



INFRASTRUCTURE & DEVELOPMENT DESIGN MANUAL

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Copies of this manual are available for purchase from the Department of Neighborhood Services - Engineering Division. This manual is also available for free on-line through our City Web site at <http://www.ci.greenfield.wi.us/> under the Department of Neighborhood Services - Engineering Division.

Administrative Procedures

Introduction

This Infrastructure and Development Design Manual has been created to assist with public and private infrastructure engineering design and installation requirements for the City of Greenfield. The standards provided in this Manual will promote consistent practices by ensuring that all improvements in the City are designed, reviewed, constructed and managed in accordance with clearly established practices and procedures. This Manual is intended to supplement the Greenfield Municipal Code and is not intended to replace it.

For specific questions that are not detailed in this document, or if you find discrepancies between this Manual and other established Codes or requirements, please contact the Department of Neighborhood Services - Engineering Division (414-329-5325). The City reserves the right to alter or add requirements during the review process. The City reserves the right to deny the review of plans and specifications that have not been prepared and submitted in accordance with these guidelines.

The City promotes environmentally sensitive land development designs whenever practical provided they are in compliance with all Federal, State, County and Local requirements.

Non-City Agency Review

Engineering designs, plans, specifications and related materials are subject to review and approval by other public agencies, including but not limited to U.S. Army Corps of Engineers, Wisconsin Department of Natural Resources, Wisconsin Department of Transportation, Southeastern Wisconsin Regional Planning Commission, Milwaukee County, Milwaukee Metropolitan Sewerage District and Milwaukee Water Works. Engineering designs, plans, specifications and related materials must conform to the legal requirements of all public agencies that may have review jurisdiction. The City has no influence over non-City agency approvals.

Additional References

In addition to this design manual, the City routinely utilizes established codes and other City manuals, standards, plans and documents as part of our engineering design and construction review practices. Common third party Technical Specifications, reference materials and Legislative Regulations are also utilized by the City. Links to both City and Non-City references are available on the City WEB site at <http://www.ci.greenfield.wi.us>. Once on the City WEB site, navigate to City Departments - Neighborhood Services - Engineering and then select the **Design Standards** link. Common reference materials include, but are not limited to the following and are subject to change:

CITY

- City of Greenfield Site Development Standards (non-residential)
- City of Greenfield Street Restoration Standards
- City of Greenfield Street Lighting Standards
- City of Greenfield Tree Protection and Preservation Policy Manual
- Greenfield Comprehensive Outdoor Recreation Plan (CORP)
- City of Greenfield Comprehensive Land Use Plan
- City of Greenfield Municipal Code
- Bicycle and Pedestrian Plan - (Under development - est. 6 months)
- Typical Details, Sample Plans, Drawings and Documents

NON-CITY

- Standard Specification for Sewer and Water Construction in Wisconsin (Standard Specifications)
- American Society for Testing and Materials (ASTM)
- Manual on Uniform Traffic Control Devices (MUTCD)
- Milwaukee Metropolitan Sewerage District (MMSD)
- Milwaukee Water Works (MWW)
- Wisconsin Department of Natural Resources (WI DNR)
- Wisconsin Department of Transportation Facilities Development Manual (WI DOT FDM)
- U.S. Army Corps of Engineers (USACE)
- American Concrete Pipe Association (ACPA)
- Americans with Disabilities Act (ADA)
- Wisconsin State Statutes & Administrative Codes
- National Association of Sewer Service Companies (NASSCO)

Definitions

Sidewalk	A 5 ft. wide x 5 in. thick concrete pavement located parallel to a curb or roadway pavement edge intended for pedestrian use. When practical, sidewalks are located within a 1 ft. setback from the public right-of-way.
Sidepath	A pavement, 6-8 ft. in width and at least 4 in. thick not located parallel to a street or curb intended for mixed bicycle or pedestrian use. A sidepath is usually made of asphalt and located within public right-of-way.
Multi-Use Path	A pavement, 6-8 ft. in width and at least 4 in. thick not located parallel to a street or curb intended for mixed bicycle or pedestrian use. A multi-use path is usually made of asphalt and located outside of public right-of-way.
Service Walk	A 4 ft. wide x 4 in. thick pavement intended to provide a walking path between a structure's door and a public street or private parking lot area.
Private Improvement	Any improvement that is installed privately and remains under private ownership and maintenance.
Public Improvement	Any improvement that is installed in public property, in public right-of-way or in an approved public easement where said improvement is, or will become City property and responsibility to maintain.
Approval of Public Improvement	A type of approval granted by the City once substantial completion of a given improvement has occurred to allow for the use of said improvement prior to formal City "acceptance" of said improvement.
Acceptance of Public Improvement	The process where a previously "approved" public improvement is officially granted and dedicated to the City thereby effectuating the transfer of title and responsibility of said facility to City.

Approvals and Procedures

Formal Application Requirements

Development in the City of Greenfield may require various City approvals including, but not limited to Planning Commission, Board of Public Works, Park and Recreation Board, Tree Commission and the Common Council. To begin a formal City review and approval process, an application shall be made to the City (typically the Planning Commission). Approvals are made by policy makers (conceptual) and administrative staff (technical). "City Approval" is not obtained until both conceptual and technical requirements are met.

Under certain circumstances, "City Approval" may be granted in conjunction with the issuance of a building permit. In these cases, any terms or conditions associated with the City Approval will be included with the building permit.

Before making a formal application to the City, the developer and its agents should consult with the City as part of a pre-submittal review of City requirements, to review the scope of the proposed project and to discuss any project concerns. This consultation shall be initiated by the developer or its agents. Please contact Chuck Erickson, Community Development Manager by phone at (414) 329-5342 or via e-mail at [click here](#) to set up a pre-submittal meeting or to inquire as to what City approvals are needed for a given project. A follow up pre-submittal meeting may be required if the first meeting did not address the necessary issues.

Please note that in addition to City staff, the City utilizes consulting engineers as part of our pre-submittal meetings and as part of our plan review procedures and construction inspection efforts. In accordance with Ordinances 2524 and 2525, the City passes engineering staff and consulting engineering labor charges back to the applicant or the designated party listed on the application. Charges and fees will be discussed more in depth below where applicable.

It shall be the responsibility of an applicant desiring to be placed on a Plan Commission, or other meeting agenda to notify the Mayor and Alderman of the District with respect to the proposed development or project prior to submitting a formal application.

The City reserves the right to deny entry on a given Board or Commission agenda, or to outright deny plan review if the required materials have not been properly prepared and submitted with a formal application request, including payment of applicable fees and/or cash deposits.

When applicable, City of Greenfield Site Development Standards (non-residential) shall also be referenced during development design.

In addition to providing the required materials for a given Board or Commission, all formal applications shall include the following materials, when applicable:

Civil Plan set including:

- Cover sheet (cover sheet to include sheet index and legend)
- Existing plat of survey showing current topography and boundary data
- Certified Survey Map / Preliminary Subdivision Plat / Final Subdivision Plat
- Development Site Plan
- Utility Site Plan
- Erosion Control Plan
- Grading Plan
- Plan and Profile Sheets
 - Sanitary Sewer
 - Water Main
 - Storm Sewer (may be combined with paving plan)
 - Paving Plan (may be combined with storm sewer)
- Storm Water Management Plan
- Lighting Plan
- Traffic Control Plan (construction or otherwise)
- Provide calculations for existing and proposed green space, impervious areas, etc. (see Appendix A)

Any additional supporting documents pertinent to development review shall also be provided. This may include items such as landscaping, environmental based materials, traffic counts or studies, material specifications, property ownership and title verification materials, etc.

When easements are required and are not included on a proposed subdivision plat or Certified Survey Map, a legal description and 8.5" x 11" map exhibit of the easement is required. The City will take these items and will prepare a draft easement document using standard City easement format and language. In the case of easements for public water main, the City of Milwaukee Water Works will prepare the required easements.

During the plan review process, the City will utilize an Engineering Plan Review Form in addition to providing specific detailed, written review comments. The purpose of the Engineering Plan Review Form is to quickly summarize the current review and approval status for items that are applicable to the development. The Engineering Plan Review Form is attached hereto as Appendix B.

Cash Deposit for Plan Review

A cash deposit to cover anticipated consulting engineering plan review fees is required at the time of formal application. Said cash deposit will be placed in a City escrow account specific to each development and will be drawn upon as consultant charges and other review fees are incurred by the City. The value of the deposit will be based on the scope of the development and will be provided to you at the time of pre-submittal meeting review. Any charges incurred by the City that are over the deposited amount will be invoiced directly, or addressed as part of a Developer's Agreement if applicable. Any excess funds will be returned to party that provided the initial deposit. A three tiered cost structure is used for determining the deposit value:

- Small - No deposit is required. The City will invoice applicant directly. A small development is one that requires City approval to proceed, but has minimal to no site or underground utility work. Minor City review is anticipated as part of the approval process.
- Medium - A \$5,000 deposit is required. A medium development is one that requires City approval and consists of minor to major development work including, but not limited to underground utility work, site work and storm water management. Medium developments typically do not include public utility installation, yet require follow up certification for storm water management facilities. In the event that a Developer's Agreement is required, construction inspection and other costs are typically identified as part of a formal Developer's Agreement.
- Large - A \$10,000 deposit is required. A large development typically consists of major development work such as subdivision, condominiums or large commercial development. Large developments often include public street and utility installation, extensive site work and storm water management. Large developments typically extend beyond plan review and eventually lead to on-site City inspection during construction. In the event that a Developer's Agreement is required, construction inspection and other costs are typically identified as part of a formal Developer's Agreement.

Prior to escrow account depletion and/or in conjunction with a City invoice for charges above and beyond the initial cash deposit, the City will provide written documentation supporting our request for additional funds. The City will endeavor to provide advance notification; however there are instances where advance notice may not be possible.

For phased developments where staged plan review is needed, additional funds may be required as part of subsequent plan review efforts.

It should be noted that the quality of the plans and related materials provided to the City are directly relatable to plan review costs. Incomplete plans and poor overall design will likely require multiple reviews adding to overall plan review costs.

Required Security

In conjunction with development plan approval or as part of an executed Developer's Agreement, the City may require "security" for the installation or modification of public improvements, storm water management components (including grading) and landscaping improvements. Should the developer fail to install the required improvements, or comply with the terms and conditions outlined in an executed Developer's Agreement, the City will utilize this security to bring the development into compliance. Acceptable forms of security include cash or letter of credit.

When security is required for a development, the City will request that the developer provide us with contract installation costs. This request will typically occur once the plan review and approval process is nearing completion when major design changes are no longer anticipated. The developer shall provide this information to the City and shall work with the City in the event that any cost clarification is needed. The City will use the costs provided by the developer to identify the amount and the duration needed for the required security.

When security is required, the following requirements shall apply:

- The initial security shall be for 100% of the contract installation cost (excludes landscaping). The City will provide the required security duration period based on the scope of the project and anticipated completion time line.
- The security must remain valid during construction of the respective improvements and through the required guarantee periods for said improvements.
- In cases where security is required for storm water management, said security must remain valid until such time that the site has been stabilized and the necessary storm water basin and/or grading certification processes have been approved by the City.
- The security can only be reduced or released with the permission of the City. The City will work with the developer to reduce security value as improvements are installed, approved and paid for.
- The security shall not be reduced below 10% of the original value until the required guarantee period has expired and/or City acceptance has occurred. Since guarantee periods and acceptance dates may vary within a development, development components (sanitary, storm, water, pavement, etc.) may be used to determine individual 10% thresholds rather than using one overall value.
- If the initial security has an expiration date and the City requests security renewal or extension, said security must be renewed at least one month prior to the security expiration date on the initial security. Prior to the expiration date, the City reserves the right to draw on the security to assure the continuation of suitable security.
- The security held by the City shall not be used to pay developer contractors or other developer obligations.
- For landscaping security, the developer will provide security for 125% of the estimated construction cost. Upon acceptance of landscaping installation, the City will retain 30% of the landscaping security for the two-year guarantee period.
- In the event that a refund, or return of security is warranted, and provided that all conditions have been met, the City will take all action necessary to promptly refund and/or return said security.

Developer's Agreement

For developments that require the installation of public improvements or for a Planned Unit Development (PUD), the execution of a Developer's Agreement with the City shall be required. The installation of minor public improvements such as street trees and public sidewalk may not require a Developer's Agreement as there are other processes in place to address the installation of these items.

Generally speaking, the purpose of the Developer's Agreement is to:

- Summarize the current plan review and approval process
- Identify land division issues
- Identify phasing or staging elements associated with a given project
- Identify the required improvements and their respective scope of work
- Clarify environmental and any other unique situations (associations, deed restrictions, model home construction, etc.) pertinent to the development
- Identify the responsibilities of the affected parties, to clarify construction activity expectations
- Identify various costs and required securities associated with the scope of work contained in the agreement
- Clarify requirements for the issuance of a building permit
- Provide legal protection for the parties involved
- Clarify requirements for the approval and acceptance of public improvements

Once a development's plan review status has reached an appropriate level, the City will prepare and forward a draft Developer's Agreement to the developer for review, revisions and comments. An executed Developer's Agreement, complete with the required materials identified in the agreement, must be provided to the City prior to commencement of construction activity. Upon successful execution of a Developer's Agreement, City shall record a one page "Notice of Developer Agreement" at the Milwaukee County Register of Deeds Office providing official notice of said agreement. The City will not execute the Developer's Agreement until we have received all required materials.

In conjunction with the execution of a Developer's Agreement, the City requires a "guarantee" period for public improvements installed by the developer. During the guarantee period, the developer shall remedy or cause to be remedied any defects in materials or workmanship which shall appear in the respective improvements. The City requires

a one-year guarantee period for all public improvements with the exception of water main and landscaping, which shall both be a two-year guarantee period. All guarantee periods start from the date of City acceptance.

In conjunction with an executed Developer's Agreement, the City shall require "security" for the installation or modification of public improvements, storm water management components (including grading) and landscaping improvements. The requirements for said security have been previously detailed under "Required Security".

In addition to the initial cash deposit provided by the developer to cover plan review charges, the executed Developer's Agreement may detail additional cash deposits and/or cash payments required for development installation. Developer's Agreement charges typically cover expenses above and beyond the initial City plan review effort. These may include, but are not limited to:

- City legal expenses
- City street sign installation
- City inspection of:
 - Erosion control
 - Grading
 - Sanitary sewer
 - Water main (per MWW)
 - Storm sewer
 - Storm water management facilities
 - Street pavement
 - Sidewalk, sidepaths, multi-use paths, etc.
 - Right-of-way restoration
- City Forester inspection
- Park fund requirements
- Deposit for future curb and gutter, storm sewer, sidewalk and street trees
- Required connection charges

Construction Activity

The City requires that a pre-construction meeting be held prior to the installation of public improvements in order to coordinate the anticipated construction with all parties involved, especially public utilities. A pre-construction meeting for the installation of private improvements is typically not required unless they are being installed as part of a development where both public and private improvements are necessary. The City will inform the developer if a pre-construction meeting is required.

In conjunction with a developer's request, the City will schedule the pre-construction meeting and will mail a pre-construction meeting notice to all parties involved using our standard contact list and a list, provided by the developer, of its agents and contractors. The City will provide a two week notification period for the pre-construction meeting from the time of mailing.

Upon substantial completion of the required public improvements, but prior to completion of all punch list items, the City may elect to grant conditional approval of said public improvements to allow additional construction to take place prior to final City acceptance (i.e. house construction in a subdivision once utility and street base are installed, but prior to final surface paving).

All required public improvements shall be and remain the property of the developer until final acceptance by the City. After conditional approval has been granted and upon completion of the required public improvements, the developer shall request in writing the final acceptance of said public improvements. Final acceptance of public improvements can take place in stages as construction allows. The City shall, within 90 days, provide the developer with either a certificate of acceptance or a notice containing specific requirements that the City requires prior to the issuance of a certificate of acceptance. The City may grant "conditional" acceptance of a public improvement (i.e. pavement that has not had the final surface installed).

Nearing the completion of construction activity, the City will utilize a Construction Activity Review Form along with providing specific detailed written punch list comments. The purpose of the Construction Activity Review Form is to track construction certification issues that are applicable to the development. The Construction Activity Review Form is attached hereto as Appendix C.

It should be noted that a contractor's ability to deliver properly built items in a reasonable amount of time will be directly related to overall inspection costs. Longer construction times and poor workmanship will require additional contractor work and City inspection efforts and is likely add to overall construction inspection costs.

Design Standards and Material Specifications

Surveying Standards

All surveys shall conform to the provisions of Chapter 236 of the Wisconsin Statutes and the Greenfield Municipal Code.

Horizontal datum shall be based on Wisconsin State Plane Coordinate System, South Zone, North American Datum of 1927 (NAD27).

Vertical datum shall be based on the National Geodetic Vertical Datum of 1929 (NGVD 29), subtracting 580.603 to arrive at the City of Milwaukee / City of Greenfield datum.

All horizontal and vertical control shall be maintained throughout the entire project and shall be clearly marked and protected during construction.

The City of Greenfield uses sanitary sewer manhole invert data as our permanent bench mark system. Temporary benchmarks can be used provided they are established from sanitary sewer manhole invert data. City will provide as-built sanitary sewer data upon request.

Site topography for engineering design, plans, specifications and related materials shall be based on actual field surveys. Site topography derived from aerial photography or planametrics is not allowed.

Prior to commencing with construction activity that might alter or damage the current placement of any U.S. Public Land Survey Section (PLSS) survey monument, the Milwaukee County Surveyor must be notified so they can take the necessary measures to protect and/or retain the current monument location. The Southeast Wisconsin Regional Planning Commission (SEWRPC) is currently acting as the Milwaukee County Surveyor.

Environmental Standards

Environmental, wetland and floodplain considerations shall be in conformance with all applicable Federal, State and County requirements as well as applicable sections of the Greenfield Municipal Code.

The City has adopted a Tree Protection and Preservation Policy Manual. The purpose of the manual is to facilitate the preservation and/or replacement of trees as part of any land development and/or building construction processes in the City. The City Forester is the point of contact for questions regarding the Tree Protection and Preservation Policy Manual.

Erosion Control Standards

Erosion control practices shall conform to Chapter 31 of the City of Greenfield Municipal Code and the Wisconsin Department of Natural Resources requirements of Chapter 283 of the Wisconsin Statutes, Chapters NR151 and NR216 of the Wisconsin Administrative Code and the Technical Standards for Construction Site Erosion and Sediment Control.

An erosion control plan is required and shall be overlaid on the site grading plan as a separate plan sheet.

A soil erosion permit is required by the City and must be issued by the Department of Neighborhood Services - Engineering Division prior to the commencement of any grading, underground utility work or construction activity.

A weekly inspection of erosion control practices is required. In addition, an inspection shall be conducted after rainfall events of 1/2 inch or more. Written reports of all erosion control inspections must be prepared and maintained throughout the project and shall be provided to the City or WI DNR upon request.

Failure to maintain the erosion control devices, practices, inspections, etc. may result in City revocation of the erosion control permit, and/or initiating legal or equitable action as may be necessary to ensure that all provisions of the soil erosion control permit are met. If said soil erosion control permit is revoked, a new application for an erosion control permit is required.

Any spilled, dropped, washed, or tracked materials caused by development construction activity shall be removed from public right-of-way and/or on existing street pavements before the end of each work day or when directed to do so by the City.

Grading Standards

A master site grading plan shall be prepared and shall demarcate the limits of grading. Said plan shall be stamped, and signed by a qualified professional engineer registered in the State of Wisconsin. Under certain circumstances, the City will allow minor grading plans to be prepared, stamped and signed by a qualified land surveyor registered in the State of Wisconsin. Said master site grading plan shall be designed as a final site grading plan. If needed, an interim site grading plan can be used. If an interim site grading plan is utilized, both an interim and a final site grading plan are required.

All grading plans shall be designed to accommodate off-site drainage. Sufficient off-site topography and related materials shall be provided to allow for a proper determination of tributary drainage areas and related storm water flows.

Typical design distance between top of foundation elevation of a structure and the outside finished grade is 8".

Individual site drainage design shall promote the use of rear and side yard swales for overland gravity flow when ever possible, particularly for residential applications. Rear and side yard swales shall be centered on property lines whenever possible.

A 2% yard grade is desired with 1% being the minimum allowed.

Rear and side yard swales and roadside ditches shall have a minimum grade of 1% and a maximum grade of 5%. Ditches and swales should be designed for a maximum 3:1 side slope. A side slope of 4:1 is preferred.

Driveways shall have a minimum slope of 2% and a maximum slope of 8%. City approval is necessary for all other driveway slopes.

Ditches and swales with a slope between 1% and 3% can utilize topsoil and seed restoration. Stabilized erosion matting may also be required under certain circumstances. Restoration of slopes greater than 3% require sod or stabilized erosion matting. Excessive slopes beyond 5% may require piping.

Crossroad culverts shall be designed to provide a minimum of 12" of cover.

Berms shall be constructed in a way not to impede or restrict desirable overland storm water drainage, nor obstruct traffic and pedestrian vision at intersections, road crossings, etc. Berm side slopes and design shall be reviewed on a case by case basis.

The use of retaining walls is allowed to address specific design concerns or for aesthetic purposes. For walls that are near sidewalks, trails, parking lots, roadways, etc. and if vehicles, bicycles, pedestrians or children are likely to be present, a protective railing may be required for walls with greater than a 1 foot drop from top of wall to the grade at the bottom of wall. Walls that are located farther from human or vehicular activity may be higher before a protective railing is considered necessary. Please contact the City for specific protective railing requirements for your given development. Walls will be considered "structural" in nature when the height meets or exceeds 4 feet. Signed and sealed shop drawings for proposed "structural" walls shall be provided to the City. Retaining wall design shall include the use of drain tile or bleeders whenever possible.

The City does not set tolerances for rough grading. Rough grading operations shall maintain the overall intent of the grading plan until such time that finished grading or individual site grading brings the site into compliance with the approved final grading plan. The City reserves the right to require an as-built grading plan at completion of rough grading operations prior to issuing building based permits. Typically, residential developments (subdivisions and condominiums) are required to provide this as-built grading plan for City certification.

Topsoil and "cut" earthen material can be stockpiled on site provided they will be used to balance the site at the completion of grading activities and/or building construction. Any excess material not needed to balance the site shall be promptly removed from the site.

All areas of "cut" shall have the top 6" of material compacted prior to the placement of topsoil.

All material classified as unsuitable for paved street or parking lot construction must be removed from the affected area. For paved areas in public right-of-way, the City will decide all questions that arise regarding suitability of material.

All areas of "fill" shall be compacted in layers not to exceed 12" of material. Placement of structural fill may require compaction testing during the filling operation. Fill placement in public right-of-way must be approved by the City and will

require compaction testing or proof rolling prior to placement of subsequent improvements in or upon the right-of-way. Areas failing compaction testing or proof rolling must be reworked and retested.

The City requires that an inspector be present during filling, compaction or proof rolling activities in current or proposed public right-of-way.

During construction, areas of soil and/or vegetation beyond the limits of grading as defined on the master site grading plan are to remain undisturbed and shall not be used or damaged by construction equipment or materials storage.

Finished topsoil depth on all non-paved areas shall be a minimum of 4".

Grading requirements for storm water management purposes may be subject to additional requirements as detailed under the storm sewer and storm water management standards provided below.

Prior to the issuance of building permits for site, the City requires that critical, non-building related storm water and/or structural areas (top of slopes, bottom of slopes, ditches, swales, storm basins, etc.) be graded and stabilized in accordance with the approved plan. Once properly installed, these areas are not to be disturbed during building permit construction.

Sanitary Sewer Standards

All sanitary sewers shall be designed in accordance with rules and regulations of Chapter NR 110 of the Wisconsin Administrative Code, the Milwaukee Metropolitan Sewerage District Discharge Regulations & Enforcement Procedures and the City of Greenfield Municipal Code.

Any requested sanitary connection to a non-City sanitary sewer system shall require the approval of both the City and the entity in charge of that sanitary sewer facility receiving the connection.

All sanitary sewer plans, specifications and calculations shall be designed, prepared, stamped and signed by a qualified professional engineer registered in the State of Wisconsin.

Sanitary sewer design and construction practices shall be in conformance with the Standard Specifications for Sewer & Water Construction in Wisconsin, as last revised.

The City requires that an inspector be present for the installation of any public sanitary sewer facilities, including laterals.

General Sanitary Sewer Location Design

Public sanitary sewer shall be located in public right-of-way or dedicated easements for said purpose. Minimum easement width shall be 20 feet, unless easement is used in conjunction with right-of-way.

Public sanitary sewer shall be placed on the centerline of a street or easement to the greatest extent possible. If multiple utilities are located in the same easement, width shall be increased by the distance between the respective utilities. There shall be at least 10 feet in width from a given utility to the limits of the easement.

Sanitary sewer mains in curved streets shall not be more than 10 feet from the centerline.

Sanitary manholes shall be located at the centerline of a street or easement.

All sanitary sewers located inside the right-of-way, but less than 10 feet from the lot line, must provide a 10 foot easement adjacent to the right-of-way.

When located outside of street or parking lot pavement, all sanitary manholes shall allow for access by maintenance crews. Sanitary manhole placement will not be allowed on steep slopes, in marshy/wetland areas, in landscaped areas, in close proximity to structures and overhead encumbrances, etc.

A sanitary manhole must be installed at the end of each line and at all intersections of sanitary sewer main. Sanitary manholes are also required at changes in pipe grade, size or alignment. Sanitary manhole spacing shall not exceed 400 feet.

Minimum sanitary sewer size shall be 8" except for service laterals to lot lines or force main sewers.

Minimum depth for sanitary sewer shall be 8 feet from flow line to established street grade.

Minimum vertical separation shall be 18 inches between sanitary sewer and water main. Minimum horizontal separation shall be 8 feet between sanitary sewer and storm sewer or water main.

Sanitary laterals may not be connected to manholes without City permission.

Sanitary facilities shall be placed as to not interfere or impede the free discharge of overland storm water flows.

Storm water detention facilities may not be constructed over existing or proposed sanitary sewer facilities.

General Sanitary Sewer Flow Design

Sanitary sewer systems shall be designed to flow by gravity whenever possible.

Greenfield does not have any active public lift stations in operation at this time. In the event that future lift stations are requested, it is likely that the City will require that these lift stations be privately installed, owned and maintained.

All sanitary sewers must be sized adequately to accommodate future tributary areas.

Minimum velocity in all sewers shall be 2 feet per second except on short dead end sections where velocity shall be 2.3 feet per section.

Minimum slopes shall be as follows:

8"= 0.40%

10" = 0.28%

12" = 0.22%

15"=0.15%

18"=0.12%

21"=0.10%

24"=0.08%

The City will provide slopes for sewer main above 24" in diameter.

Peak Flow

Residential = 0.0097 cfs/acre to 0.040 cfs/acre

Commercial = 0.040 cfs/acre

Industrial = 0.040 cfs/acre

Design Capacity

Manning's Formula shall be used to determine the relation of slope, design flow, velocity, diameter and "n" value. The "n" value shall not be less than 0.013 for all sanitary sewer pipe materials. The depth of pipe flow for design conditions shall be 0.80 parts full. The following table provides minimum slopes and design flow capacities for various pipe diameters:

Sewer Diameter	Slope (ft/ft)	Design Flow (cfs)	Design Flow (MGD)
8	0.0040	0.74	0.48
10	0.0028	1.13	0.73
12	0.0022	1.64	1.06
15	0.0015	2.45	1.58
18	0.0012	3.56	2.30
21	0.0010	4.90	3.16
24	0.0008	6.25	4.04

Design Formula

$$Q=1.486/n^*A_{0.8}^*R^{(2/3)}^*S^{(1/2)}$$

Where Q = Design Flow (cfs)

n = Coefficient of Roughness

R = Hydraulic Radius (ft)

$$= (A_{0.8})/(WP_{0.8})$$

$A_{0.8}$ = cross-sectional area of pipe at 0.80 parts full (sq ft)

$WP_{0.8}$ = wetted perimeter at 0.80 parts full (ft)

S=Slope (ft/ft)

$A_{0.8}$ =Cross-sectional area of pipe at 0.80 parts full (sq ft)

CFS x 0.646 = MGD

Sanitary sewer calculations and service areas shall be submitted with the proposed plans.

Sanitary Sewer Manholes

New sanitary manholes shall be pre-cast or poured in place concrete. Minimum barrel diameter shall be 48 inches. Minimum access diameter shall be 26 inches. All cone sections shall be eccentric in design.

New sanitary manhole chimneys shall be pre-cast concrete rings. Minimum chimney height is 6 inches and maximum height is 14 inches.

All sanitary manholes shall utilize a Neenah R-1661 frame and grate with self sealing lid and concealed pick-holes, or equivalent.

Rim elevations should be set for final grade. For structures in paved areas, the City preference is for the rim elevation to be set 1/4 inch below binder surface grade. A cast iron adjustment ring or pre-cast concrete adjustment rings shall be utilized for adjustment prior to final asphalt surface paving.

For sanitary manhole structures outside of the roadway pavement, the rim elevation shall be set above 100 year floodplain and ditch flow line elevations when applicable. The use of bolt-down lids may be required.

The top step shall be placed 8" below the top of corbel (cone) section. The bottom step shall be placed 8" above the manhole bench. All steps shall align vertically in manhole and be equally spaced with a maximum vertical spacing of 16 inches. Step placement shall not be aligned above any pipe inlet or outlet.

New or reconstructed sanitary manholes will require the installation of an internal / external seal. If an internal seal exists, it is the property of the City of Greenfield and should be returned to our Department of Public Works yard. Internal /External seals shall be manufactured by Adaptor, Inc., West Allis, Wisconsin, or equal.

Backfill material around a sanitary manhole shall be mechanically compacted in 6" lifts. Flooding of excavated area for compaction is not allowed.

Outside drop sanitary manholes are required when there is a difference of 24 inches between pipe invert and the bench elevation.

Sanitary Sewer Mains

Sanitary sewer pipe shall be Polyvinyl Chloride (PVC) ASTM D-3034 SDR 35 or Reinforced Concrete Pipe (RCP) ASTM C-76 for standard installation depths. Polyvinyl Chloride (PVC) ASTM D-3034 SDR 26 shall be utilized where finished grade to flow line depths meet or exceed 15 feet.

Newly installed sanitary sewers that flow into an existing sanitary manhole shall be plugged and braced. Said plug shall remain in place until authorized by the City to remove.

If a new sanitary manhole is constructed over an existing sanitary sewer line, the pipe shall not be broken until the project is completed and the manhole vacuum testing has been successfully completed.

Bedding, pipe cover and backfilling shall be in conformance with the Standard Specifications for Sewer & Water Construction in Wisconsin, as last revised, or as determined acceptable by the City. Backfill material shall be mechanically compacted. Flooding of excavated trench for compaction purposes is not allowed. The use of frozen spoil materials for trench backfill is not allowed.

Sanitary Sewer Laterals

Sanitary laterals shall be Polyvinyl Chloride (PVC) ASTM D-3034 SDR 35. Please contact the City for approval on the use of other pipe material prior to sewer design.

All sanitary laterals shall be at least 6" in diameter and installed at a quarter inch per foot grade unless otherwise noted on the plans. Sanitary laterals shall be connected perpendicular to the sewer main at the time of installation by using a wye.

Vertical sanitary lateral risers shall be used where excessive drop occurs from the property line to the mainline sewer.

Sanitary laterals shall be installed from the sewer main to the property line and must be connected or capped.

A hardwood board marker, or equal, shall be placed at the end of each sanitary lateral when not connected to building service. Board shall be set vertically with a minimum of 12 inches of the board exposed above finished grade. The exposed section of board shall be painted blaze orange.

Sanitary Testing and Televising

All sanitary sewer manholes shall be tested for leakage by the vacuum testing method. If manhole fails test after two attempts, corrective action must be taken prior to additional testing.

All sanitary sewer mains shall be tested for leaks by using a low pressure air test. If sewer main fails test after two attempts, corrective action must be taken prior to additional testing.

Closed circuit television inspection of sanitary sewer mains is required upon completion of sewer installation. Said televising shall include a lineal footage counter display in the video imaging. Sanitary sewer mains must be cleaned and manhole benches poured prior to televising. Closed circuit television or video discs of the televising shall be submitted to the City for its review and record files. The contractor shall be required to repair all visible damage and leaks found during the City review of video tapes or video discs.

Storm Sewer and Storm Water Management Standards

All storm sewers and storm water management systems shall be designed in accordance with Chapter 30 of the Greenfield Municipal Code, Chapter 13 of MMSD Rules and Regulations and Chapter NR151 of the Wisconsin Administrative Code.

Any requested storm sewer connection or surface discharge to a non-City storm sewer system shall require the approval of both the City and the entity in charge of that storm sewer facility receiving the connection and/or surface discharge.

All storm sewer plans, specifications and calculations shall be designed, prepared, stamped and signed by a qualified professional engineer registered in the State of Wisconsin.

Storm sewer design and construction practices shall be in conformance with the Standard Specifications for Sewer & Water Construction in Wisconsin, as last revised.

The City requires that an inspector be assigned for the installation of any public storm sewer facilities, including laterals. The City may elect to verify proper installation of public storm facilities by televising facilities prior to acceptance.

If required, a Storm Water Management Plan (SWMP) shall be submitted with the initial plan review submittal. Storm water detention facilities may not be constructed over existing or proposed sanitary sewer facilities.

Developments shall be designed to provide overland gravity flow routes to major drainage ways. Drainage shall not be affected in the event of failure or exceeded capacity of the local storm sewer network. A minimum of 12 inches of freeboard is required to protect structures from flooding during the course of a 100-year storm event. Freeboard shall be measured from the 100-year high water level to the lowest available building opening.

General Storm Sewer Location Design

Storm sewer shall be located in public right-of-way or dedicated easements for said purpose. Minimum easement width shall be 20 feet, unless easement is used in conjunction with right-of-way.

Storm sewer shall be placed on the west or south side of the street centerline to the greatest extent possible. In easements, storm sewer shall be placed in the center of said easement. If multiple utilities are located in the same easement, the easement width shall be increased by the distance between the respective utilities. There shall be at least 10 feet in width from a given utility to the limits of the easement.

All storm sewers located inside the right-of-way, but less than 10 feet from the lot line, must provide a 10 foot easement adjacent to the right-of-way.

Minimum vertical separation shall be 18 inches between storm sewer and water main. Minimum horizontal separation shall be 8 feet between storm sewer and sanitary sewer or water main.

Minimum cover for storm sewers in paved areas shall be 12 inches measured from top of pipe to sub-grade elevation. Minimum cover for storm sewers in non-paved areas shall be 24 inches.

Storm sewer manhole spacing shall not exceed 400 feet. Place catch basins such that surface water does not flow across or around any street intersection. Maximum flow length within the street gutter shall be 300 feet.

A storm manhole shall be provided at the end of each line that does not terminate at a catch basin, inlet or end section. Storm manholes are also required at changes in pipe grade, size or alignment.

Yard drains and other field inlets shall be connected to the main line sewer by not less than a 6 inch diameter pipe. All other storm sewer shall be a minimum of 12" except for service laterals and pavement under-drain systems.

Any outfall that discharges into an open ditch or waterway shall have a head wall or end section made of the same material as the pipe. Storm outfalls shall utilize rip-rap and geotextile fabric, or other approved measure to help dissipate energy and reduce rutting and soil erosion.

Storm sewer facilities shall be placed as to not interfere or impede the free discharge of overland storm water flows.

Storm Sewer Structures

Storm sewer manholes shall be pre-cast or poured in place concrete with a minimum barrel diameter of 48 inches. A flat top or cone section may be used. All cone sections shall be eccentric in design. Chimney heights shall not exceed 14 inches. Minimum access diameter shall be 26 inches. The maximum corbel allowed is 3".

The use of junction chambers and other unique storm sewer structures is allowed to address specific design and water quality concerns. The City reserves the right to request structural shop drawings for these structures, signed and sealed by a professional engineer registered in the State of Wisconsin.

The City may require the installation of hydrodynamic separators as part of public storm sewer system design and construction in order to help achieve TSS reduction for storm water quality purposes.

Catch basins shall be pre-cast or poured in place concrete. For rectangular catch basins, the minimum size shall be 24"x36". For round catch basins, the minimum barrel diameter shall be 42 inches. A flat top section shall be used with a minimum access diameter of 26 inches. All catch basins require a minimum 12" sump.

Yard drains shall utilize the bell section of a 12" RCP pipe, 21" to 27" in length and turned vertically, feeding into a minimum 6 inch diameter PVC pipe. Grate shall be place directly on pipe bell section with out the use of a frame.

The use of debris grates on inlet pipe end sections is recommended by the City.

The use of special inlets will be considered pending the approval of the City prior to development design.

Non-curb structures shall utilize a Neenah R-1661 or Neenah R-2471 frame and grate, or equivalent. Curbed structures shall utilize a Neenah R-3228-K frame and grate, or equivalent. Field catch basins and inlets shall utilize a Neenah R-2560-D or Neenah R-2533 frame and grate, or equivalent. Yard drains shall utilize a Neenah R-4030 grate, or equivalent.

Rim elevations should be set for final grade. For structures in paved areas, the City preference is for the rim elevation to be set 1/4 inch below binder surface grade. A cast iron adjustment ring or pre-cast concrete adjustment ring shall be utilized for adjustment prior to final asphalt surface paving.

Steps are required for any structure that exceeds 48 inches in depth. When required, the top step shall be placed 8" below the top of corbel (cone) section. The bottom step shall be placed 8" above the manhole bench. All steps shall align vertically in manhole and be equally spaced with a maximum vertical spacing of 16 inches. Step placement shall not be aligned above any pipe inlet or outlet.

Backfill material around structure shall be mechanically compacted in 6" lifts. Flooding of excavated area for compaction purposes is not allowed.

Storm Sewer Mains

Storm sewer mains shall be reinforced concrete pipe (RCP) class III with a minimum diameter of 12 inches. Please contact the City for approval on the use of other pipe material prior to sewer design.

If a new manhole or structure is constructed over an existing sewer line, the pipe shall be broken at the time of manhole construction. Caution shall be used to ensure that construction debris is removed from the structure and not allowed to flow downstream.

Bedding, pipe cover and backfilling shall be in conformance with the Standard Specifications for Sewer & Water Construction in Wisconsin, as last revised, or as determined acceptable by the City. Backfill material shall be mechanically compacted. Flooding of excavated trench for compaction purposes is not allowed. The use of frozen spoil materials for trench backfill is not allowed.

Storm Sewer Laterals

Storm laterals shall be Polyvinyl Chloride (PVC) ASTM D-3034 SDR 35. Please contact the City for approval on the use of other pipe material prior to sewer design.

All storm laterals shall be at least 6" in diameter and installed at a quarter inch per foot grade unless otherwise noted on the plans. Laterals shall be connected to the sewer main at the time of installation with a "Kor-N-Tee" manufactured by NPC, Inc., Milford, New Hampshire, or equivalent.

Storm laterals to be installed from the sewer main to the property line and must be connected or capped.

A hardwood board marker, or equal, shall be placed at the end of each storm lateral when not connected to building service. Board shall be set vertically with a minimum of 12 inches of the board exposed above finished grade. The exposed section of board shall be painted fluorescent green.

Water Distribution Standards

The City of Greenfield is a retail customer of Milwaukee Water Works. All public water mains in the City of Greenfield are owned and operated by Milwaukee Water Works. Proposed water main shall be designed and installed in accordance with Milwaukee Water Works requirements and specifications. Complete standards and specifications can be obtained on-line (<http://water.mpw.net/standardspecs.htm>).

Roadway Standards

All streets shall be designed and located in relation to existing and planned street networks, topographical conditions, natural terrain features and with the overall characteristics and qualities of the neighborhood.

The City has established a network of existing and planned streets, currently identified in our Official Maps. Per the Greenfield Municipal Code, new street layout shall conform to official City mapping. In cases where an alternate street layout is requested, additional action may need to take place by the City as part of the development approval process to "de-map" certain proposed roadways and clear the way for an alternate street layout.

The Southeast Wisconsin Regional Planning Commission (SEWRPC) serves as the Regional Planning Commission and Metro Planning Organization (MPO) for the Greenfield area. SEWRPC has developed a Regional Transportation System Plan (RTSP) for Southeastern Wisconsin. Existing arterial streets and highways have been identified in the RTSP as well as planned improvements for the regional street and highway system in our area. All roadways shall be designed in conformance with the RTSP.

In conjunction with the development of the Greenfield Comprehensive Outdoor Recreation Plan (CORP), a Bicycle and Pedestrian plan has been prepared which may further define design parameters for sidewalks, sidepaths, multi-use paths and bicycle accommodations within, immediately adjacent to, or in conjunction with public right-of-way.

Major streets shall be properly integrated with the existing and proposed system of major streets and highways.

Collector streets shall be properly related to mass transit systems, population densities and to the major street into which they feed. Collector streets shall accommodate traffic generating from facilities such as schools, churches and shopping centers.

Minor streets shall be laid out to match existing topography, discourage use by through traffic and permit efficient drainage and sewer systems. The minimum amount of street as necessary is required to provide convenient and safe access to property.

Any requested connection to a non-City roadway shall require the approval of both the City and the entity in charge of that roadway receiving the connection.

Unless otherwise approved by the City, all new public streets shall be either concrete or bituminous asphalt and require an urban cross-section design with concrete curb and gutter. Roadway designs may include the use of permeable pavement, subject to approval by the City. Storm sewer shall be installed in conjunction with curb and gutter to provide proper street and roadway drainage. Perforated pipe underdrain may be required in certain conditions. A rural cross-section design with out concrete curb and gutter shall utilize a ditch and culvert or storm sewer system for drainage conveyance. Ditch side slopes shall be 4:1 maximum.

The typical concrete roadway cross-section shall utilize an 8" crushed aggregate base course, 31" concrete vertical face curb and gutter and 7" concrete surface. The use of geotextile fabric may be required.

The typical bituminous asphalt roadways shall utilize an 8" crushed aggregate base course, 31" concrete vertical face curb and gutter, a 3" asphaltic binder placed in one lift and a 2" asphaltic surface place in one lift. The use of geotextile fabric may be required.

Driveway approaches shall be 7" concrete over a 6" crushed aggregate base course.

Minimum street right-of-way and roadway guidelines are as follows:

	Right-of-Way	Roadway
Major	90'-120'	44' (curb face to curb face)
Collector	70'	38' (curb face to curb face)
Minor (urban)	60'	30' (curb face to curb face)
Alley	20'	18' (curb not required)
Cul-de-sac	60' radius	45' (radius to curb face)

All public roadways shall be installed in public right-of-way properly dedicated or established for said purpose.

The grade of all major and collector streets shall not exceed 6% unless necessitated by exceptional topography. The grade of all other streets shall not exceed 12%. The minimum grade of all streets shall be 0.5%. Typical cross slope shall be 2%. Cross slope shall not exceed 4%.

Streets shall intersect as near as possible to right angles. No more than two streets shall intersect unless approved by the City. Street jogs with centerline offsets of less than 125 feet shall be avoided. Street alignment through an intersection should be continuous.

A minimum sight distance with clear visibility, as measured along the centerline, shall be provided for at least 300 feet on major streets, 200 feet on collector streets, and 100 feet on minor streets.

If the overall grade difference between two tangent profiles is greater than 1%, a vertical curve should be used. The minimum vertical curve length shall be equivalent to 15 times the algebraic difference in the rate of grade change for major streets and collector streets, and 1/2 of this minimum length for all other streets.

A tangent of at least 100 feet long shall be introduced between reverse horizontal curves and vertical curves for all major or collector streets.

A minor street that is terminated and unable to be extended shall utilize a cul-de-sac. In the event that a minor street is terminated and can be extended, a temporary T-turn around shall be utilized until such time that said street is extended.

The minimum curb return radius shall be 25 feet as measured to the back of curb.

Handicap curb ramps shall comply with all State and Federal ADA specifications.

Retaining walls may be used in street and roadway design if no other design alternatives are available. The City will provide design parameters for retaining walls as needed.

Cross-section or intersection details may be required and shall be provided to the City upon request.

Acceleration and deceleration lanes shall be designed in accordance with Wisconsin Department of Transportation Facility Development Manual specifications and the Manual on Uniform Traffic Control Devices (MUTCD), as last revised.

Street signage and pavement markings shall be designed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), as last revised.

New street names shall not duplicate the name of existing streets. However, streets that are continuations of other already existing streets shall bear the name of the existing street. Street signs shall conform to City standards. The City must approve all new street names.

Per Ordinance 2101, a driveway approach permit is required for the installation of driveways in public right-of-way. Driveway approaches can be installed by property owners at the time of individual house or building construction. Driveway curb head cut-outs are not required as part of the initial street design as the City utilizes a curb head saw removal program. Please see Ordinance 2101 for additional driveway approach and permitting details.

A City inspector must be assigned for any street or driveway installation in public right-of-way.

All required underground utilities shall be installed and approved before placing the crushed aggregate based course.

For bituminous asphalt roadways, the concrete curb and gutter, crushed aggregate base course and asphaltic binder must be installed as part of the initial construction. The use of asphalt wedges at the curb flange and structures shall be used, as needed, between binder and surface layers.

For bituminous asphalt pavement, the surface course shall not be placed until the development has obtained an 80% build-out of house construction and/or at least one year after the asphaltic binder was installed and/or when determined appropriate by the City. Before the final surface course is placed, the City shall inspect and identify all necessary repairs or replacements to the concrete curb and gutter, asphaltic binder, underground utilities and terrace areas. All repairs or replacements identified by the City shall be completed before, or in conjunction with final surface course installation.

Before crushed aggregate base course installation, the subgrade shall require a proof-roll in the presence of a City inspector. A quad-axle dump truck carrying a 20-ton load (weigh slip required) shall be used for the proof-roll. Subgrade deflections greater than 1" may require undercutting or other base stabilization techniques.

The subgrade shall be constructed to a 0.1' tolerance prior to installation of crushed aggregate base course. The aggregate base course shall be constructed to a 0.05' tolerance prior to asphalt paving operations.

Concrete curb and gutter shall cure for a minimum of seven days before backfilling, aggregate base course installation, placement of asphalt or vehicular traffic is allowed. The use of curing additives may alter the minimum seven day period.

Asphalt binder course installation will not be allowed when the air temperature is below 32° F. Asphalt surface course installation will not be permitted when the air temperature is below 36°F. City may require the use of additives for cold weather paving. City may require the use of nuclear density testing to ensure 93% density.

Removal of existing concrete curb and gutter and concrete pavement shall be joint to joint. Existing asphalt pavement removal will be determined by City at the time of proposed plan review.

The City allows for the cutting of vertical curb head by a City approved contractor in conjunction with our driveway permit procedures. For developments, the initial pouring of curb and gutter can be a continuous pour, or a developer may elect to pour individual driveway openings.

Per Ordinance 2369, the City has adopted Street Restoration Standards for work done in public right-of-way. Please refer to the Street Restoration Standards for additional information on required restoration work in public right-of-ways.

Sidewalk, Sidepaths, Multi-Use Paths and Bicycle Accommodation Standards

Sidewalk installation shall be required in accordance with Chapter 9 of the Greenfield Municipal Code. Sidewalk installation in other commercial, institutional and recreational areas shall be considered on an individual basis with the health and safety of the public in mind.

In conjunction with the development of the Greenfield Comprehensive Outdoor Recreation Plan (CORP), a Bicycle and Pedestrian plan has been prepared which may further define design parameters for sidewalks, sidepaths, multi-use paths and bicycle accommodations within, immediately adjacent to, or in conjunction with public right-of-way.

Any requested sidewalk, sidepath or multi-use path connection to a non-City system shall require the approval of both the City and the entity in charge of that facility receiving the connection.

Public sidewalk, sidepaths and multi-use paths shall be installed in public right-of-way, or within dedicated public easements for said purpose. A minimum distance of 1 foot shall be established from the edge of any public walk or path to the easement limits.

Handicap curb and access ramps shall comply with all State and Federal ADA specifications.

Sidewalks, sidepaths and multi-use paths shall have a 2% cross slope. Maximum longitudinal grade shall be 8% with the exceptions of handicap curb and access ramps.

Concrete sidewalk shall be constructed 5' wide and 5" thick on a 4" compacted aggregate base course. Sidewalk layout shall follow the proposed street grade and layout unless otherwise specified. The portion of sidewalk through a driveway shall be 7" thick.

Sidepath and multi-use path width and location can vary depending on design parameters. Concrete sidepaths shall be constructed 5" thick on a 4" compacted aggregate base course. Asphalt sidepaths shall be constructed 4" thick on a 4" compacted aggregate base course.

Sidewalk, sidepath and multi-use path designs may include the use of permeable pavement, subject to approval by the City.

Sidewalk, sidepath and multi-use path sub-grade shall be thoroughly compacted within 2 inches of the proper elevation before forms are set or material installed. Additional depth may be required for the aggregate base course if needed to accommodate maintenance vehicle traffic.

Sidewalks, sidepaths and multi-use paths shall not be installed on a frozen sub-grade.

When using concrete, either traditional forming methods or machine placement can be utilized. If a machine is used, work shall meet or exceed that produced by traditional forming methods. All concrete shall be consolidated and struck off flush at finished grade.

Landscaping Standards

The removal of trees and other foliage in public right-of-way shall be kept to the minimum required to properly construct the required improvements.

Upon successful installation of the required improvements, all areas shall be properly established with seed or sod placed on a minimum of 4" of topsoil.

Certain slopes or critical drainage areas may require the use of sod or erosion matting to prevent soil erosion and to help establish proper vegetation.

The placement of seed, sod or other measures may be restricted or further regulated during the winter months when vegetation growth has gone dormant. The use of dormant seed and winter planting techniques may be required.

Protective screen plantings may be required to create a barrier between residential and non-residential properties. When required, a screen planting plan shall be prepared by a qualified landscape architect registered in the State of Wisconsin. Screen planting plan shall be approved by the City.

Street trees are required with a maximum spacing of 50 feet on center. The City will estimate the required number of trees and related cash deposit at the time of development. The City will utilize said cash deposit to plant trees as part of a City project once the development has obtained an 80% build out, or when determined appropriate by the City.

Street Lighting Standards

All street lighting shall be in conformance with the City of Greenfield Street Lighting Standards, as last revised. We Energies lighting systems are also utilized in the absence of a municipal lighting system. Each lighting system shall be installed in accordance with their respective guidelines and specifications. Lights shall be a minimum of 3 feet from driveways.

Traffic Signal Standards

A traffic impact analysis (TIA) may be required for large developments. When required, or warranted, new traffic signals shall be installed at developer's expense.

Non-City Utilities (Gas, Electric, Cable, etc.)

To the greatest extent possible, all new private utility lines (gas, electric, cable, etc.) for a development shall be installed underground in public right-of-way or within easements created for their specific purpose. The developer shall provide the necessary access and/or easement rights to private utility companies to support utility installation and maintenance for the development.

Private utility companies shall be contacted for their respective design, construction and financial requirements. Private utility companies shall be provided with an initial set of proposed plans and all subsequent plan changes to ensure that their utilities are being designed with the overall site development in mind.

Private utility companies are required to obtain permits from the City for utility installation in public right-of-way. The City reserves the right to comment upon and/or request design changes for private utility installation in public right-of-way.

When outside of the public right-of-way, the City shall be provided with a copy of the proposed private utility layout prior to installation. The City reserves the right to comment upon and/or request design changes for private utility installation outside the public right-of-way.

The placement of private utility apparatus (transformers, control boxes, pedestals, valves, etc.) shall be minimized to the greatest extent possible in critical areas such as drainage swales, berms, high traffic areas, over or immediately adjacent to other utilities, etc.

Any private utility relocation costs that is required as part of site development shall be borne by the private utility company, or the developer in accordance with their contractual agreements. The City shall not be responsible for these costs.

Drafting Standards and Requirements

General Standards

Water main plans shall comply with City of Milwaukee Water Works standards. Complete Milwaukee Water Works standards and specifications can be obtained on-line (<http://water.mpw.net/standardspecs.htm>).

All other plans shall comply as follows:

Whenever possible, plans shall be prepared on sheets measuring 36" across and 24" high with a 1" binding edge on the left side.

Title blocks shall conform to the City standard, located in the lower right hand corner of the plan and read from the 36" (or long) side of the sheet.

The seal and signature of the professional engineer who prepared the plans shall be affixed immediately left of the title block.

North direction shall be up or to the right of the sheet and indicated by a North arrow.

For plan and profile drawings, it is the City's preference to have the plan view shown on the bottom of the page and the profile view on the top of the page.

The recommended scale of utility plans shall be 1"=40' horizontal and 1"=4' vertical, except when a different scale is necessary. The recommended scale of paving plans shall be 1"=20' horizontal and 1"=2' vertical, except when a different scale is necessary.

The unit of measure on all plans shall be feet and inches. Metric units are not allowed.

All bench marks shall be clearly noted on the plan.

Stationing shall be used on all plans, typically noted at 100 foot intervals and for all street centerlines. Additional stationing shall be used to identify vertical and horizontal curves, or other items as necessary.

Initial plan date and the date of all revisions shall be clearly shown.

Each utility shall be drawn on a separate plan sheet with the exception of storm sewer and paving plans which can be combined.

Whenever possible, utility runs from structure to structure shall be contained on one page rather than across two plan sheets.

If a cover sheet is used, it shall include a sheet index and a legend to symbols and line styles used within the plan set.

Upon approval, three full size paper copies of the final engineering plans shall be submitted to the City. Additionally, a CD-ROM in a Computer Aided Drafting (CAD) format compatible to the City's current Microstation software version is required.

General Note Standards

All plans shall include the following general notes:

- Contractor shall use hand methods for excavation when clearance to adjacent utilities shown on the plans is less than 12" and clearance to adjacent field marked utilities not shown on the plans is less than 18".
- The locations of underground utilities shown on these plans are based on Diggers Hotline surface locations and/or the best available records at the time of plan preparation. Said locations are not guaranteed to be complete or correct. The Contractor shall be responsible for determining the exact location of all facilities and to provide adequate protection during the course of construction.
- It is the Contractor's responsibility to contact Diggers Hotline prior to any sub-surface excavation.

Plan View Standards

Right-of-way, lot lines, street centerline and easements shall be shown in the plan view. Right-of-way lines shall be of sufficient line weight to stand out above and beyond the other line types listed. Easements shall be a clearly labeled dashed line.

Subdivision names, certified survey map numbers, lot numbers and dimensions, block and/or parcel numbers, tax key numbers, site addresses and street names shall be shown in the plan view. Street names shall be of sufficient weight to stand out above and beyond the other labels listed.

Existing physical planimetric features shall be shown including but not limited to pavement, driveways, sidewalks, tree lines, fences, street lighting, retaining walls, carriage walks, planters, etc.

All existing utilities, both overhead and underground shall be shown. Include existing lateral locations if possible. Text labels can be used as necessary for clarification purposes.

Proposed sanitary sewer lines shall be shown as a solid heavy line, properly labeled to include size, material, length, pipe class, slope, etc. Proposed storm sewer lines shall be shown as a heavy dashed line, properly labeled to include size,

material, length, pipe class, slope, etc. For large diameter storm sewers (typically greater than 48"), the pipe outline should be shown to accurately represent the limits of the pipe. Direction flow arrows should be added to proposed sanitary and storm sewer lines.

Proposed manholes, catch basins, inlets, outlets, yard drains, special structures, etc. shall be shown as solid, heavy symbols. They shall be properly labeled to include feature ID number, type, size, shape, diameter, material, rim/grate elevation, invert depths, sump elevation, etc. For large or irregularly shaped structures, the outline of the structure should also be shown.

Proposed sanitary laterals shall be shown as a solid heavy line, properly labeled to include size, material, length, pipe class, slope, etc. Proposed storm laterals shall be shown as a heavy dashed line, properly labeled to include size, material, length, pipe class, slope, etc. If all laterals are to be laid at a consistent slope, a general note can be used.

Proposed pavement shall be shown with sufficient line weight to stand out on the plan. When possible, back of curb, face of curb and curb flange lines should be shown. If not possible, back of curb is required. For streets without curb and gutter, the edge of pavement and edge of shoulder should be shown. Proposed driveways, sidewalks, walking paths, and related features shall be shown in a slightly lighter line weight.

The City does not have specific line weight or line style standards. For general plan sheet preparation, the infrastructure asset for which the plan is prepared shall be of sufficient line weight and clarity to be clearly recognizable above and beyond other line work on the plan. Generally accepted engineering drafting standards should be used.

Profile View Standards

All elevations are to be based on City of Milwaukee / City of Greenfield datum. Elevations shall be based on the National Geodetic Vertical Datum of 1929 (NGVD 29), subtracting 580.603 to arrive at the City datum.

Existing and proposed grade lines shall be shown and labeled, including sufficient vertical curve data. Elevation data shall be provided at relevant station increments and proposed infrastructure.

All pipes shall be drawn as two lines representing the top of pipe and flow line of pipe.

Pipe slopes shall be shown to the nearest 0.0001 feet / foot.

At each manhole, catch basin, etc. shown in the profile, please label the station and offset, rim elevation, flow line elevations and sump elevation (if applicable).

Proposed piping shall be shown as a solid heavy line, properly labeled to include size, material, length, pipe class, slope, etc.

All existing and proposed utilities and utility crossings shall be shown and properly labeled to clearly convey what is being displayed. For utility crossing or cover conflicts, additional text notes should be used.

Backfill material shall be dimensioned and labeled as needed.

Lateral risers shall be dimensioned to the flow line of pipe.

Record Drawing and As-built Standards

Water Main Standards

Water main record drawings and related materials shall comply with City of Milwaukee Water Works standards. Complete Milwaukee Water Works standards and specifications can be obtained on-line (<http://water.mpw.net/standardspecs.htm>).

Sanitary Sewer Standards

Sanitary sewer record drawings are required for all public sanitary sewer. Whenever possible, the original construction plan shall be used as the base drawing with as-built data overlaid.

Sanitary sewer record drawings shall be done in accordance with all applicable MMSD rules and regulations.

At a minimum, as-built sanitary sewer main pipe data shall include size, material, length, pipe class and joint information.

At a minimum, as-built sanitary sewer manhole and structure data shall include feature ID number, type (manhole, cleanout, etc.), shape, diameter and/or size, material, rim/grate elevation and invert depths.

At a minimum, as-built sanitary sewer lateral data shall include size, material, length and pipe class. Additionally, data should be provided to indicate the depth of lateral at right-of-way line or connection to house service.

Utilize labeling methods to delineate where external and/or internal seals were installed and the type of each used.

All elevations are to be based on City of Milwaukee / City of Greenfield datum. Elevations shall be based on the National Geodetic Vertical Datum of 1929 (NGVD 29), subtracting 580.603 to arrive at the City datum.

Manholes, ends of pipe, end of laterals, etc. shall include a Northing and Easting coordinate. Wisconsin State Plane Coordinates, South Zone, (GRID) shall be used for computing N/E coordinates.

The bench mark used for plan preparation shall be noted.

Notes containing the name of contractor, the date construction was completed and the name of inspector and/or firm that provided the inspection should be included on the plan.

The City shall review a "draft" plan prior to submission of a final as-built plan. The City will forward the final as-built plans to MMSD.

Closed circuit televising data provided as part of the construction approval process may be used in reviewing and verifying as-built data or for the purpose of assigning a NASSCO pipeline assessment condition rating.

In conjunction with sanitary sewer as-built preparation, the City also requires a detailed manhole inspection and condition assessment for all public sanitary manholes. The City utilizes our own manhole assessment methods and does not currently use a NASSCO manhole assessment condition rating. In addition to manhole condition and assessment data, an internal photo and an external photo of the manhole surface area is also required.

Since City inspection is required as part of public sanitary sewer installation, the City (or our consultants) will prepare the necessary as-builts and manhole inspection data at developer expense. The developer shall be responsible for private sanitary sewer as-built preparation and submittal. Developer shall provide the City with an as-built plan for any privately installed sanitary sewer.

Storm Sewer Standards

Storm sewer record drawings are required for all public storm sewer. Whenever possible, the original construction plan shall be used as the base drawing with as-built data overlaid.

At a minimum, as-built storm sewer main pipe data shall include size, material, length and pipe class.

At a minimum, as-built storm sewer manhole, catch basin, inlet, outlet, yard drain and special structure data shall include shape, diameter and/or size, material, rim/grate elevation, invert elevations and sump depth (if applicable).

At a minimum, as-built storm sewer lateral data shall include size, material, length and pipe class. Additionally, data should be provided to indicate the depth of lateral at right-of-way line or connection to house service.

All elevations are to be based on City of Milwaukee / City of Greenfield datum. Elevations shall be based on the National Geodetic Vertical Datum of 1929 (NGVD 29), subtracting 580.603 to arrive at the City datum.

Manholes, ends of pipe, end of laterals, etc. shall include a Northing and Easting coordinate. Wisconsin State Plane Coordinates, South Zone, (GRID) shall be used for computing N/E coordinates.

The bench mark used for plan preparation shall be noted.

Notes containing the name of contractor, the date construction was completed and the name of inspector and/or firm that provided the inspection should be included on the plan.

The City shall review a "draft" plan prior to submission of a final as-built plan.

Since City inspection is required as part of public storm sewer installation, the City (or our consultants) will prepare the necessary as-builts at developer expense. The developer shall be responsible for private storm sewer as-built preparation. Developer shall provide the City with a copy of the private storm sewer as-built data for our permanent records.

Grading and Drainage Standards

When required, the developer shall prepare and forward an as-built grading plan to the City. The City will use the as-built grading plan to evaluate the overall site grading to verify compliance with the approved grading plan. A review of the as-built grading plan is conducted prior to City issuance of additional building permits. The as-built grading plan shall not be submitted to the City until mass grading operations have been completed, critical areas have been established and stabilized, and the remaining grading activities are minimal (spreading of top soil, using basement spoils, etc.). Multiple as-built grading plans may be required if an interim site grading plan is utilized, or at the discretion of the City based upon scope of the development.

The approved master site grading plan shall be used as the base sheet for the as-built grading plan, with as-built data overlaid. The as-built grading plan shall be labeled as "Record Drawing".

The as-built grading plan shall be stamped by a qualified land surveyor or professional engineer registered in the State of Wisconsin, depending on who prepared the approved master site grading plan. The date of the as-built survey shall be included along with any notes or related material to support data provided on the plan.

As-built spot grades and contours at 1 foot intervals shall be shown as a bold line. Proposed spot grades and contours at 1 foot intervals shall be shown as a light solid or dashed line.

While as-built storm water basin data can be shown on the as-built grading plan, storm water basins are subject to additional certification requirements as described below.

Required Storm Basin Certification Material Standards

In accordance with the Greenfield Municipal Code, certification is required for the constructed storm water management facilities of a development. As-built data shall be collected shortly after final stabilization has been obtained.

Above Ground Facilities

The minimum requirements for the as-built drawing and certification materials of above ground basins, rain gardens, bioswales, etc. are as follows:

- Provide full topography from the safety shelf to about 15' beyond the top of berm perimeter.
- Provide spillway elevations and widths.
- Provide as-built information for pipes, orifices, and applicable structure(s) (including OCS).
- Provide updated SWMP Report using as-built data for verification of detention pond storage.
- Provide updated SWMP Report using as-built data for verification of TSS/TP removal.
- Provide engineer certification that basin was built and is functioning as designed.
- Provide three (3) paper copies and one (1) disk with the as-built drawing in digital format (MicroStation version "J", or other software acceptable to the City).

Underground Facilities

For underground detention/retention systems, the City requires that the design engineer provide a stamped and sealed certification letter indicating that the underground system was built in accordance with the approved plans and that it is functioning as designed. If alterations were made during construction, they should be noted in the certification letter. The City does not require as-built elevations on the underground features.



DEPARTMENT OF NEIGHBORHOOD SERVICES
Engineering Division
7325 West Forest Home Avenue
Greenfield, WI 53220
PH: (414)-329-5325 FAX: (414)-543-9615

APPENDIX A **IMPERVIOUS** **AREA** **CALCULATION** **FORM**

Date: _____

Development Name: _____

Development Address: _____

Development Tax Key(s): _____

Watershed(s): Kinnickinnic River Menomonee River Root River Oak Creek

Data Provided By: _____

Is this a revision to a previously submitted IMPERVIOUS AREA CALCULATION FORM? (Y/N) _____

EXISTING CONDITIONS DATA:		Area in Square Feet	Percentage of Total Site
1	Total Existing Impervious (Hard Surfaces) Area		
2	Total Existing Greenspace Area		
3	Total Site Area (line 1 + 2)		100%

PROPOSED CONDITIONS DATA:		Area in Square Feet	Percentage of Total Site
4	Total Proposed Impervious (Hard Surfaces) Area		
5	Total Proposed Greenspace Area		
6	Total Site Area (line 4 + 5)		100%

NET CHANGE IN IMPERVIOUS AREA _____ Sq. Ft. (increase) (decrease)
(Net difference between line 1 and line 4 areas)

TOTAL DISTURBED AREA _____ Sq. Ft.

Do Not Write Below; Reserved for Staff Comment



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Engineering Division
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Greenfield, WI 53220
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APPENDIX B
ENGINEERING
PLAN REVIEW
FORM

Development Name: _____

1st Review
2nd Review
3rd Review
4th Review

Date

Design Engineer: _____

Reviewer: _____

ENVIRONMENTAL STANDARDS		N/A	APPROVED	REVISE
1	WDNR and/or USACOE wetland approvals			
2	Documentation for the Ordinary High Water Mark (OHWM)			
3	FEMA approval for modifications to mapped floodplain and/or floodway			
4	Tree protection and preservation			
5				

Comments: _____

EROSION CONTROL STANDARDS		N/A	APPROVED	REVISE
1	WDNR Erosion and Sediment Control Technical Standards			
2	Locations of erosion control devices			
3	Erosion control matting for critical areas			
4				

Comments: _____

GRADING STANDARDS		N/A	APPROVED	REVISE
1	Gradient for ditches and swales (1-percent minimum)			
2	Driveway slopes (between 2- and 8-percent)			
3	Retaining wall design			
4	Adequate overland flow paths and freeboard protection			
5				

Comments: _____

SANITARY SEWER STANDARDS		N/A	APPROVED	REVISE
1	Sanitary sewer system location (both horizontal and vertical)			
2	Details for sanitary sewer manholes and laterals			
3	Sanitary sewer material specifications			
4	SEWRPC approval for sanitary sewer extension			
5	WDNR forms for public sanitary system			
6				

Comments: _____

STORM SEWER STANDARDS		N/A	APPROVED	REVISE
1	Storm sewer system location (both horizontal and vertical)			
2	Details for all storm sewer structures			
3	Storm sewer material specifications			
4	Storm sewer hydraulic calculations and map for tributary drainage areas			
5				

Comments: _____

STORM WATER MANAGEMENT STANDARDS		N/A	APPROVED	REVISE
1	Infiltration requirements (per Wisconsin Administrative Code NR 151)			
2	Water quality calculations (per Wisconsin Administrative Code NR 151)			
3	Hydrologic calculations for 2-year, 10-year, and 100-year storm events			
4	Configuration for outlet control device			
5	Sizing calculations for emergency overflow weir			
6	Maintenance access for storm water facility			
7	Long term maintenance plan			
8	MMSD Chapter 13 Storm Water Management Plan Submittal Checklist			
9	Prepare and execute a "Storm Water Maintenance Plan Agreement"			
10				

Comments: _____

WATER DISTRIBUTION STANDARDS		N/A	APPROVED	REVISE
1	Hydrant spacing for access by Fire Department personnel			
2	Milwaukee Water Works (MWW) plan review approval for water main			
3	WDNR forms for public water main extension			
4				

Comments: _____

ROADWAY STANDARDS		N/A	APPROVED	REVISE
1	Street width for access by emergency services personnel			
2	Roadway cross-section details			
3	Vertical curves for centerline grade breaks (1.25-percent maximum)			
4	Design details for sidewalk, sidepaths, and multi-use paths			
5				

Comments: _____

The submitted engineering documents for the above-noted development appear to be in conformance with City of Greenfield requirements. The technical review of these documents is hereby approved. The City of Greenfield shall be notified immediately of any further plan revisions or field adjustments, as additional engineering plan review will be necessary under these circumstances.

Signature

Date



DEPARTMENT OF NEIGHBORHOOD SERVICES
Engineering Division
 7325 West Forest Home Avenue
 Greenfield, WI 53220
 PH: (414)-329-5325 FAX: (414)-543-9615

APPENDIX C
CONSTRUCTION
ACTIVITY REVIEW
FORM

Development Name: _____

Date
 1st Review
 2nd Review
 3rd Review
 4th Review

Design Engineer: _____

Reviewer: _____

PUNCHLIST PREPARATION		N/A	COMPLETE	INCOMPLETE
1	Contractor maintenance of required site erosion control practices			
2	Restoration of non-paved areas			
3	Marker board installation for sanitary, storm, and water service laterals			
4	Clean sanitary and/or storm structures			
5	Testing for sanitary sewer structures and main			
6	Closed circuit television inspection of all sanitary sewer main			
7	Prepare sanitary manhole inspection forms and enter data on GIS system			
8	Install final lift of asphalt upon roadway			
9				

Comments: _____

RECORD DRAWING PREPARATION		N/A	COMPLETE	INCOMPLETE
1	Field work for sanitary and/or storm structure measure-downs			
2	Survey work for sanitary and/or storm structure horizontal coordinates			
3	Survey work for vertical control			
4	Verify slopes of sanitary and/or storm sewer			
5	Obtain drawings (electronic format) from the design engineer			
6	Prepare and provide City of Greenfield with final drawings			
7				

Comments: _____

AS-BUILT GRADING PLAN STANDARDS		N/A	COMPLETE	INCOMPLETE
1	Storm sewer system location (both horizontal and vertical)			
2	Drainage swale compliance for emergency overflow routing			
3	Configuration for retaining wall(s)			
4	Overall balance of topsoil and earthen materials			
5	Adequate stabilization measures			
6	Certification by a professional land surveyor or engineer			
7	As-built drawing in electronic format			
8				

Comments: _____

STORM BASIN CERTIFICATION STANDARDS		N/A	COMPLETE	INCOMPLETE
1	Verification of basin storage volume (stage/storage table)			
2	Configuration for outlet control device			
3	Emergency overflow spillway compliance			
4	Sufficient freeboard protection between top of berm and overflow spillway			
5	As-built basin calculations for 2-year, 10-year, and 100-year storm events			
6	Adequate stabilization measures			
7	Certification by a professional engineer			
8	As-built drawing in electronic format			
9				

Comments: _____

The constructed facilities appear to be in conformance with the approved plans and City of Greenfield requirements. The City of Greenfield hereby grants "approval" of said facility installation subject to the completion of conditional items noted. For any public improvements, final City "acceptance" is required and will be addressed through other documentation or in accordance with the executed Developer's Agreement. The City of Greenfield shall continue to monitor the site and reserves the right to withdraw said "approval" in the event that noted conditional items are not addressed in a timely manner.

 Signature

 Date