycle: after selecting minimum size grease interceptor by flow rate, calculate the grease production to achieve the target pump-out schedule of at least 1 month and no more than 3 months. Choose grease interceptor that meets or exceeds required grease storage. If exact number of meals is known, calculate with formula; if exact number of meals is unknown, use grease production table below

Meals Per Day	Low Grease Production		Medium Grease Production		High Grease Production	
	Sandwich Shop, Convenience Store, Fresh, Bar, Sushi, Bar, Delicatessen, Snack Bar, Ice Cream Parlor, Hotel, Breakfast Bar, Residential		Coffee House, Pizza, Cafeteria, (no food prep), Japanese, Fast Food, Drive-In, Greek, Indian, Low Grease Output FSE (w/fryer)		Cafeteria, Family Restaurant, Italian, Steak House, Chinese, Bakery/Donut Shop, Buffet, Mexican, Seafood, Barbecue, Fried Chicken, Grocery Store	
	No Flatware 0.005 lbs./meal	With Flatware 0.0065 lbs./meal	No Flatware 0.025 lbs./meal	With Flatware 0.0325 lbs./meal	No Flatware 0.035 lbs./meal	With Flatware 0.0455 lbs./meal
	Grease Lbs. Per Month	Grease Lbs. Per Month	Grease Lbs. Per Month	Grease Lbs. Per Month	Grease Lbs. Per Month	Grease Lbs. Per Month
100	15	20	75	98	105	137
200	30	39	150	195	210	273
300	45	59	225	293	315	410
400	60	78	300	390	420	546
500	75	98	375	488	525	683
750	113	146	563	731	788	1024
1,000	150	195	750	975	1050	1365
1,250	188	244	938	1219	1313	1706

No. of Meals Per Day		Grease :Lbs. /meal		Days/Pump out cycle		Calculated Grease Production
	x		x		=	0
Step 1		Step 2		Step 3		Step 4

Grease Separators Sizing for Commercial Sinks

BATCH DUMPING PROCESS

The separator should hold one half of the liquid holding capacity of the sink that it services. To determine the cubic holding capacity of the sink, multiply the Length by the Width by the Depth in inches. Divide this figure by 231 to obtain the liquid holding capacity in Gallons. (Example shown is a single compartment sink. Multiply by the number of compartments to get the total holding capacity.) Use this figure in the chart.

Holding Capacity in Gallons Formula:

$$\frac{L" \times W" \times D"}{231}$$

Example:

$$\frac{24" \times 24" \times 20"}{231} = \frac{11,520 \text{ cu in}}{231} = 49.87 \text{ Gal}$$

*Low-Inlet models are recommended when a quick opening drain valve is used on the sink waste, resulting in a low waste outlet from the sink. Use a Low-Inlet model when there is not sufficient room next to the sink, or when it is necessary to place the separator underneath the sink drainboard. On larger model separators, we recommend a flush-with-floor installation in concrete floor construction. For installations in or on the floor below, use the next larger size separator.

Example:

Type of Fixture: 2-Compartment Commercial Sink

Maximum Holding Capacity of Fixture: 30 gallons

Liquid Holding Capacity and Seal of Separator: 17 gallons

Example:

Number of Fixtures: 3-5

Maximum Holding Capacity of Fixture: 110 gallons

Liquid Holding Capacity and Seal of Separator: 60 gallons

Location: Floor below fixtures

COMMERCIAL FOOD WASTE GRINDER

A grinder with a 1/2 h.p. motor requires a separator with a minimum holding capacity of 50 gallons. This is for a small installation in a restaurant with a seating capacity up to 100 people. For larger grinders with higher h.p. ratings, each additional 1/2 h.p. requires an increase of 20 gallons to the separator. Thus, a 1 h.p. grinder requires a 70 gallon holding capacity, a 1 1/2 h.p. grinder requires a 90 gallon holding capacity, and so on

DISHWASHER

Select a separator with a holding capacity equal to one hour's water consumption. On a dishwasher with three tanks, bypass the final rinse when permitted by code. If the rinse water bypasses the separator, the liquid holding capacity of the separator shall be equal to or greater than the total liquid holding capacity of the dishwasher

Grease Interceptors

General Information

Interceptors are mainly used for one product. There are grease interceptors, solids interceptors, hair interceptors, lint interceptors, etc...but each unit can only be used for its intended purpose. In some cases, a combination of two units is required. Example: A solids interceptor should be used in front of a grease interceptor. All interceptors require an external flow control in front of it. Some will have a restrictor on the inlet of the interceptor and call it a built-in flow control. It is still on the front end of the interceptor and does not allow the waste to enter the interceptor unobstructed.

HOW TO CLEAN THE INTERCEPTOR

For a passive grease interceptor to perform as designed, a strict maintenance schedule must be followed. If adequate maintenance is not performed, excessive grease buildup will occur until water, laden with grease, passes directly through the unit. Therefore, no matter how efficient the design or how proper the installation, these units perform only as well as the maintenance routine allows.

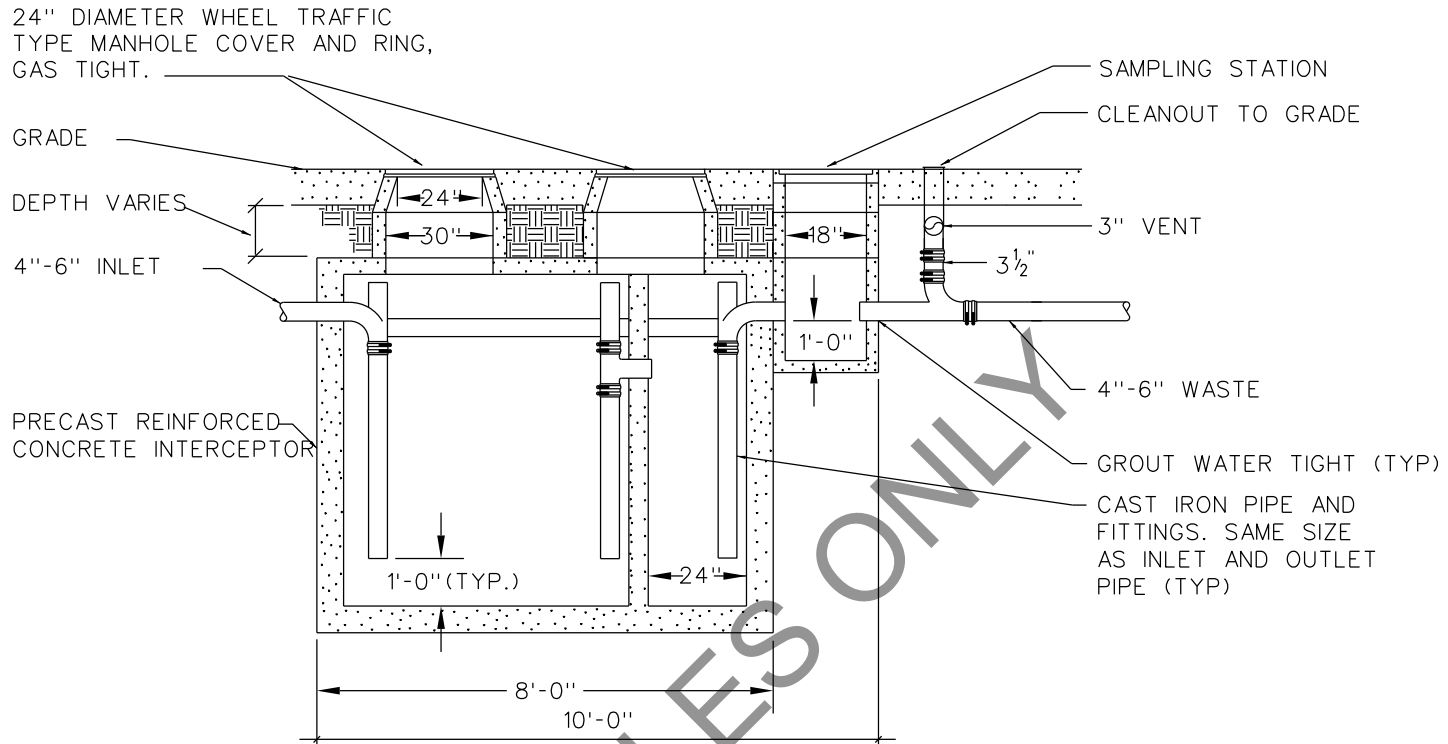
Cleaning and Maintenance Instructions should accompany every interceptor. It is a good practice to have a copy of the cleaning instructions located near the interceptor, directing the user on the proper operation/cleaning methods.

1. Remove floating grease.
2. Remove solids from the bottom of the unit.
3. Inspect gasket for damage and replace if necessary.
4. Replace cover and secure cover tightly.
5. Grease and other waste matter that has been removed from the interceptor should not be introduced into any drain, sewer, or natural body of water. This waste matter should be placed in proper containers for disposal.

Note: Cover gaskets are necessary to seal against gases and to prevent overflows. They must be heavy and elastic enough to give easy sealing.

Interceptors are not pressure vessels. Covers should be easily removable. When an interceptor is set in the floor, stainless steel bolts should be used (brass bolts are too easily stripped; steel bolts become rust locked). NOTE: Interceptors not easily opened for cleaning will not be cleaned regularly.

Many products are sold as aids to seemingly clean grease interceptors. These include acids and caustics with known hazards in handling, or so-called "miracle enzymes" with limited conditions and special instructions. These type of products are NOT RECOMMENDED because of the damage they can do to the interceptor, as well as the fact that the interceptor catches the grease at the point of use to be disposed, and not to give the user a vessel to add chemicals into the waste stream.



GREASE INTERCEPTOR DETAIL
NO SCALE

Notes:

This detail is applicable to 2 criteria:

1. Apartment buildings, 13-39 units
2. Fast food Establishments

For apartment buildings with 7-12 units, grease basin size is 3 feet by 6 feet.

This detail serves as a guide only. Developers/owners must submit product and/or materials specifications and details from local manufacturers/suppliers for review and approval by Department of Buildings and Department of Water Management.

DRAWN BY SBW
CHECKED BY CD, CC, SO

EXAMPLE ONLY

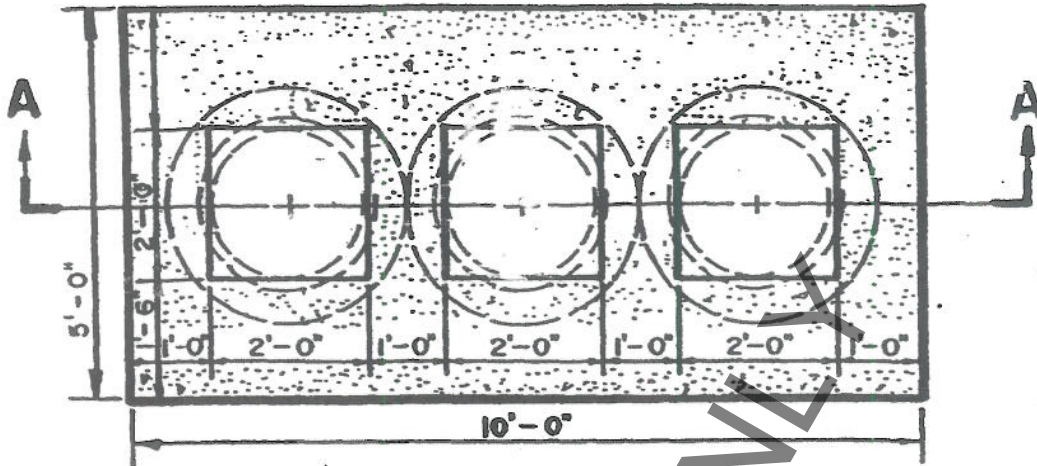
REVISIONS	
DATE	DESCRIPTION
2/18/14	Final

CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES
Large Capacity
Grease Interceptor

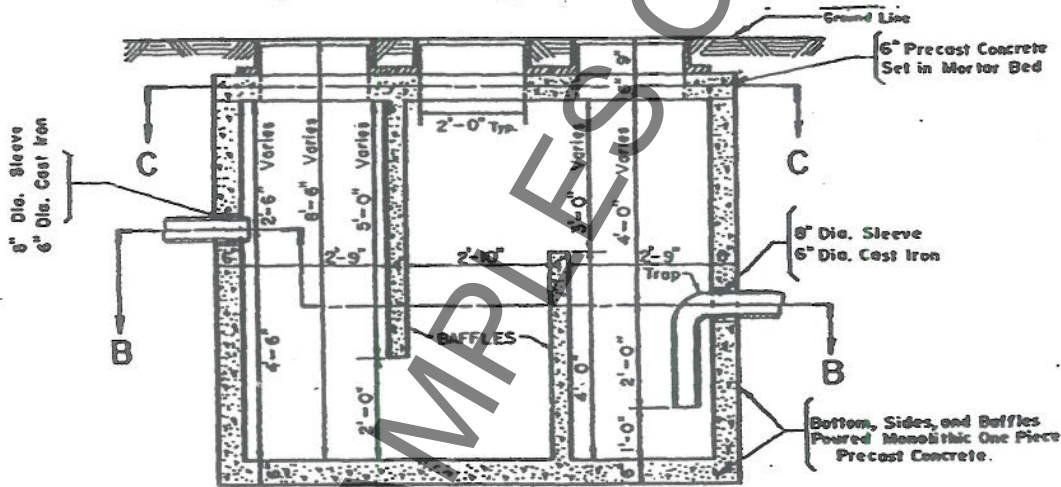
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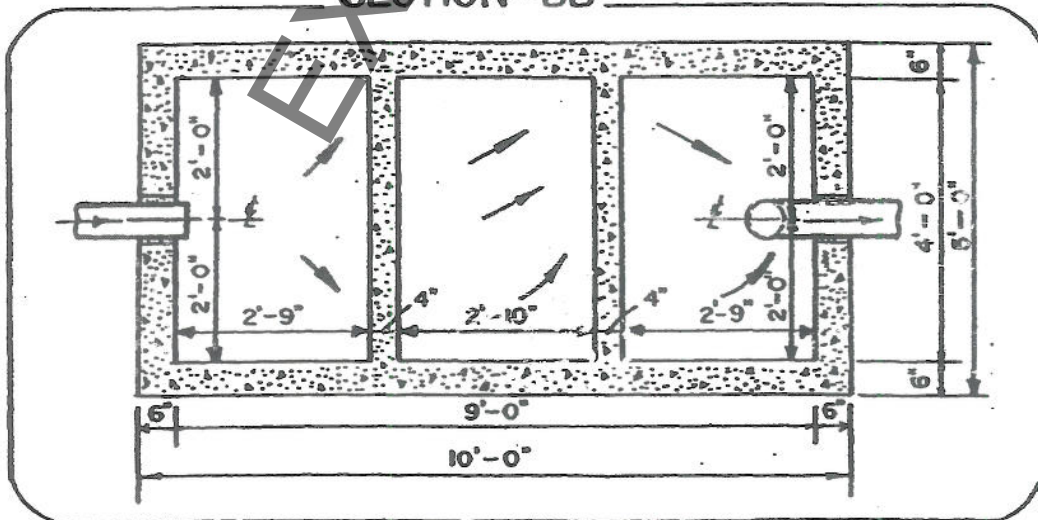
GREASE SEPARATOR PLAN and SECTION - CC



**For Restaurants Units other than Fast Food Establishments
or Apartment Building 40 Units and Over.**

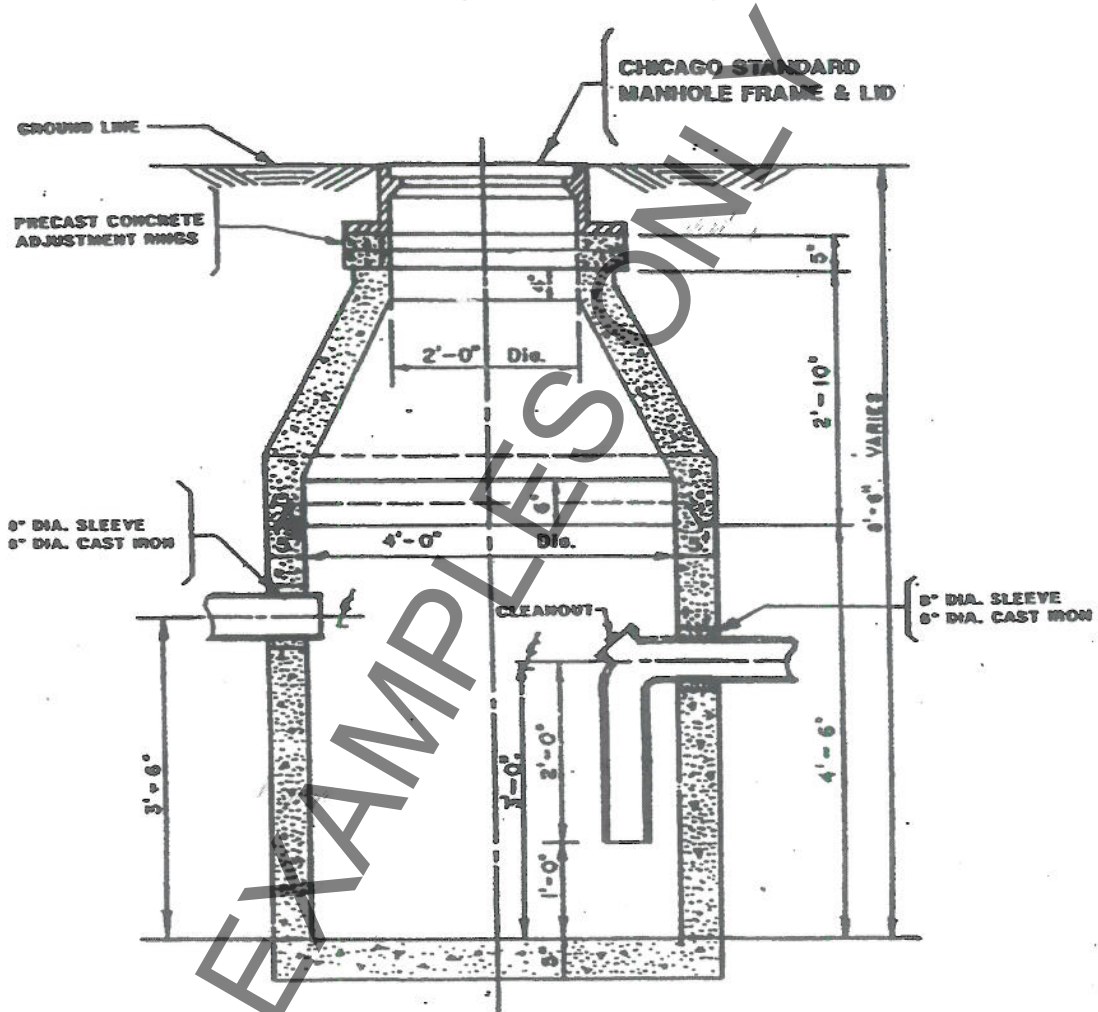


SECTION - BB



PRECAST GREASE BASIN

FOR APARTMENT BUILDINGS 13 TO 39 UNITS
OR FAST FOOD ESTABLISHMENTS.



**GREASE BASINS MUST BE VENTED WHEN
CONSTRUCTED INSIDE BUILDINGS.**

NOTE:

**FOR APARTMENT BUILDINGS WITH 7 TO 12 UNITS,
A GREASE BASIN 3 FEET BY 6 FEET IS REQUIRED.**

Sand / Oil Interceptor Sizing Worksheet

Business Name: _____
 Address: _____
 City, State, Zip: _____

Date: _____
 Calculated By: _____

To calculate the required volume, complete the highlighted boxes

Step 1

Size of Facility

Facility Size (Square Feet)
1

Square Footage
1

Step 2

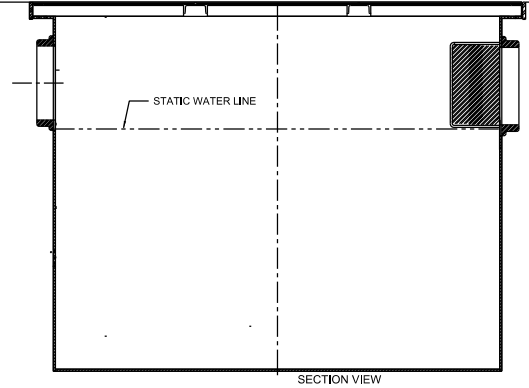
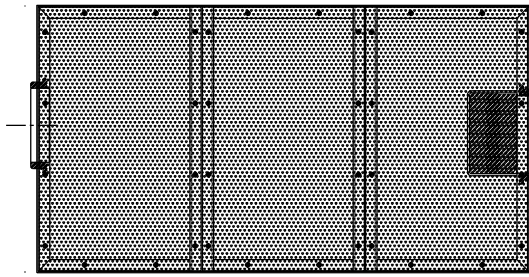
Facility Type

1	Truck Washes, Heavy Equipment Wash
2	Automatic Car Wash
3	Car Wash (Hand Held)
4	Machine Shop, Work Area, & Automotive Workshop
5	Paint Spray Booths
6	Printer
7	Parking Garage (where floors are to be washed)
8	Parking Garage (where tenant cars are to be washed)
9	Parking Garage (No Water, Fire Sprinklers Only)

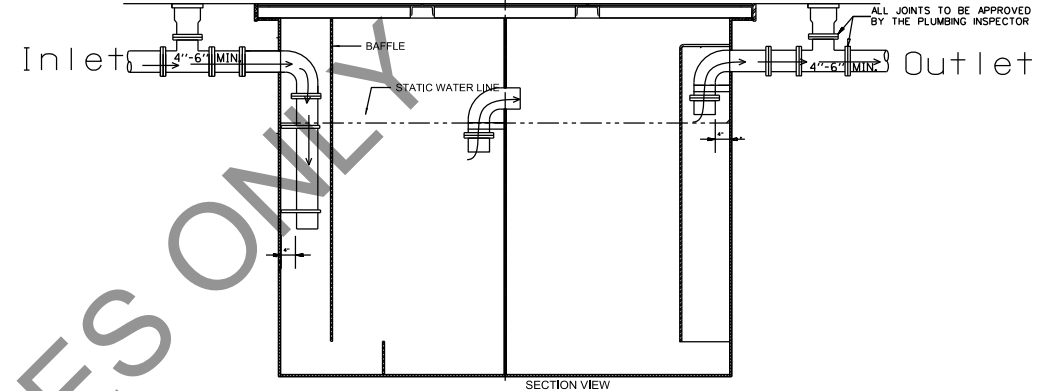
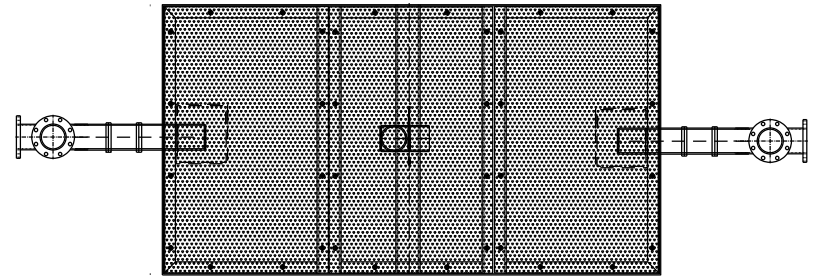
Facility Type
1

Facility Size		Facility Factor		Conversion Factor		Storage Factor		Calculated Liquid Volume		Sand - Oil Interceptor Size (Gal.)
1	x	0.0667	x	7.48	x	2.0	=	1		0
Step 1		Step 2		Step 3		Step 4				

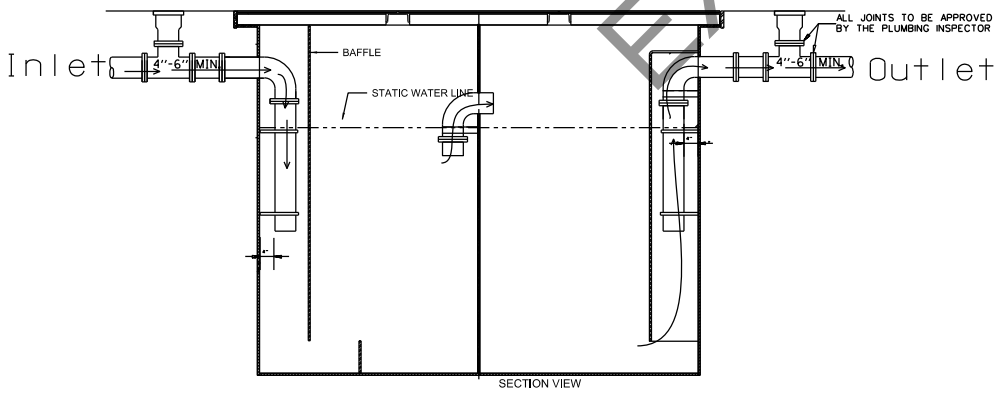
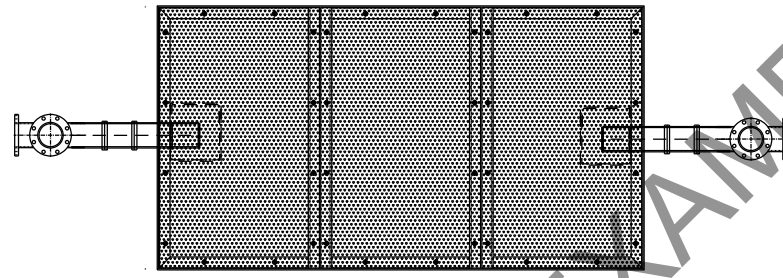
Facility Use	Sq. Ft.
Truck and Heavy Equipment	15
Automatic Car Washes	50
Car Wash (hand-held spray)	75
Machine Shop / Work Area /	100
Paint Spray Booth	250
Printers	300
Parking Garages (floors are to be	2,000
Parking Garages (tenant cars are to	3,000
Parking Garages (no water outlets	4,000



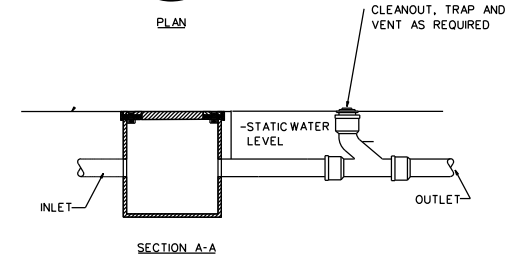
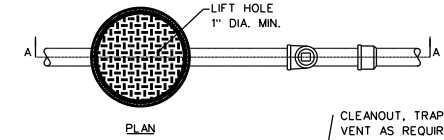
NonBaffled Grease-Oil Trap/Interceptor



Baffled Grease-Oil Trap



Baffled Grease Interceptor



Optional SAMPLING BOX

NO SCALE

DRAWN BY: SBM
 CHECKED BY: CO, CC, SO

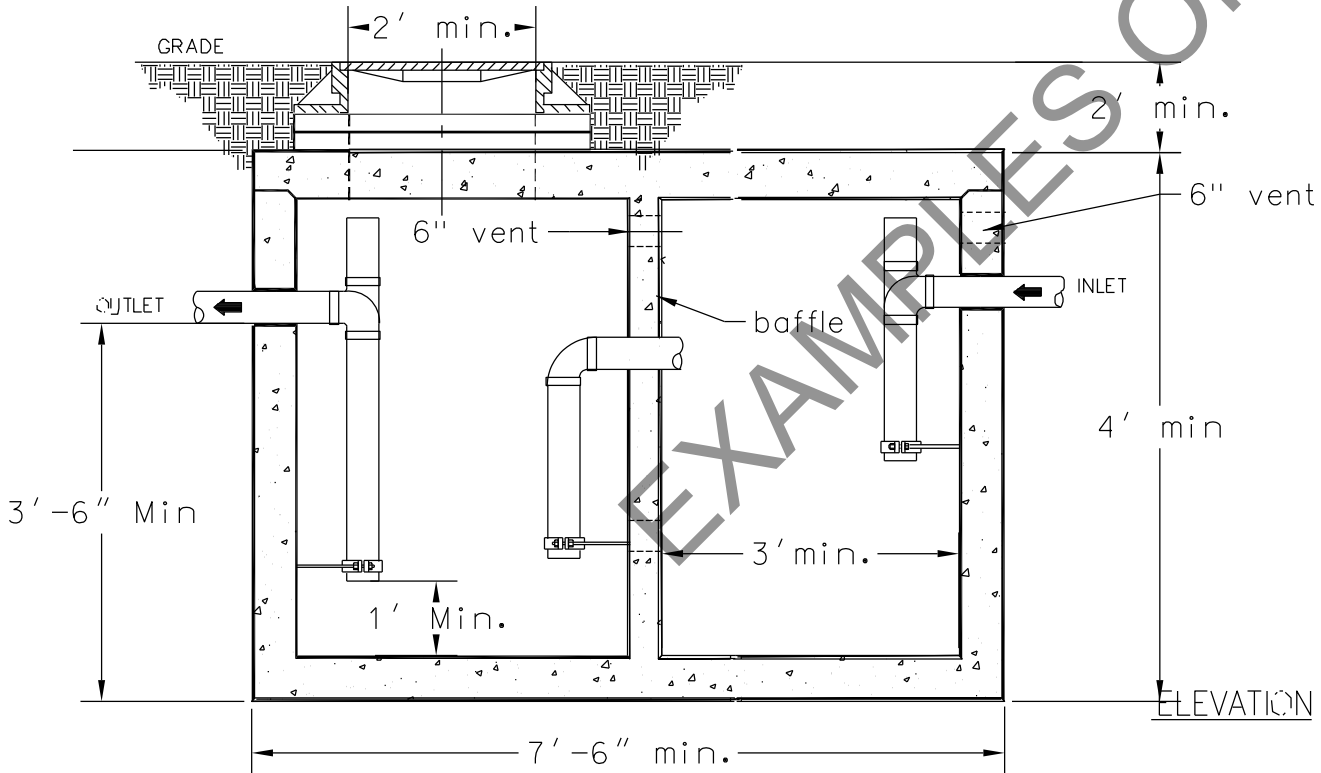
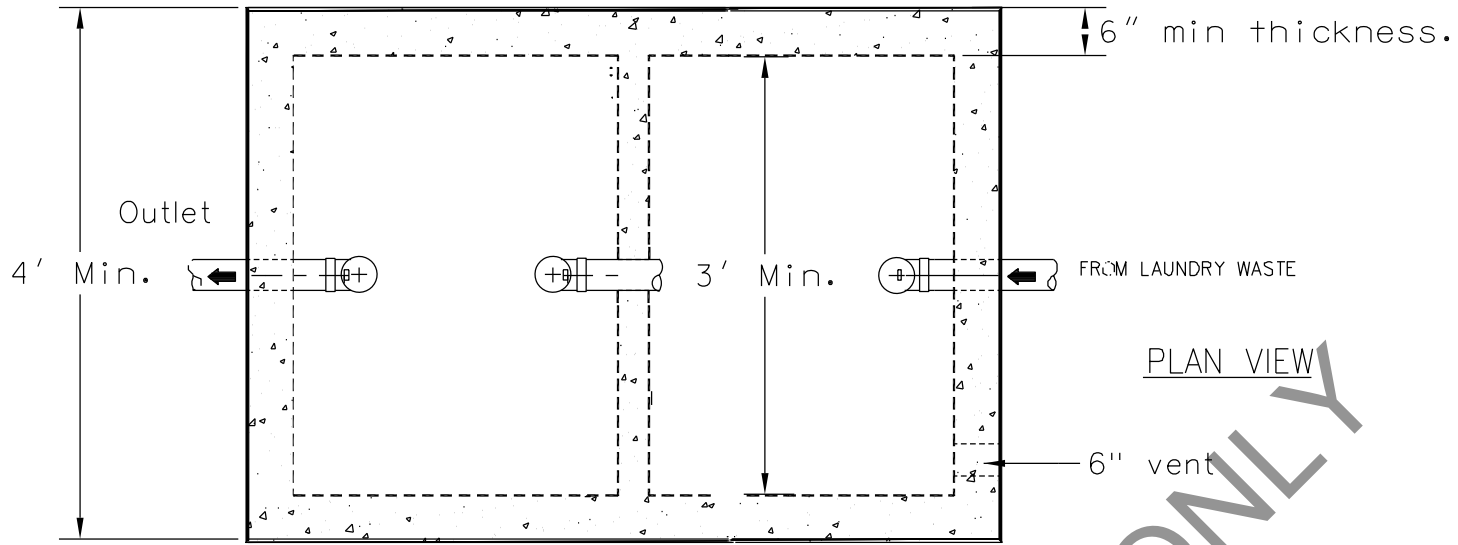
EXAMPLE ONLY

REVISIONS	
DATE	DESCRIPTION
2/18/14	Final

CITY OF CHICAGO
 DEPARTMENT OF WATER MANAGEMENT
 BUREAU OF ENGINEERING SERVICES
 Oil/Grease Trap/Interceptor
 SCALE: AS SHOWN

Lint Interceptor Sizing Calculator for Gravity Drain Laundry Machines	
Number of Machines	5
Average Gravity Discharge Rate per Machine (GPM)*	12.5
Average Wash Cycle (hours)*	0.7
Average Operating Hours (hours)*	16
Average Turns Per Day Per Machine*	5.5
Simultaneous Use Probability	75.0%
Maximum Drain Load to Interceptor (GPM)	47 GPM
* All Data for constants provided by Alliance Laundry Systems (www.unimac.com) or the Coin operated Laundry Association (www.coinlaundry.com)	
Alternate Lint Interceptor Sizing calculator	
Total Gallons Per Cycle	
Cycles per hour	
Retention time	
Storage factor (based on hours of Operation)	
Size of Lint Interceptor in Gallons	0
Storage Factors	
<i>Laundry Type</i>	<i>Factor</i>
Institutional Laundry	2.5
Standard Commercial Laundry	2.0
Light Commercial Laundry	1.5

EXAMPLES ONLY



Lint basin criteria:

No. of Washing Machines	No./size of basins
1-15 units	1, 3'x6'
16-30 units	1, 4'x8'
31-45 units	2, 1 of each size above
46-60 units	2, 4'x8'

DRAWN BY: SRW
 CHECKED BY: GD, CC, SO

EXAMPLE ONLY

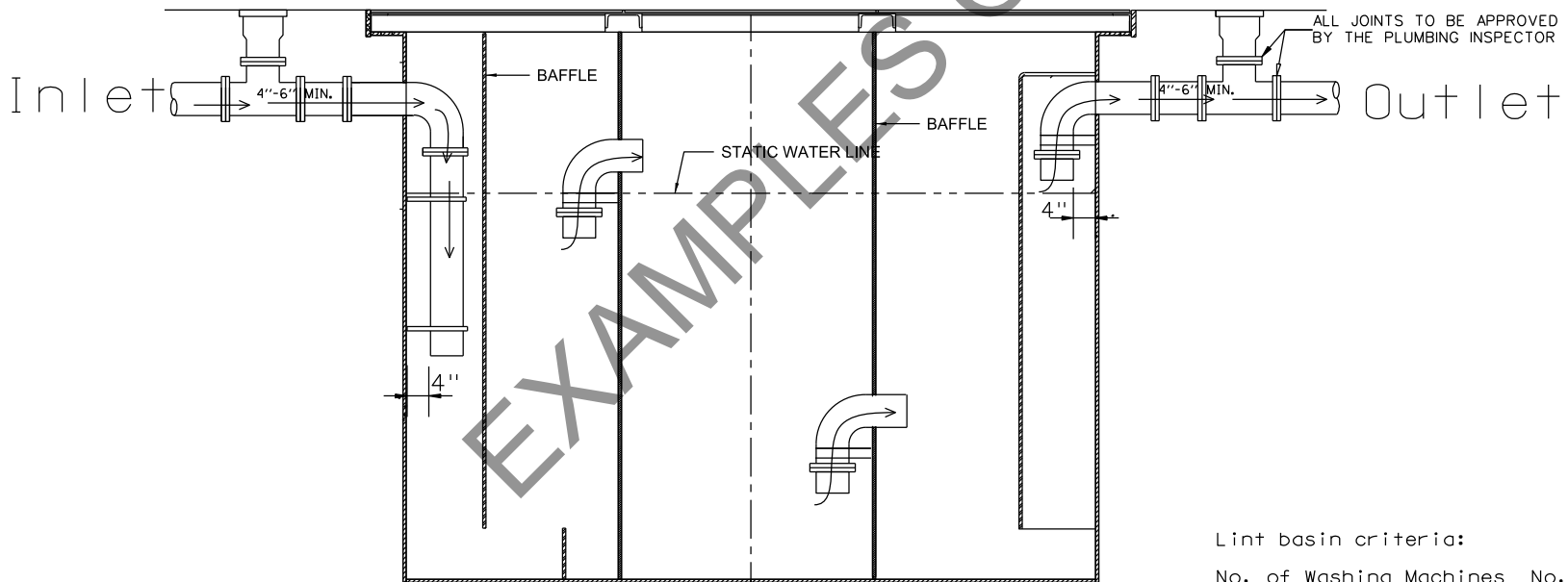
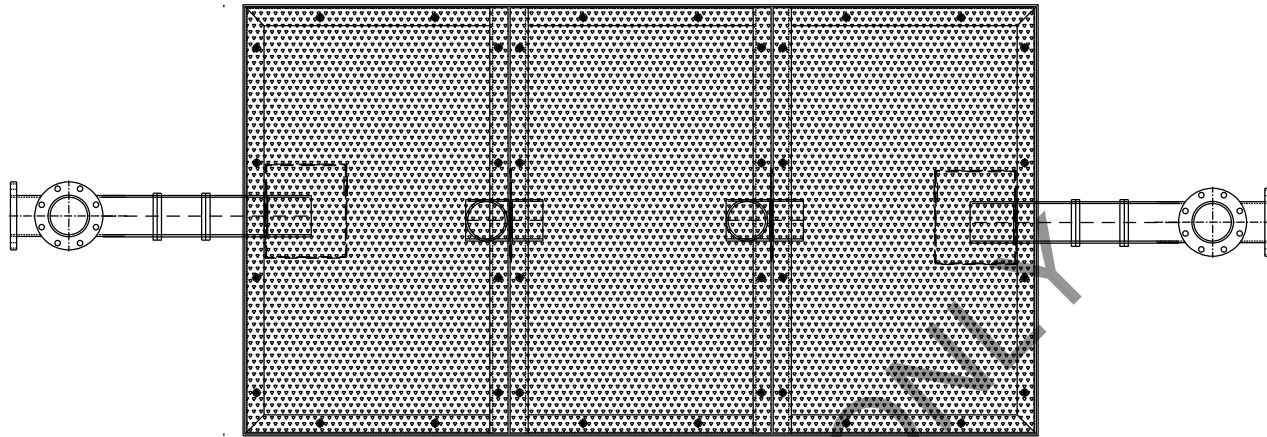
REVISIONS	
DATE	DESCRIPTION
2/18/14	Final

CITY OF CHICAGO
 DEPARTMENT OF WATER MANAGEMENT
 BUREAU OF ENGINEERING SERVICES

Lint Basin Standard

SCALE: AS SHOWN

A.102.4



ALL JOINTS TO BE APPROVED BY THE PLUMBING INSPECTOR

Lint basin criteria:

No. of Washing Machines	No./size of basins
1-15 units	1, 3'x6'
16-30 units	1, 4'x8'
31-45 units	2, 1 of each size above
46-60 units	2, 4'x8'

EXAMPLE ONLY

DRAWN BY SBW
 CHECKED BY GD, DC, SO

REVISIONS	
DATE	DESCRIPTION
2/18/14	Final

CITY OF CHICAGO
 DEPARTMENT OF WATER MANAGEMENT
 BUREAU OF ENGINEERING SERVICES

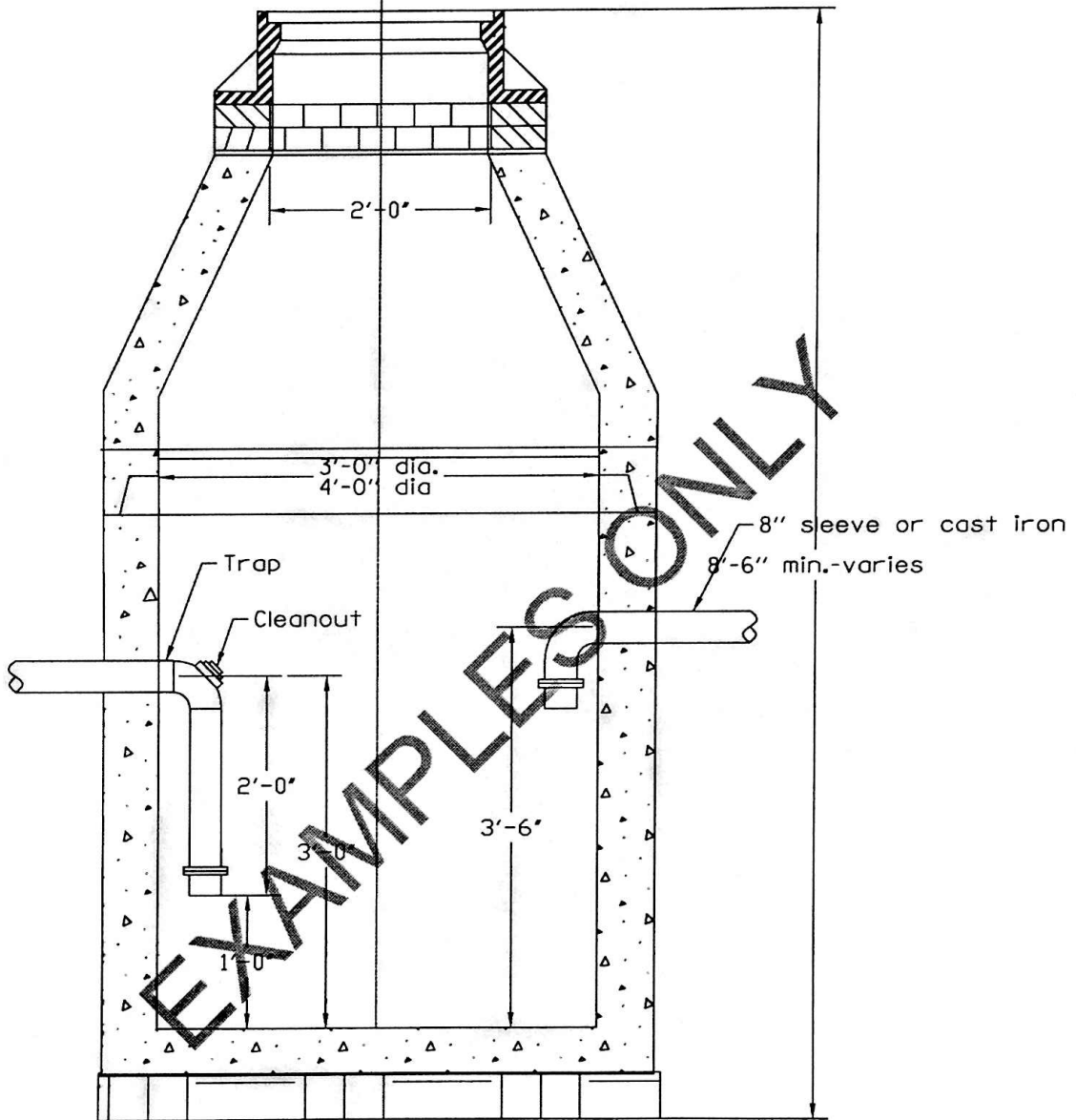
Lint Basin Standard

SCALE: AS SHOWN

A.102.5

Precast Grease/Lint Basin

NOTE: Basins must be vented when constructed inside buildings.



Grease basin requirements:

1. Apt. buildings 13-39 units and fast food establishments, use 4' basin.
2. Apt buildings 7-12 units, use 3'x6' basin

Lint Basin Requirements:

No. of Washing Machines	Qty & Size of basins
1-15 units	1 basin, 3'x6'
16-30 units	1 basin, 4'x8'
31-45 units	2 basins, 1 each 3'x6' & 4'x 8'
46-60 units	2 basins, 4'x8'

AMOUNT OF WASHING MACHINES

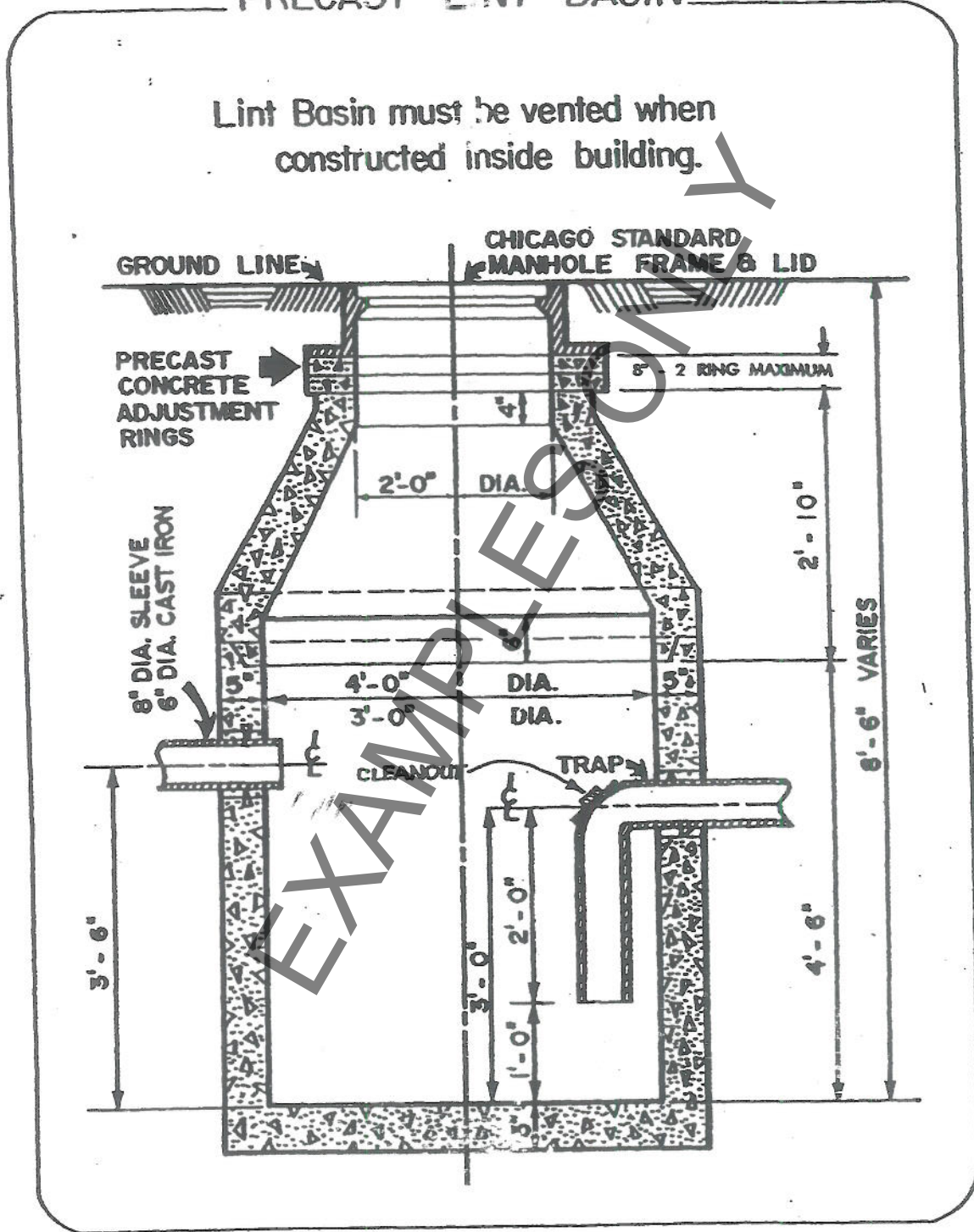
- One to 15 Units
- 16 to 30 Units
- 31 to 45 Units
- 46 to 60 Units

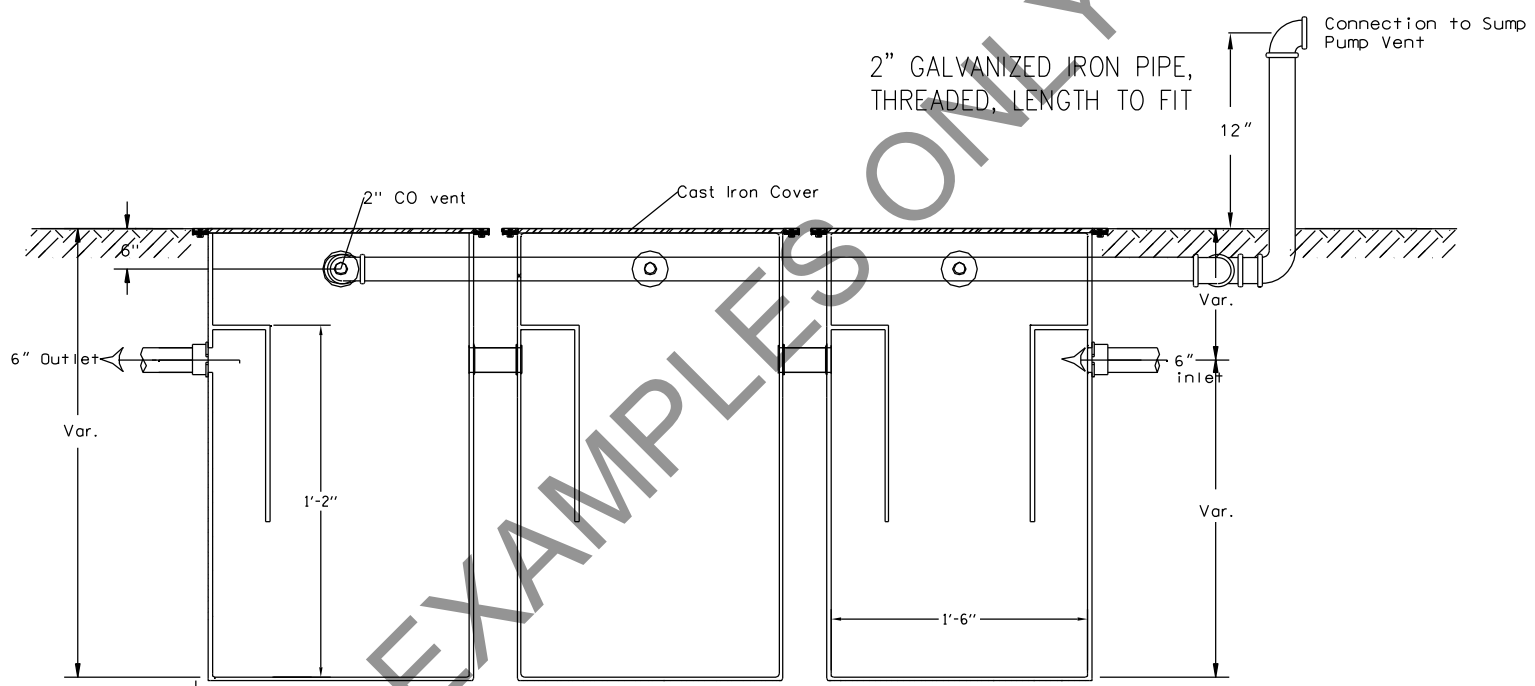
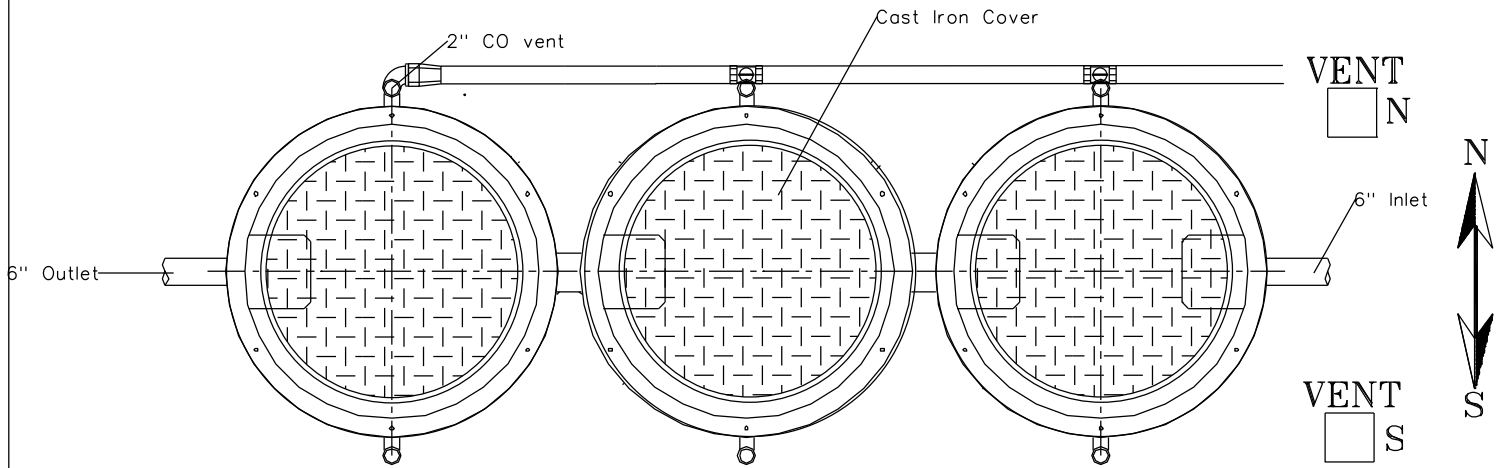
REQUIREMENT, AMOUNT & SIZE

- 1 — 3' X 6'
- 1 — 4' X 8'
- 2: 1, 3' X 6' and 1, 4' X 8'
- 2 — 4' X 8'

PRECAST LINT BASIN

Lint Basin must be vented when constructed inside building.





Notes:

1. Minimum diameter of each basin must be 1'-6".
2. Bottom of each basin must be 1'-2" below invert of outlet/inlet of all basins.
3. Inlets and outlets must be 6" minimum.
4. Vent connections must be 2" minimum.
5. All basin covers must be cast iron, air-tight, and boltable/lockable.

Material and/or product specification sheets must be submitted with Sewer Permit application for approval.

EXAMPLE ONLY

DRAWN BY SBW

CHECKED BY GD, GC, SO

REVISIONS	
DATE	DESCRIPTION
2/18/14	Final

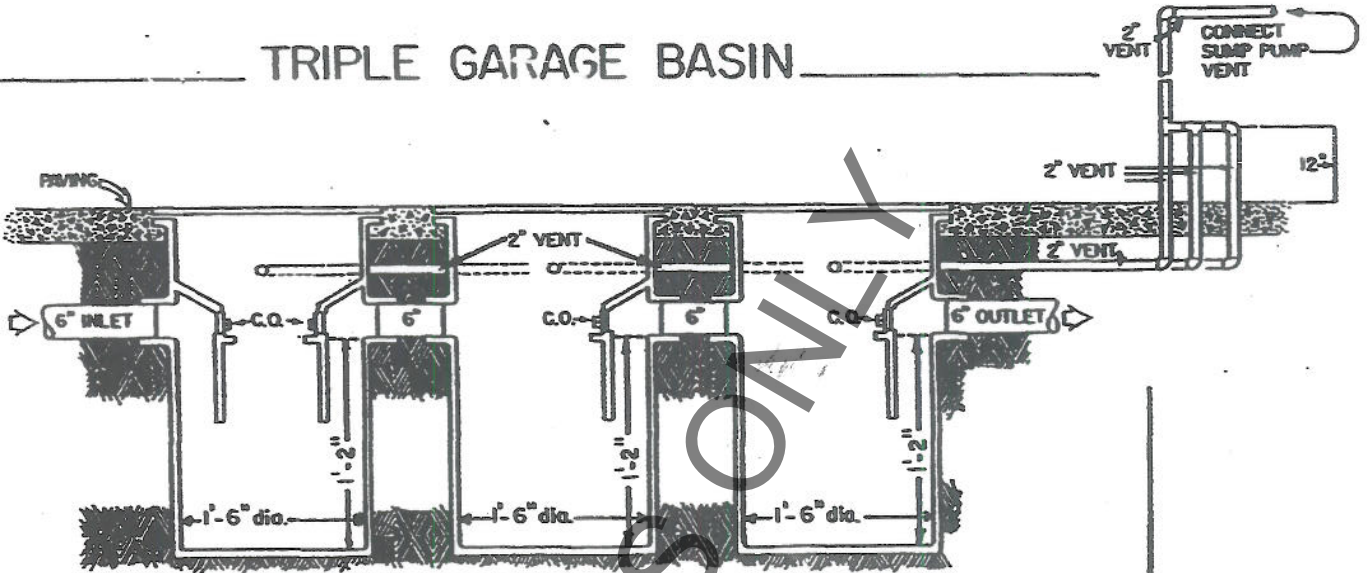
CITY OF CHICAGO
DEPARTMENT OF WATER MANAGEMENT
BUREAU OF ENGINEERING SERVICES

Triple Garage Basin

SCALE: AS SHOWN

A.103.1

TRIPLE GARAGE BASIN



NOTE:

Bottom of Basin shall be 1'-2" below invert of outlet.
Neenah 18" Cast Iron Triple Garage Basins.

6" Inlets and Outlets.

2" Vent connections.

Cast Iron gas-tight bolted covers.

Depths of Basins as required by Inlet & Outlet elevation.

See plan for Invert Elevation.

CITY OF CHICAGO
Department of Water Management

DRAINLAYER'S LICENSE CLASSIFICATIONS:

During 2002, the Department of Water Management implemented a **DRAINLAYER'S TRAINING PROGRAM** in conjunction with licensing. This program will be offered by City Colleges of Chicago in 2006 again. Successful completion of this program, including passing both a written and practical exam is required in order to obtain a drainlayer's license from the City of Chicago for 2006. All current license holders should have completed this program from January 7, 2005 through November 13, 2005. If not, please see the 2006 Program Schedule attached.

Work included under an "A" drainlayers license

New building construction, sewer main construction, or sewer and sewer related activity is done. All license requirements are needed including C.D.O.T. license, practical and written test every five years.

New construction on private property

New construction in the public way

Single family residences

Development of townhouses - condominiums - multiple family residences

Also, all items included under a type "B" and "C" license

Work included under a "B" drainlayers license

Repairs and construction on existing buildings only, or sewer and sewer related activity is done. No new building construction or new sewer main construction activity is done. Otherwise, all license requirements are needed including practical and written test every five years except C.D.O.T. permit needed only as applicable.

Repairs - Repair extensions

Repair or adjustment of a sewer structure in public way or private property

Flood controls, overhead conversions, sump and drain tile pipe

Flood control repair

Sump pump without overhead conversion/drain tile pipe

Stubs permits

Power rodding

Inspection manhole

Paving

Also, all items included under a type "C" license

Work included under a "C" drainlayers license

Only sewer and sewer related activity is done. No building construction or sewer main construction activity is done. Requirements start on page 13 of the 2006 Permit and Fees Booklet are needed including practical and written test every five years.

Pumping permit for miscellaneous other

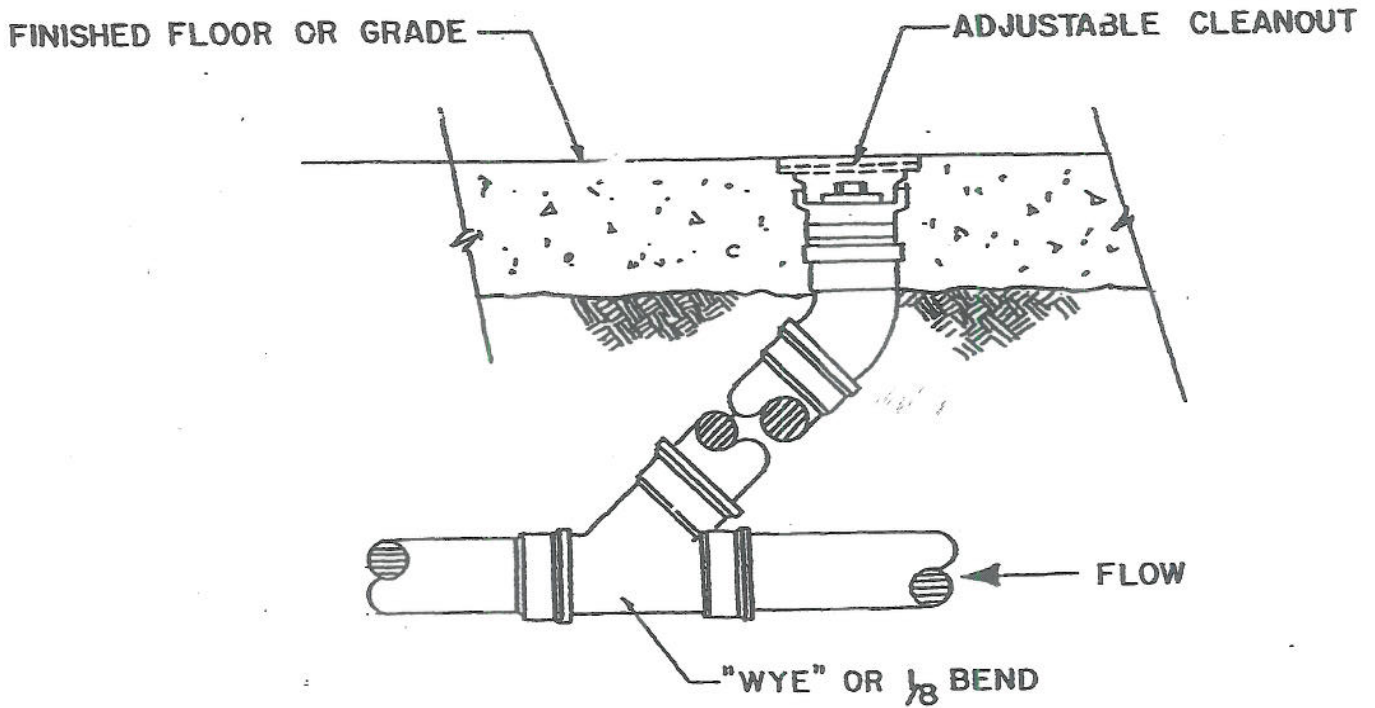
Pumping water out of basements

Seal permits

Televising, cleaning, lining and inspection of sewers

Installation of testing equipment

Please be advised a type "A" license encompasses the activity listed under a type "B" and a type "C" license, and likewise a type "B" license encompasses the activity listed under a type "C" license. Drainlayers **ARE NOT ALLOWED** to make **REPAIRS** and/or **ADDITIONS** in the **PUBLIC WAY** unless it is for commercial/industrial or a building with more than four units.



TYPICAL CLEANOUT TO FINISHED FLOOR
NOT TO SCALE

Note: May be used for pipe sizes smaller than 12" in diameter to segment pipe lengths exceeding 150 feet.

**STORM SEWER OUTFALL
ASSOCIATED WITH**

{Insert Property Street Address}

**CALL 311 IF YOU SEE
DISCHARGE DURING
DRY WEATHER**

STORM OUTFALL SIGN ON WATERWAYS

Operation and Maintenance Plan Owner's Certification Statement

Property Name: _____

Property Address: _____

As the owner(s) of the subject property, by signing this document, I/we acknowledge that I/we have received and reviewed the Operation and Maintenance Plan, dated _____, and understand its contents. (as required by the Stormwater Management Ordinance, Section 11-18-030).

In the event that I/we were to sell this property, I/we agree to give a copy of the Plan to the new owner(s) and this Owner's Certification Statement for signature. This signed Certification Statement must be submitted to the City's Department of Buildings upon transfer of ownership.

I/we further agree to adhere to the maintenance schedule of best management practices stipulated in the Plan. I/we also acknowledge that if I/we don't maintain the measures as shown in the Plan, upon City inspection, I/we could be liable for a violation of the City's Municipal Code (according to Stormwater Management Ordinance Section 11-18-130).

Initial Owner(s) Printed Name

Initial Owner(s) Signature Date Notary Public

2nd Owner(s) Printed Name

2nd Owner(s) Signature Date Notary Public

3rd Owner(s) Printed Name

3rd Owner(s) Signature Date Notary Public

CITY OF CHICAGO
Department of Water Management

RIGHT OF WAY AS-BUILTS - RECORD DRAWINGS FORM

The contractor will be required to submit "as built plans" / record drawings of all new sewers and sewer structures that will be owned and maintained by the City. These "as-built plans" / record drawings should be sealed by a registered land surveyor and/or a registered professional engineer and submitted within 30 days after the completion of the sewer work. These "as-built plans" / record drawings should be forwarded to the Department of Water Management, Bureau of Engineering Services, Sewer Design Section located at 1000 East Ohio Street, Elevation +51, Room 313, Chicago, Illinois 60611 along with a copy of this form, the coinciding sewer permit and video tape, as applicable.

Drainlayer's Name: _____ Phone No.:

Drainlayer's Signature:

Date of Project Completion:

Date Submitted As-Built Plan / Record Drawing:

FOR OFFICE USE ONLY:

Project Manager: _____ Phone No.:

Project Name:

Project No. and/or Contract No.:
(i.e., CDOT, IDOT, COUNTY)

Project Location:

Issues By: _____ Date:

APPENDIX II-B

City of Chicago - DWM

Bureau of Engineering Services - Sewer Design Section

Design /Construction Affidavit in Support of the Stormwater Infiltration or at Grade Discharge of Downspouts on Residential Buildings

Project Name: _____

Property Address(es)(Property): _____

The Developer/Owner, Designer and Architect (hereafter the Affiants) have authority to sign this Affidavit and have personal facts of the matters contained herein. The Affiants acknowledge that the plans dated _____ and approved by the DWM (Plans) form the basis for this Affidavit. The Affiants further acknowledge that in lieu of traditional stormwater management detention/retention and traditional connected and functional downspouts, and to allow for the drainage from each Property, alternative safe and functional flood control measures, in accordance with the Municipal Code, will be installed, connected and operational to the Property as identified above. Further, the Affiants assume full responsibility for the design and construction of the project, and hereby certify that such infiltration and discharge will not create a flooding or safety hazard to the occupants of the subject property or to those adjacent properties as listed above. The alternative safe and functional flood control measures in the above address(es) are feasible for the following reasons:

- Adequate methods to eliminate or control soil erosion have been incorporated into the design and construction.
- Adequate design measures, and/or subsoil investigations have been conducted to ensure that any migration or rising of the groundwater table will not adversely impact existing/proposed buildings.
- Adequate flood proofing of existing and /or proposed basement walls and foundations will be performed to ensure that seepage will not occur.
- Sump pumps to accommodate any surface infiltration will be sized and installed, as needed.
- Positive drainage to the public right-of-way will be provided with at least 0.1 feet of freeboard between an overland flow route to the public right-of-way and low grade to adjacent properties.

If for any reason, within 18 months of building occupancy (as approved by the City of Chicago), the site is found to cause a flooding or safety hazard to the occupants of the subject property or those of the adjacent properties as listed above, the Developer/Owner will be responsible for the performance of the necessary remedial and corrective measures (Responsibilities). The Developer will fully disclose and warrantee these Responsibilities. Further, the terms and facts of this Affidavit will be incorporated into an executed and recorded easement agreement.

**Design /Construction Affidavit in Support of the Stormwater Infiltration or
at Grade Discharge of Downspouts on Residential Buildings
Page two**

Any breach of the conditions contained in this Affidavit, as determined solely by the City of Chicago, that are not cured by the Developer/Owner within 30 (thirty) days of official notice, the City of Chicago may utilize any and all legal and equitable remedies available to the City."

Signed by Designer

Name/Company:

Address:

Phone Number:

Signature: _____, Date _____

Professional Engineer or Licensed Architect's Seal:

Signed by General Contractor

Name/Company:

Address:

Phone Number:

Signature: _____, Date _____

Contractor License Number:

Signed by Developer/Owner

Name/Company:

Address:

Phone Number:

Signature: _____, Date _____

APPENDIX II-C

City of Chicago - DWM

Bureau of Engineering Services - Sewer Design Section

Design /Construction Affidavit in Support of Soil Erosion and Sediment Control Measures during Construction

Project Name: _____

Property Address(es)(Property): _____

The Developer/Owner and General Contractor (hereafter the Affiants) have authority to sign this Affidavit and have personal facts of the matters contained herein. The Affiants acknowledge that the plans, dated _____, and approved by the DWM/DOB (Plans) form the basis for this Affidavit. The Affiants further acknowledge that Regulated Developments, under the City's Stormwater Ordinance, that discharge to a combined sewer system, must provide functional and effective construction soil erosion and sediment control (SESC) at the Property as identified above. Further, the Affiants assume full responsibility for the design, construction and maintenance of SESC measures to prevent the discharge of sediment, dust, and other pollutants in stormwater runoff from the Property.

Construction SESC measures will be installed at the above address(es) prior to land disturbing activities and be maintained in functional order until the property has been "permanently stabilized" (i.e. when all land disturbing activities have been completed, all construction SESC measures have been removed, and an uniform perennial vegetative cover with a density of 70 percent for unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures have been completed).

Any breach of the conditions contained in this Affidavit, as determined solely by the City of Chicago, that are not cured by the Developer/Owner within 7 (seven) days of official notice, the City of Chicago may utilize any and all legal and equitable remedies available to the City."

As the General Contractor of the subject Property, I certify adherence to this Affidavit and to the following:

Design /Construction Affidavit in Support of Soil Erosion and Sediment Control Measures during Construction

Page two

The SESC measures will be designed, constructed and maintained in accordance with standards and specifications set forth in the most recent version of the Illinois Urban Manual published by the Illinois Environmental Protection Agency (IEPA) and the Natural Resources Conservation Service (NRCS). As a minimum, all temporary SESC measures such as vegetative cover, silt fences, inlet protection, check dams, etc., shall be designed to accommodate anticipated 1-year storm flows.

Any applicable Storm Water Pollution Prevention Plan (SWPPP) will be followed along with the minimum SESC measures specified herein. The SWPPP will be kept onsite during construction for inspection.

Temporary soil stabilization will be applied to topsoil stockpiles and disturbed areas where construction activity will not occur for a period of more than 21 calendar days.

Permanent soil stabilization shall be done within 14 calendar days after completion of final grading of the soil.

Inspection of SESC measures will be completed at least once every 7 calendar days and within 24 hours of a storm 0.5 inches or greater. SESC measures will be maintained to perform their intended function until the site is permanently stabilized.

All temporary roadways, access drives and parking areas will be stabilized and be of sufficient width and length to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not by water flushing) as necessary, or before the end of each workday.

Tires and wheel wells of vehicles and construction equipment shall be free of dirt and/or sediment before leaving a construction area to prevent tracking onto a public or private paved road, or sidewalk.

Trucks loaded with waste material that may be carried off by wind or rain shall be covered prior to leaving the construction site.

All onsite drainage structures within the construction area and down slope within the public right-of-way shall be protected with sediment control measures.

The discharge of sediment into the sewer system, as part of site dewatering, must be controlled and minimized to prevent clogging of the City's sewer system.

The use, storage and disposal of chemicals, cement and other compounds and building materials used on the construction site shall be managed during the construction period, to prevent their entrance into the City's sewer system.

All temporary SESC measures will be removed within 30 days after final site stabilization is achieved or after temporary measures are no longer needed.

Unless adequate sediment and erosion control measures are implemented for all onsite infiltration BMP systems, the installation of such systems will be scheduled after all of the major construction activity is completed.

Design /Construction Affidavit in Support of Soil Erosion and Sediment Control Measures during Construction
Page three

Signed by General Contractor

Name/Company:

Address:

Phone Number:

Signature: _____, Date _____

Contractor License Number:

As the Developer/Owner of the subject Property, I certify adherence to this Affidavit.

Signed by Developer/Owner

Name/Company:

Address:

Phone Number:

Signature: _____, Date _____

APPENDIX II-D CONNECTION SIZING

I. Sanitary Connections Sanitary sewer connection sizes are based on the following table:

*Max. Connection Diameter (in)	Peak DWF (cfs)	Main Sewer Diameter (in)
6	up to 0.35	10
8	0.35 to 0.62	12
10	0.62 to 0.97	15
12	0.97 to 1.55	18 or larger

The DWF (with peaking factor) should be based on the number of fixture units (FTU), reference the *Municipal Building Code, Table 18.29-1108.1*. The conversion from the number of fixture units to drainage area (sf) to peak DWF (cfs) is as follows:

$$\text{Drainage area} = [(\text{FTU} - 150) * 7.2] + 4850 \text{ sf}$$

$$\text{Peak DWF} = \text{Drainage Area} / 43,560 \text{ sf/acre} * 1.0 \text{ cfs/acre}$$

The maximum connection size will be the lesser size indicated by the 2nd or 3rd columns.

II. Storm Connections Storm connections should be one standard pipe size larger than the restrictor size (as determined by the site's maximum release rate), but should not limit the flow. The connection size may be used as a restrictor if it is hydraulically proven, under the maximum design head pressure, that the actual discharge rate will not exceed the maximum allowable discharge rate from the site. Note that all vortex restrictors require an 8-inch diameter receiving pipe or connection. If the connection is used to by-pass upstream flows, then the maximum connection size should be based on the criteria for combined sewers.

III. Combined Connections Combined sewer connection sizes are based on the restricted stormwater discharge from the site plus the peak DWF. The connection size, based on the maximum 100-year flow, assumes that about 3.5 feet of surcharge can occur within the connection. The following table should be used as a guide for sizing the connection.

*Max. Connection Diameter (in)	Max. 100-yr Flow (cfs)	Main Sewer Diameter (in)
6	up to 1.8	10
8	1.8 to 3.2	12
10	3.2 to 5.0	15
12	5.0 to 7.2	18 or larger

The maximum connection size will be the lesser size indicated by the 2nd or 3rd columns.

*Also see Chapter II, Section 3.4- Connection to City Sewer

APPENDIX II-E

Existing Facilities Protection



DEPARTMENT OF WATER MANAGEMENT
CITY OF CHICAGO

**Department of Water Management (DWM) Sewer Requirements For
Existing Facilities Protection**
August 2015

1. The utility company/government agency and its contractors are responsible for the adequate protection of the existing sewers, drain connections, sewer structures and bench monuments during construction of new utilities and/or adjustment to existing utilities and the use of heavy equipment within the limits of the project.

2. It is the responsibility of the utility company/government agency and its consultants/contractors to obtain the necessary background information from the sewer unit of the DWM in meeting requirements for design drawings/contract plans and for existing facilities protection during the construction stage.

Records from the sewer unit of the DWM include: existing sewers, drain connections, sewer structures, benchmark locations, ordinance grades, age of sewer and pipe material.

When replacing curb and gutter, ordinance grades must be shown on the plan. To the extent possible, the proposed top-of-curb grades must be within 0.2 feet of the approved ordinance grade.

Copies of sewer records and benchmarks can be obtained by payment at the sewer unit of the DOB, located at City Hall, 121 N. LaSalle Street – Room 804, Chicago, Illinois 60602.

3. A permit is required from the sewer unit of the Department of Buildings (DOB) prior to the construction of, or repairs to, underground sewers, drain connections or sewer structures, including the adjustment of sewer structures and removal/replacement of frames and lids. The permit must be obtained by a drainlayer currently licensed from the sewer unit of the DOB.

4. The sewer unit of the DOB must be notified at least 48 hours in advance of construction, with the name and telephone number of the resident engineer who could be contacted for any sewer emergency.

Existing Facilities Protection

Page two

5. In order to protect City's Bench Monuments (standard and sub-standard), all bench monument locations within the limits of the project must be listed on the plan sheets. If not found or damage to the bench monuments is made or encountered, please contact the sewer unit of the DWM immediately at (312) 744-3351. Design plans must be submitted to and approved by the DWM for the replacement or relocation of any standard or sub-standard (i.e., secondary) benchmark.

6. In the relocation or construction of private or public utilities, including pipe underdrains and/or subdrains, the utility must be located as far away as possible from the City sewer and appurtenant sewer structures. The minimum desired horizontal clearance from all sewer structures is (4) feet. Clearance requirements from sewers is as follows:

Clearance from utilities other than water:

A minimum distance of the inner diameter of sewer (I.D.) plus four (4) feet must be maintained between the sewer and the utility center lines. If the outside diameter/width of utility conduit is more than the sewer O.D., a minimum of four (4) feet horizontal clearance must be obtained from the outside face to outside face. The minimum desired vertical clearance from crossing is (18) inches. If either horizontal or vertical requirements are not met, the sewer must be rehabilitated with an appropriate liner or replaced with DIP, unless prior approval is allowed by the DWM to evaluate the sewer (via televising) before and after construction.

Clearance from water:

IEPA separation requirements must be met. A minimum of ten (10) feet horizontal clearance (edge-to-edge) or eighteen (18) inches vertical clearance is required between sewer and water-mains. If the latter is met, a minimum horizontal clearance of the outer diameter of sewer (O.D.) plus (4) feet must be maintained. Sewer crossings below a water-main must have minimum vertical clearances of (6) inches. The existing sewer must be rehabilitated with a water-main quality liner or replaced with DIP for encroachments within the aforementioned limits for a distance of (10) feet from the edges of the water-main. When a sewer crosses above a water-main, no encroachments within (18) inches are allowed and the sewer must always be of water-main quality material for a distance of (10) feet from the edges of the water-main.

Existing Facilities Protection

Page three

7. Manholes, catch basins and inlets must be protected from the entry of asphalt/debris into the sewer system during construction. The contractor must mark locations of all sewer structures on the sidewalk before starting pavement removal/replacement. Adjustment of frames and lids of sewer structures must be completed prior to street resurfacing.
8. No permanent structures are permitted over the existing sewers and sewer structures located within the public right-of-way or easement without prior approval of the DWM.
9. The DWM discourages tree plantings that are located within the outer diameter of the sewer plus 4 feet (OD+4), but if necessary, may allow tree plantings with a maximum mature height of 15 feet and a maximum mature root depth of 2.5 feet. Potential plantings that meet this requirement include the following:
 - Ornamental shrubs or bushes meeting the mature height and mature root depth discussed above.
 - Flowers or other non-wood herbaceous plants.
 - Above ground, removable planting containers that can be moved by construction equipment in the event that sewer main repair is required.

Existing trees planted above sewer mains that do not meet these requirements do not need to be removed. However, if such existing trees are removed; all trees installed in their place must meet these requirements. The recommended minimum clearance between the outside of the sewer/structure and the center of a tree is fifteen (15) to twenty (20) feet depending on the size of the sewer.

10. For the following cases, the contractor is required to conduct a pre-construction videotaped inspection prior to the issuance of a sewer permit and a post-construction videotaped inspection prior to acceptance of the sewer. The videotape must be submitted to the sewer unit of the DWM for review and approval. Should pre-construction televising indicate conditional issues with the sewer, it shall be replaced or rehabilitated prior to construction as part of the project improvement.

- Street Construction/Reconstruction Projects
- Viaduct Clearance Improvements
- Piling/Caisson Installations

Existing Facilities Protection

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The utility company/government agency or its representing contractor must maintain access to the existing sewer facilities including sewer structures at all times and coordinate the proposed improvements with the sewer unit of the DWM Engineer/Inspector to avoid any interruption of the sewer facilities maintenance or services. The sewer flow has to be maintained at all times.

12. For street reconstruction and new sewer main installations, all non-concrete catch basins and gutter boxes are to be replaced, irrespective of their condition, with new DWM standard catch basins or inlets. The only exceptions are concrete or lined catch basins that are in good condition.

For fire station and bus terminal driveway/pad reconstruction, all non-concrete structures located within in the right-of-way are to be replaced or lined, irrespective of their condition, in accordance with DWM standard structures and materials.

For other street restoration projects, the utility company/government agency or its representing contractor must coordinate with the sewer unit of the DWM to arrange for the inspection of the existing catch basins. The sewer unit of the DWM will determine the need for catch basin repair, replacement or cleaning.

13. Existing sewers to be abandoned must be removed or filled with grout and so noted on the plans. Sewers 24" in diameter and larger must be filled with grout (smaller sewers are closed with a plug, while 24" diameter and larger are closed with a bulkhead.) Within the Central Business District, all abandoned sewers must be injected with flowable fill. Flowable fill must be used instead of grout, in other locations whenever possible.

14. The following requirements must be followed in the design of new sewers and sewer structures in the ROW:

- Materials used for sewer construction must be either reinforced concrete (Type III or better), or vitrified clay pipe, or ductile iron pipe (wrapped in polyethylene wrap).
- Catch basins located within intersections must be relocated about ten (10) feet from the property line for partial street restoration or twenty five (25) feet from the property line for full street restoration to prevent conflicts with pedestrian walkways and handicapped ramps. Relocations are not permitted if it results in increasing the number of existing catch basins.

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- Normally 3 pairs of catch basins are used for 600 - foot blocks and 1 to 2 pairs are used for 300 - foot blocks. Any increase in the number of existing catch basins on a block must be justified, via a grading plan.
- Wherever hydraulically beneficial, any dead-end sewers in streets crossing a proposed sewer route will be extended with an overflow connection made to the new sewer subject to approval by the sewer unit of the DWM
- In viaduct areas or streets with:
 - 1) Less than or equal to three (3) feet of cover, replace all sewers three (3) feet in diameter or smaller with class 52 ductile iron pipe.
 - 2) Less than or equal to five (5) feet of cover, replace all sewers five (5) feet in diameter or smaller with class 52 ductile iron pipe or RCP, Class V, and
 - 3) More than five (5) feet of cover, videotape all sewers larger than five (5) feet in diameter for lining or other rehabilitation.

15 The DWM's Rain Blocker Program must be maintained with any roadway improvement. The design of any roadway improvement must consider limiting the number of catch basins to the extent practical. The number of existing structures should not be increased.

- Flow restrictors must be installed in all catch basins outside of the Central Business District. Restrictors shall not be installed in catch basins in close proximity to viaduct areas, bus stops, or emergency entrances. The DWM must approve the non-installation or removal of any restrictor. Requirements for restrictor installation are as follows:
 - Arterial Streets/Bus Routes: 3-inch orifice restrictor
 - Residential Streets: 3-inch vortex restrictor
 - Alleys: 3-inch orifice restrictor in the last CB.
 - Closed lids are required on all manholes except at intersections where a perforated lid shall be used.

16. The minutes of the pre-construction meeting must state that a list of the DWM's, "Requirements for Existing Facilities of Protection" was provided to the resident engineer and the contractor for compliance.

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17. The project plans and/or specifications must include the following notes:

Prior to start of construction, a permit is required from the sewer unit of the DOB for any underground sewer work including adjustment of sewer structures and removal/replacement of frames and lids. Permit must be obtained by drain-layer currently licensed from the sewer unit of the DOB.

The contractor is responsible for the adequate protection of the existing sewers, drain connections, sewer structures, and bench monuments during construction operations and use of heavy equipment in the limits of the project.

The contractor must locate and promptly and properly connect to the new sewers all live house drains, catch basin drains and other existing laterals, drains and sewers, of whatever nature, which are connected to the existing sewers being repaired or replaced.

Existing catch basin laterals to be reused must be rodded and flushed in the presence of the sewer unit of the DWM Inspector. A new connection to the main sewer is required if the existing catch basin lateral is not approved by the sewer inspector.

When a sewer structure is abandoned, all pipe openings must be plugged, structures filled with trench back-fill, lids and frames removed and surface restored as per the sewer unit of the DWM standards and specifications.

The contractor is required to replace any broken frames and lids of sewer structures with standard frames and lids of the DWM. In adjustment or reconstruction of sewer structures, any non-standard frames and lids must be replaced with standard frames and lids. In adjustment or reconstruction of inlets, any non-standard inlets (gutter boxes) must be replaced with DWM standard inlets.

City manholes have solid lids except at street intersections where perforated lids are used. Perforated catch basins/manholes grates with ½-inch wide slots is the current citywide standard. However, in viaduct areas, the “old” standard grates with the larger 1-1/2” wide slots must be used.

The frames and lids of sewer structures to be abandoned, removed, or filled must be salvaged and delivered to Water Management located at 3901 S. Ashland Avenue. Delivery must take place between 10:00 am and 2:00 pm Monday through Friday. Call (312) 747-1777 to arrange for delivery.

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In locations where the main sewer is not being replaced and the existing drainage facilities are disturbed or damaged during construction by the contractor, it will be the contractor's responsibility to restore and replace the damaged facilities at his/her expense to the satisfaction of the DWM.

In case of any damage to the City's sewer system, private and public drain connections, and/or bench monuments, the contractor must contact the sewer unit of the DOB immediately at phone number (312) 744-3351. The contractor must, at his/her cost, replace the affected sewers, drain connections, sewer structures and/or bench monuments as necessary. The sewer flows must be maintained at all times.

Flow restrictors must be installed in all catch basins, outside of the Central Business District. Flow restrictors must not be installed in close proximity to viaduct areas, bus stops or emergency entrances. Flow restrictors are available for pick-up at the DWM's Central District, located at 3901 S. Ashland Avenue, by calling (312) 747-1777, between 7:00 am-3:00 pm, 48 hours in advance.

Upon project completion of roadway resurfacing or reconstruction, resident engineers must contact the DWM Sewer Evaluation Section at 312-747-4680 to schedule a field meeting for project acceptance (ie. address punch list items).

Upon project completion, the contractor must provide the sewer unit of the DWM, for review and acceptance, any required DVD of the sewer mains.

As-built plans of new or replaced sewers in the public right-of-way must be submitted to the DWM Sewer Design Section within 30 days after completion of the project and will be included as a punch list item prior to acceptance of the project.

The as-built plans must be sealed by a Professional Engineer or Registered Land Surveyor and be submitted with the form in Appendix II-A Sheet A.23. Plan and profile drawings of the sewers and sewer structures must be submitted on a compact disk in .TIF format. All electronic files must be submitted in a file folder with one file name reflecting the addresses of the project, with street name first: (e.g. Jackson St. 300-500 S.) A hard copy of the as-built plans must also be submitted.

Note: Refer to sewer unit of the DWM "Detail Specifications for Sewer Construction, Book 3" for complete requirements on sewer construction in the public way by private contractors.

APPENDIX II-F

Approved Vendor List for Custom Vortex Restrictors

City of Chicago Approved Vendor List for Custom Vortex Restrictors

	Vendor	Website Address	Contact Name	Contact Email	Phone Number	Model Type
1	Contech Engineered Solutions	conteches.com	A.J. Margetis Bob Schwartz	amargetis@conteches.com ; bschwartz@conteches.com	(773) 661-9794 (847) 778-9168	Fluidic-Amp with Sleeve
2	Hydro International	hydro-int.com	Phillip Taylor	ptaylor@hydro-int.com	(608) 205-4441	Reg-U-Flo S-Type with Push-fit mount and Reg-U-Flo VM-Type

Notes:

- 1 Vendor, size, and model number vortex restrictor must be labeled on the Utility Plan and Operation & Maintenance Plan
- 2 Vendor detail of vortex restrictor must be added to a detail sheet in civil plan set
- 3 Provide rating curve of restrictor with calculations
- 4 Any vendor of vortex restrictors is welcome to submit specs for review. Upon approval of product, vendor will be added to approved list for the following year

APPENDIX III-A

Outlet Capacity Maps

APPENDIX III-B CITY OF CHICAGO RAINFALL INTENSITIES

**City of Chicago
Department of Water Management**

Name of Project: _____
 Address: _____
 A/E of Record: _____

(FOR COMPUTATIONS AND REFERENCE)

City of Chicago Intensity-Duration-Frequency (IDF) Curve
 (Based on Bulletin 70 Rainfall Data)

Storm Duration (min)	Storm Event in Years									
	5-Year		10-Year		25-Year		50-Year		100-Year	
	Rainfall (in)	Average Intensity (in/hr)	Rainfall (in)	Average Intensity (in/hr)	Rainfall (in)	Average Intensity (in/hr)	Rainfall (in)	Average Intensity (in/hr)	Rainfall (in)	Average Intensity (in/hr)
5	0.46	5.520	0.54	6.480	0.66	7.920	0.78	9.360	0.91	10.920
10	0.84	5.040	0.98	5.880	1.21	7.260	1.42	8.520	1.67	10.020
15	1.03	4.120	1.21	4.840	1.49	5.960	1.75	7.000	2.05	8.200
30	1.41	2.820	1.65	3.300	2.04	4.080	2.39	4.780	2.80	5.600
60	1.79	1.790	2.10	2.100	2.59	2.590	3.04	3.040	3.56	3.560
120	2.24	1.120	2.64	1.320	3.25	1.625	3.82	1.910	4.47	2.235
180	2.43	0.810	2.86	0.953	3.53	1.177	4.14	1.380	4.85	1.617
360	2.85	0.475	3.35	0.558	4.13	0.688	4.85	0.808	5.68	0.947
720	3.31	0.276	3.89	0.324	4.79	0.399	5.62	0.468	6.59	0.549
1080	3.50	0.194	4.11	0.228	5.06	0.281	5.95	0.331	6.97	0.387
1440	3.80	0.158	4.47	0.186	5.51	0.230	6.46	0.269	7.58	0.316
2880	4.09	0.085	4.81	0.100	5.88	0.123	6.84	0.143	8.16	0.170
4320	4.44	0.062	5.18	0.072	6.32	0.088	7.41	0.103	8.78	0.122
7200	4.91	0.041	5.70	0.048	6.93	0.058	8.04	0.067	9.96	0.083
14400	6.04	0.025	6.89	0.029	8.18	0.034	9.38	0.039	11.14	0.046

