

Sewer and Water Plan Review Requirements and Guidance

General Requirements and Plan Information:

- Plan Information shall include the following:
 - Project Name
 - Owner/Developer
 - Engineer/Engineering Firm
 - Project Address and parcel number(s)
 - Council District and Councilmember
 - MWS Project Number(s) and permit number(s)
 - Engineer's Stamp/Seal, signed and dated (date should be recent)
 - Vicinity Sketch/Proximity Map
 - North Arrow
 - Scale
 - Benchmark/Datum
 - Metro Water Services Standard Plan Notes
 - Plan tracking number once provided
- Applicant requirements to be verified during plan development process
 - [Availability Request](#) and Capacity Study
 - Confirm payment of applicable review fees
 - Identify development type
 - Confirm plans follow directive of study
 - Determination of public/private service
 - Location/procedure followed for connection to existing system
 - Offsite or other type of improvements specified
 - Associated capacity fees or percentage thereof paid as required for plan approval
 - Reference of any associated permit numbers
 - Payment of associated plan review fees
 - Preliminary plan and utility review process recommendations:
 - Research and request GIS information from MWS-RAM@nashville.gov
 - Review and analyze property owner and characteristics, contour elevations, etc.
 - Review adjacent water and sewer infrastructure (size, hydrant or manhole locations, adjacent pressure boundaries, contours etc.)
 - Note existing MWS project numbers for existing adjacent infrastructure and reference when developing plans where visible on the survey and design file, etc.
 - Review any visible features in a Google street view to determine any conflicts or make sure infrastructure such as hydrant, manholes, etc. is in appropriate location
 - Determine if the project will include any phasing. Project phases should be identified early in the process to establish separate project numbers and prepare for early releases

Sewer and Water Plan Review Requirements and Guidance

Sewer Design Consideration and Requirements:

- The primary goal for the design and construction of new sewer systems is to contain sanitary waste and prevent the capture (and subsequent treatment) of inflow and infiltration
- Sewer design and documents shall provide the following:
 - Sewer Plan View: The sewer plan view shall show the connection point to the existing system, which should be labeled with the existing MWS project numbers, along with the proposed design alignment.
 - Sewer Profile View: The sewer profile view shall provide the following:
 - Horizontal and vertical scale
 - Existing and the proposed grades
 - Approximate location and elevation, where known, of other utility crossings
 - Each manhole (MH) shall be labeled, include stationing, provide the top of casting (TC) elevation, and list the invert (IE) in(s) and out
 - Each pipe segment shall be labeled with the pipe material, segment length, and proposed slope
 - Sewer Calculations: The sewer calculations shall provide the proposed slope, full flow velocity, and full flow capacity of each proposed sewer segment.
- Sewer Design Considerations
 - Sewer design layout should consider the following:
 - The connection angle (angle of flow) should never be less than 90°
 - Pipe segments should be straight from MH to MH
 - Structures (MHs) should generally be located in the center of the road or travel lane
 - MHs should not be placed in ditches, creeks, or streams or at the toe of steep slopes
 - Where possible, sewer design alignment should provide a minimum of 10 feet of horizontal separation from waterlines. Where 10 feet of horizontal separation cannot be maintained or at crossings, the minimum vertical separation should be 18" with water on top. (Sewer crossing over water should be avoided wherever possible, but if it cannot, 24" separation is required or a casing pipe, encasement or pipe material change may be required and the designer should consult with MWS engineering review staff. *(MWS aims to vertically arrange infrastructure in the following priority order: water, stormwater, sewer).*
 - Where possible, 5 feet of horizontal separation from gas lines should be provided.
 - Do not create new sewer parallel to existing sewer. *(Scenario: Same roadway, opposite sides of the street).*
 - MHs located within the 100-yr floodplain shall provide watertight lids (SDET002). If the sewer system has continuous watertight sections that are greater than 1000 linear feet, ventilation is required (SDET004).
 - Connection to existing system considerations and requirements:
 - New Structure
 - If a new MH is being installed, interpolate approximate inverts using record drawings or survey data of upstream and downstream MH data
 - If the existing pipe material is clay, add note, *"In the event the existing clay line is damaged during construction the existing line will require replacement from MH to MH."*
 - Existing MH
 - If an existing MH is being tapped or cored, compare surveyed inverts to record drawings and provide a watertight connection and seal at the appropriate elevation above the invert out.

Sewer and Water Plan Review Requirements and Guidance

- If there is a concern the existing manhole is not in great condition, add note, *“MWS inspector may use discretion to determine if existing manhole requires replacement or rehabilitation.”*
- Manhole considerations and requirements:
 - A manhole structure is required for all pipe junctions (changes in direction, material, slope, and/or etc.)
 - Provide 0.2’ of fall across all structures (invert in and invert out).
 - Exceptions: Doghouse manholes, because existing inverts are interpolated. Set new invert in at 0.2’ above interpolated invert out. 0.1’ may be permitted in certain circumstances to accommodate cover or separation issues. Best engineering judgement should be utilized.
 - When a smaller pipe connects to a larger pipe then the crowns of the pipes shall match and invert elevations shall be set accordingly.
 - Drops connections
 - In general, MWS does not allow drop connections. If there is a conflict with another utility that cannot be avoided an external drop may be justified (SDET011).
 - Internal drops should never be allowed and requires Assistant Director approval (SDET021) if considered.
 - If the incoming gravity sewer enters a manhole (invert in) at an elevation less than 24” above the invert of the sewer leaving the manhole (invert out) this is not considered a “drop connection”. However, if this occurs, a flow channel must be grouted into place within the MH.
 - MHs located in paver sections requires a concrete collar (SDET018A).
 - Manholes shall be constructed with a xypex waterproofing admixture or approved equivalent.
- Pipe considerations and requirements:
 - 8” diameter is the minimum size for public sewer infrastructure
 - Sewer pipe between MHs should be uniform in alignment, slope, and material
 - The distance between manholes should not exceed 400 ft. If the sewer is greater than 15" in diameter, then the sewer can go up to 500 ft. between MHs.
 - Pipe material is typically PVC (SDR 35) or DIP. It is rare concrete is used and concrete requires watertight joints and xypex waterproofing admixture). DIP sewer pipe shall be coated with permashield or approved equal.
 - [FYI: SDR = Standard Dimension Ratio, this is the ratio of pipe diameter to wall thickness and the SDR can be expressed as $SDR=D/s$, where D=the outside diameter of the pipe and s= wall thickness of the pipe. A higher SDR means the wall is thinner. The highest allowable SDR by MWS is SDR 35 (unless the proposed is a low pressure system (LPS) then SDR21 PVC should be used). A lower SDR means a thicker pipe wall. Lower SDRs are allowed. You may see PVC expressed as Schedule or Sch. Class rather than SDR. For schedule class, the higher the number the thicker the wall. SCH40 is common, SCH40 is a thicker wall than SDR 35 and would be allowed, where applicable.]
 - Pipe cover requirements and considerations:
 - 4 ft of cover should be designed wherever possible 4' if possible. The absolute minimum cover is 2.5 ft (measured from the top of the pipe to surface grade). Although 2.5 ft is shallow and may require shallow type (flattop) manhole. If a proposed plan submits

Sewer and Water Plan Review Requirements and Guidance

sewer with less than 4' of cover determine if it is possible to adjust the design to allow for 4 ft of cover.

- In pavement: If the cover is between 2.5 and 4 ft, the pipe material should be DIP. If the cover is greater than 4' PVC is ok.
- Cross Country: Avoid min. depth (2.5 ft) where possible. Determine likelihood of future road at cross-country location.
- If 2.5 ft cannot be achieved for stream crossing (at min. slope) pipe material should be DIP, wrapped in plastic, and grouted with flowable fill.
- If pipe is located in fill sections (ensure sewer profiles show existing and proposed grades) material should be DIP.
- If cover is greater than 15 feet material should be DIP.
- If cover is extremely excessive > 24+ ft., further evaluation is needed and designer should consult with MWS engineering staff.
- Min. pipe slope is 0.4% for 8" sewer. Refer to TDEC guidelines for min. slope of larger diameter sewers. At slopes above 15%, check velocity. If velocity is exceeding 15 fps, DIP material should be used. Calculations should be provided for full flow conditions. Slopes greater than 20% require anchors. Refer to TDEC guidelines for more information. (SDET009)
- Ensure segment lengths and stationing match up correctly.
- New proposed sewers 18" or larger require state approval.
- Never add new combination (sewer) footage.
- Ensure a minimum of 18" vertical separation at all crossings. If 18" of separation cannot be achieved: DIP and/or concrete encasement may be necessary. If the crossing is with water, and sewer is on top (this should be avoided but if it cannot) then a min. of 24" separation between the bottom of the sewer and top of the water main must be provided.
- Service line considerations and requirements:
 - All service lines should connect perpendicularly to the main.
 - The min. size service line at connection (tap to cleanout) is 6".
 - Service lines 8" or greater must connect to the public sewer at a manhole.
 - A 10" service line should not connect to a public 8" line.
 - Private sewer lines (service line) shall be laid at least 1%. If a private line serving multiple units cannot achieve 1%, it may be designed in accordance with the MWS public standard. A letter of responsibility is required and shall be recorded with the register of deeds.
 - Cleanouts should be placed on the service line at a distance of 10 ft from the sewer main, unless that location is in public ROW, then the cleanout should be placed at the edge of ROW or property line whichever is most appropriate. Additionally, long service/private lines should have cleanouts located every 50ft or at any horizontal directional change.
 - Building FFEs should be verified and compared to service line locations and to public sewer depth. Ensure gravity flow is possible.
 - Pool filter backwash water must drain to sanitary sewer (air gaps are required). Only pool deck drains can connect to the stormwater system.
 - Dumpster pads with drains must be routed to sanitary sewer. These pads must be covered. Food service establishments must route through grease control equipment.
 - Grease Interceptor should have a separate connection to private sewer service lines. (Sanitary/toilet flows should not be routed through these grease interceptor devices.)
- Sewer calculation considerations and requirements:

Sewer and Water Plan Review Requirements and Guidance

- Check the Manning's n value used in calculations. "n" value should be 0.013. Never use a higher "n" value.
- Only use a lower "n" value if replacing older (larger than 8") in combined sewer areas for capacity purposes. Sewer replacement in combination areas requires capacity analysis. The capacity of a combination line should never be reduced.
- Check slope, velocity, and capacity for full flow conditions. Refer to **standard sewer calculations template**.
- If possible, check trunk line sewer to ensure pipe is sized for the basin. Trunk and interceptor sewers shall have a 2.5 peaking factor, whereas mains/submains use a peaking factor of 4.
- Easement considerations and requirements:
 - 20 ft easement should be provided and centered over sewer line with 10 ft on either side.
 - Sewer design engineer must make a request with MWS review engineer if they want to offset sewer line within easement. (i.e. 8 ft/12 ft split acceptable in most cases.)
 - If the sewer is going to be encumbered by any structures, an easement encroachment approval letter from Property Services (Mike Atchison) must be obtained.
 - Acquisition of any required off-site easements are needed prior to plan approval. Design engineer is responsible for coordinating with associated owner(s).
 - Onsite easements can be granted prior to infrastructure acceptance. (Design engineer is responsible for confirming ownership).
 - Easement shall extend all the way to the property line. (Creation of spite strips is not permitted. Easements must be extended, easement provided within a reasonable request, or ensure "open space" is provided per plat).
- Potential additional considerations and requirements:
 - Aquatic Resource Alteration Permit (ARAP)
 - Bypass pumping
 - Abandonment/Replacement Plans

Low Pressure Sewer Systems (Grinder Pump Collection Lines) Consideration and Requirements:

- Low pressure system (LPS) and pumping calculations will drive pipe size and design.
- Minimum velocity is 2 ft/sec
- Pipe should be PVC SDR 21 for low pressure sewer piping
- Minimum cover is 30". Pipe should be buried at minimum depth unless additional depth is required to avoid an obstruction. 18" of separation should be provided at crossings with sewer on the bottom under.
- The receiving connection manhole and the subsequent 2 downstream manholes require protective coating. (Warren S301, Spectra shield, or approved equal, refer to Metro standard specifications). Additional odor control systems must be provided with new LPS.
- The design pressure should not exceed 185 total dynamic head (TDH). Calculations should account for the number of pumps in the system and utilize the maximum number simultaneously pumps operating for calculations. Refer to **E-one design guidelines**.
- Loops should be avoided in LPS design.
- Air release valves should be placed at high points in the system.
- Cleanouts should be placed at the end of each main and whenever two or more mains come together. Each zone shall have a valve. Valves should also be placed at locations whenever two or more mains come together.
- Refer to **LPS calculations guide** for additional information.

Sewer and Water Plan Review Requirements and Guidance

Water Design Considerations and Requirements:

- Water design and documents shall provide the following:
 - Water Plan View: The water plan view shall show the connection point to the existing system, which should be labeled with the existing MWS project numbers, along with the proposed design alignment.
 - All waterline details should be provided, labeled, and stationed, incremental stationing should be provided at least every 100 ft.
 - Proposed waterlines provide pipe size and are labeled as DIP.
 - If the proposed main is 12" or larger, a water line profile is required. You may always request a profile on any sized line if you feel you need it to review the plans, but it is required when the proposed main is 12" or larger.
 - Station all details (TS&V, valve(s), tees, hydrants, crosses, bends (bend type), reducers, blowoffs, etc.). Provide incremental stationing at least every 100 ft.
 - Water Calculations: The water calculations shall provide the proposed fire flow for each new hydrant
 - A dual (2) hydrant flow test and corresponding results shall be provided and will be required to complete water calculations. *[FYI the fire marshal requires the results from the dual hydrant flow test to be within 6 months of the current date for their purposes]*
 - Calculate approximate fire flow rate for each proposed hydrant.
 - New fire hydrants should produce at least 1000 gpm at 20 psi. When calculating fire flow, the Hazen William Friction factor should be C=130.
 - Calculate either flow at 20psi or pressure at 1000 gpm.
 - Refer to Hydrant Calcs guide for how to find pressure at 1000 gpm.
- Connection to existing system considerations and requirements:
 - Connection types may include removal of existing blowoff, a tapping sleeve and valve (TS&V), or new cut in tee
 - Ensure TS&V is accurately sized, for example an 8" cannot connect to an existing 6" (whereas a 6" could connect to an existing 8"), would need to connect with a 6" and enlarge to an 8" in this case.
- Waterline layout considerations and requirements:
 - Waterlines should always be placed under pavement.
 - Waterline should be placed 5 feet from face of curb wherever possible. A waterline should never be placed under the curb and gutter or sidewalk. The same is true for valve placement.
 - MWS does not operate the valves on TS&V therefore ensure gate valve or property line valve is placed after TS&V at entrances to new roads and near the property line where possible.
 - New buildings should be within a 250 ft radius of a FH or 500 ft by way of pavement (hard surface road).
 - Ensure proposed hydrant is not located in sidewalk and placed in furnishing strip or other appropriate location.
 - Check that hydrants are at least 10 ft away from signal pole, wire or mast signal configuration. *(This may not always be possible in urban areas.)*
 - A valve should be placed within 5 ft (but no more than 7 ft) from the face of the hydrant. Hydrant plan design should provide an inset at 1":10' scale to show details more clearly.
 - There should always be a valve installed prior to a blowoff. There should also always be a valve prior to reducing the water main size in diameter

Sewer and Water Plan Review Requirements and Guidance

- All intersections shall have valves for isolation purposes. Tees or crosses should have a min. of 1 less valve from each run of pipe.
- Ensure valves at intersections are placed in line with the curb line of the perpendicular roadway at a (minimum) or further back to the projected ROW line (maximum).
- Looped waterline systems are ideal. Ensure pressure boundaries are same if looping into two existing systems. Dead ends should be avoided. If they cannot, the line should end with a hydrant or blowoff valve.
- Pipe design considerations and requirements:
 - Minimum pipe size for principle water mains with fire hydrants is 8" diameter. (6" is the state standard and may be acceptable on a case by case basis).
 - 4" and 6" diameter pipe should only be used in cul-de-sac or dead-end situations and must be evaluated with MWS engineering staff.
 - DIP is the only acceptable material for public water mains.
 - Water lines should be designed and installed with at least 30" of cover, unless the main is 12" or larger, in which case min. cover is 36". If working in TDOT ROW, additional cover maybe required.
 - 18" of vertical separation should be provide at all crossings. Water should be installed on top, wherever possible. If this cannot be achieved, refer to WDET010. If water is not placed on top a min. of 24" separation shall be provided.
- Service line considerations and requirements:
 - Service connections shall connect to the public main perpendicularly.
 - Water services 2" or larger require private plan approval and cross connection review.
 - Refer to standard schematics for configuration details. Common configuration included Schematic No. 3, 7, and 11. *(Note we do not use the valve associated with the tapping sleeve and valve assembly for operation purposes therefore valves shall be placed in front of each meter and/or DDCV.)*
 - MWS does not charge for meters and provides 5/8" and 1" meters only (residential uses). Beyond the 1" meter size, owners will be responsible for supplying. Plumber/plumbing supplier should send meter info to MWS permits office for meter permit application.
 - Service line cannot be 'abandoned' and must be cut and capped at the main where there is no plan for repurposing or continued use.
 - Gang boxes can be used to serve multiple meters using one tap. Refer to detail WDET002J. 6 meters may be placed in a gang box in the standard configuration. *(If the gang box is oriented with the long side perpendicular to water main than 7 meters can be placed in the box. While the detail referenced above shows a 3" tap/service line typically 4" is more commonly used because of the material availability/cost.)*
 - Meters shall be installed at a depth in which the top of the meter is 18-24" below the top of the meter box.
 - Connections to existing public lines smaller than 6" must be evaluated by an MWS engineer. *(Note that some locations may not allow connection without public waterline improvements. Existing connections can always be reutilized. We do not allow new connections to public 2" waterlines or smaller, those automatically fall into the infrastructure replacement/upgrades needed category.)*

Water and Sewer Variance Considerations and Requirements:

- Review at the below links:
 - [Variance Requirements](#)
 - [Cross Connections Program](#)

Sewer and Water Plan Review Requirements and Guidance

- All Backflow Preventers (Domestic RPBP, Irrigation RPBP, Fire DDCV) should be behind the meter approximately 5-10 feet. Any deviation from this standard requires a variance approval.
- The DDCV must be 20 feet from the service tee. If the distance exceeds 20 feet, an automatic flushing system is required.
- All backflow devices must meet the University of Southern California specifications.
- All backflow devices should be oriented horizontally. The only exception is DDCVs may be placed vertically but a vertically placed DDCV requires variance approval.
- If the backflow is to be placed inside, a variance is required. If placed inside the room, the device must have 7 feet of clearance, a min. of 18" separation, 3 feet of clearance in front of the device, accessibility for MWS access. Backflows must be 12" off the ground and cannot exceed 66" in height. Larger diameter lines may have additional spacing requirements.
- If the meter cannot be placed at the ROW, then a variance is required.
- Deduct meter approval requires a variance. *(A deduct meter is a privately owned irrigation meter which is located behind the domestic meter. Deduct meters may also be approved through customer service.)*
- Backflow devices must be above ground. If there is a circumstance preventing this, a vault could be considered for through a variance only for a DDCV.
- Shared sewer services on HPRs requires a variance. Shared sewer services require a Letter of Responsibility which must be recorded with the Register of Deeds. If the existing line is to be utilized, it must be in an acceptable condition. A private manhole, located as close as possible to the property side of the property line, must be provided where the two lines come together.