



Standard Design
And
Construction Specifications
For Wastewater Systems

May 2024

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General Design Criteria

1. General Design Criteria

1.1. Introduction

The following design criteria shall be used for conventional sewer systems to be incorporated into the District's service area and shall govern the design of all District wastewater facilities. Exceptions and deviations from these specifications must be approved in writing by the KMPUD General Manager.

1.2. Intent of Criteria

The intent of these criteria is to ensure that the wastewater system constructed will dependably and safely collect the required amount of wastewater throughout the system at the least overall cost. Wastewater utilities shall be designed to meet or exceed the lifespan, or depreciation period, listed in the KMPUD Asset Life Schedule (KMPUD Policy Statement 370).

KMPUD is committed to providing environmentally responsible services, therefore, all proposed installations shall be evaluated to ensure that the installation is environmentally sustainable and resource efficient throughout the life cycle of the system.

1.3. Current Standards

Applicable ordinances, rules, and regulations of all federal, state, and local agencies shall be complied with.

1.4. Wastewater System Design – Mains and Laterals

All installations are to be as shown in Kirkwood Meadows Public Utility District's Standard Drawings.

1.4.1. Hydraulic Analysis

A hydraulic analysis of any proposed wastewater system shall be supplied to the District upon request. Each sewer main in the proposed sewer system shall be analyzed for two scenarios:

- Average daily flow (ADF) plus infiltration as well as peak day flow.
- Peak day flow, where $Q_{\max}=3 \times \text{ADF}$.

Wastewater models submitted to the District are required to be geo-referenced in the NAD83 State Plane California Zone 2 Feet Coordinate System and Lambert Conformal Conic Projection. The models shall be submitted in a WaterCAD format.

1.4.2. Design Conditions

Design conditions apply to an empty conduit with no internal pressure.

- Depth of cover to be minimum thirty-six inches (36") or twelve inches (12") below any potable water line invert elevations, whichever is greater.

- Minimum trench width shall be one pipe outside diameter plus eight inches (8") on either side of the pipe, and a maximum of one pipe outside diameter plus 36 inches (36") unless otherwise approved by the District.
- Bedding tamped to twelve inches (12") above pipe, load factor 1.5.
- Soil density one hundred thirty-five pounds per cubic foot (135 lb/cf).
- Bedding angle ninety (90) degrees.
- Live load AASHTO H-20, sixteen thousand pound (16,000 lbs.) wheel load.
- Rigid pipe 1.5 factor of safety versus crushing.
- Flexible pipe allowable deflection at joints – as specified by pipe manufacturer.
- Wastewater lines placed within Caltrans Right of Way shall be protected with a steel casing that complies with Caltrans standards, with a minimum cover of thirty-six inches (36").
- No Star Pipe Products materials are allowed.

1.4.3. Sizing

Pipeline sizing for gravity lines shall be determined on the basis of the design flow rate and the following criteria:

Pipe Diameter	Manning's Roughness Coefficient	d/D Maximum
4" to 12"	0.013	0.50
14" or greater	0.013	0.75

Required velocities at design flow (Q) shall be as follows:

	Minimum	Maximum
Gravity Pipelines	2 fps	10 fps
Force Main Pipelines	2 fps	5 fps

Sewer sizes shall not be increased in flat topography to justify use of flatter grades. Under minimal flow conditions, wastewater in larger pipelines can have velocities lower than that in smaller pipelines. If the minimum scouring velocity cannot be maintained during initial operation prior to the design flow capacities being reached, the ability to periodically flush the system shall be required.

Head losses for force mains shall be limited to five feet (5') per one thousand feet (1000 ft). Properly designed odor control facilities shall be provided for all force mains, pump stations, treatment sites and where odor is an issue, as determined by the District.

Gravity sewer collection mains and laterals shall have a minimum diameter of four inches (4"). Force mains shall have a minimum diameter of six inches (6").

1.4.4. Material

1.4.4.1. Gravity or Collection Mains

Gravity pipe shall be PVC SDR-26 or better. Pipe shall have bell and spigot joints conforming to ASTM D 3212 and have flexible watertight elastomeric seals conforming to ASTM F 913 or F 477. Neither solvent nor glue-joints shall be permitted.

1.4.4.2. Force Mains

Force or pressurized mains shall be Polyvinyl Chloride (PVC) Pressure Pipe in sizes four inches (4") through thirty-six inches (36"), shall conform to current AWWA C900 and have Underwriters' Laboratories, Factory Mutual and NSF approval. PVC pipe shall be a minimum of dimension ratio (DR) eighteen (18), Pressure Class (PC) 235 for internal working pressures up to one hundred fifty (150) psi; use a minimum of DR fourteen (14), PC 305 for internal working pressures between one hundred fifty (150) psi and two hundred (200) psi. For internal working pressures greater than two hundred (200) psi, the pipe DR/Class shall be approved by the District.

Pipe shall have bell and spigot joints conforming to ASTM D 3212 and have flexible watertight elastomeric seals conforming to ASTM F 913 or F 477. Solvent, glue-joints or butt fused pipe shall not be allowed.

Joints between PVC pipe, and other types of pipe shall be made by means of the proper sized and type compression adapters. Lengths of PVC shall be joined by a locked-in flexible elastomeric gasket coupling with bell and spigot configuration. Lubricants intended for use with PVC pipe shall be compatible with the plastic material and not adversely affect the potable quality of the water being transported. Joints between PVC pipe and fittings shall be slip-on type or mechanical type as shown on the plans. Slip-on type joints shall be sealed by means of rubber rings designated for use with the type of pipe being installed.

1.4.4.3. Laterals

Lateral pipe and fittings shall be Schedule 80 PVC conforming to the requirements of PVC 1120 per ASTM D 1785 and D 2467, respectively. Fittings shall be solvent weld type. Threaded PVC pipe shall not be permitted. Molded threaded adapter fittings may be used.

1.4.4.4. Interconnections

Connections between C900 and Schedule 40 or 80 shall be made with C907 injection molded fittings. Threaded PVC pipe shall not be used.

1.4.5. Pipe Slope

Pipe Diameter (in)	Minimum Slope	Maximum Slope
4	.012	.150
6	.010	.120
8	.007	.085
10	.005	.060
12	.004	.050
15	.003	.035
18	.002	.030
24	.002	.020

In extreme conditions, flatter slopes may be considered providing the depth of flow will not be less than three-tenths (0.3) of the pipe diameter or the velocity less than one and six-tenths (1.6) feet per second at design average daily flow and justifiable reasons for the modification are presented to the District. Deviations from these slopes are only allowed with written permission from the District.

In extreme conditions, steeper slopes may be considered provided the following conditions are met:

- Restrained joints are used.
- Cut-Off walls and drainage measures are used to prevent a buildup of hydrostatic pressure in trenches.
- When a sewer with a slope greater than 0.12 passes through a structure with a horizontal change of direction in excess of thirty (30) degrees, design of base channelization shall be required to prevent overflows and yet allow for routine maintenance operations.

Sewer laterals shall have a minimum slope of 0.025 (2.5%, ¼" per 1') from sewer to property line.

"Sags" or "low-spots" in gravity collection lines shall not exceed one-fourth inch (1/4").

1.4.6. Lift Stations

Lift stations shall be designed by a California registered Professional Engineer and reviewed for approval by the District. District staff should be consulted in the early planning stages to assess the need for such installations and to develop the site-specific design criteria, which shall be determined solely by the District.

1.4.6.1. Minimum Pump (Lift) Station Requirements

- Minimum storage capacity within the lift station shall be one hundred and twenty five percent (125%) of anticipated, ultimate average daily flow for the lift station if the following conditions are met:

- Emergency overflow storage is provided above the alarm point of the lift station; and
- A minimum largest unit pump redundancy is in place; and
- A permanent emergency standby generator capable of running all required pumping equipment simultaneously is installed. Automatic start and auto-transfer switches are required.

If these criteria are not met, additional emergency storage capacity shall be required.

- Emergency storage shall be wholly contained within one emergency storage tank. Multiple septic tanks in sequence or parallel shall not be permitted. The use of septic tanks in lieu of traditional wet-well design shall not be permitted. Fiberglass tanks or vaults shall not be permitted.
- The wet well/vault forms shall not be stripped until forty-eight (48) hours after concrete placement and no backfill will be allowed until concrete cylinder strength tests indicate that it has reached one hundred percent (100%) of design strength.
- Level sensing shall be via transducers. Additionally, a high level float switch connected to an auto-dialer with battery back-up shall also be provided. A minimum of two high level alarms shall be required.
- A manual bypass and valve (same pipe size) to drain the force main back into the lift station shall be required. This drain should be of an elevation to allow the fluid in the force main to flow by gravity back to the lift station wet-well.
- The maximum wet-well depth shall be eighteen feet (18').
- All interior concrete surfaces of the wet well, emergency storage, etc. shall be coated with an approved epoxy coating. Approved coatings are Tnemec 434 @ 125 mils with Tnemec 435 @ 15 mils or Carbolite Plasite 4550S @ 100 mils.
- All exterior concrete surfaces of the wet well, emergency storage, etc. shall be coated with an approved epoxy coating. Approved coatings are Tremco Tremproof 250 GC, 100mils of Hydro-Pox 204 or Thoroseal (MasterSeal 581).
- All tanks vaults to be properly screened and vented with odor control equipment. All vaults shall provide twenty-four inch (24") working clearance to all fittings.
- All doors and lids shall require no more than fifty (50) lb force to open, provide lift assistance as required. Fall protection shall also be provided.
- A pump minute meter and cycle counter is required. Pump operating cycles shall be a maximum of three (3) cycles per hour and ten (10) minute cycles based on a full average day design flow within

an eight (8) hour period. Pumps shall remain fully submerged under normal operation.

- For standardization, spare part and maintenance purposes, pumps shall be those manufactured by ITT Flygt USA. All pumps shall be installed with VFDs by Allen Bradley, Siemens, Cutler-Hammer or an approved equal.
- Provide appropriate hoists with stainless steel lifting changes and stainless steel guide rails for pump removal.
- Suction and discharge piping shall be class 50 ductile iron. All exposed piping shall have adequately sized and located thrust rods. A check valve isolated by shut off valves is required on all outlet piping. All sewer valves shall be plug type designed for use in wastewater systems.
- A permanent, emergency generator shall be provided at the site. Fuel type shall be natural gas where possible. If not possible, propane gas shall be permitted, however the storage tank shall be sized to provide a minimum of thirty-six (36) hours of generator run time under full load. The Contractor shall be responsible for permitting all generators with the Great Basin Unified Air Pollution Control District.
- Permanent phone connectivity, where possible, and a backup radio transmitter shall be provided for systems communications.
- All electrical equipment placed in minimum NEMA 4x rated enclosures.
- All above grade electrical conduit shall be PVC coated rigid conduit.
- Provide sun and weather protection as appropriate for all equipment and working spaces.
- Sufficient site and panel lighting shall be provided for District crews to perform night work.
- A two inch (2") water meter shall be provided as well as a two inch (2") freeze-proof service connection and 5/8-inch freeze-proof hose bib.
- The entire site shall be paved with a) two inches (2") of Asphalt Concrete over five inches (5") of Class II Aggregate Base or b) four inches (4") of Portland Cement Concrete, all over a minimum of five inches (5") of class 2 AB.
- The site shall be accessible either via a minimum twelve foot (12') driveway with a hammerhead turnaround and constructed of a) two inches (2") of Asphalt Concrete over five inches (5") of Class II Aggregate Base or b) four inches (4") of Portland Cement Concrete. The driveway shall be accessible from a PUE or access easement dedicated to the District.

- The site shall be a separate lot deeded to the District. The site shall be sized to allow for twenty foot (20') clearance on all sides from any equipment, fencing or piping.

Complete O&M manuals shall be submitted and the Contractor shall provide all training necessary for maintenance and operation of facility.

1.4.7. Manholes

All manholes with a depth less than or equal to twelve feet (12') shall have a minimum diameter of forty-eight inches (48"). All manholes with a depth of greater than twelve feet (12') shall have a minimum diameter of sixty inches (60"). In no instance shall manholes have a depth of more than eighteen feet (18') without prior written consent of the District. Manholes shall be spaced at four hundred foot (400') maximum intervals. In addition, manholes shall be placed at all the following locations: changes in horizontal or vertical alignment, changes in sewer diameter, at street intersections, at sewer pipe intersections, at connections with laterals six inches (6") or larger in diameter, and at the beginning of sewer runs such as cul-de-sacs. Junction manholes shall be designed with the invert elevation of the intersecting sewer at the same elevation as the invert elevation of the upstream sewer.

Clean-outs must be installed at the end of a sewer pipeline if the distance from a manhole is less than two hundred feet (200').

Manholes shall be directly accessible from public roadways where possible. Where not possible, manholes shall be accessible via a minimum twelve foot (12') wide dedicated access easement from a public right-of-way access point. The driveway shall be constructed of a minimum of two inches (2") of Asphalt Concrete over five inches (5") of Class II Aggregate Base compacted to 95% relative compaction or four inches (4") of Portland Cement Concrete.

1.4.7.1. Slopes Through Manholes

When sewers of uniform slope pass through a manhole, the slope will be maintained and the invert at the center of the manhole will be given.

When sewers change slope at a manhole, incoming and outgoing invert elevations shall be shown on the plans.

Provide sufficient drop through a manhole to compensate for energy loss caused by change of alignment. A drop of two-tenths of a foot (0.2') for straight runs, one-tenth of a foot (0.1') for a change of alignment greater than thirty degrees (30°) and two-tenths to one-half (0.2-0.5) feet for ninety degree (90°) bends shall occur across manholes.

When pipe sizes change at structures, design the inlet crown at least as high as the outlet crown.

1.5. Wastewater System Design – Building Sewer

1.5.1. General

The building sewer is the line between the building served and the service connection. Pipe material and installation of the building sewer shall meet all the requirements of Sections 1.2 & 1.3.

1.5.2. Line Sizing

Single family residence building sewer lines shall be minimum three inch (3") diameter. High density, commercial and industrial building sewer lines shall be sized based on flows and shall be minimum four inch (4") pipe diameter.

1.5.3. Material

PVC and ABS are acceptable materials for the building sewer and shall be Schedule 40, with Schedule 40 solvent welded fittings or SDR-26 PVC with bell and spigot fittings.

ABS and Schedule 40 PVC fittings shall conform to ASTM D 3311 and be solvent welded. All ninety degree (90°) bends shall be long-radius sweeps; "hard" ninety degree (90°) fittings are not permitted.

ABS pipe and fittings shall be Schedule 40 and conform to ASTM D 2661. Solvent cement used on ABS shall conform to ASTM D 2235.

Schedule 40 PVC pipe shall conform to ASTM D 1785 or D 2665 (or both). Solvent cement used on PVC shall conform to ASTM D 2564.

SDR-26 PVC pipe and fittings shall conform to ASTM D 3034 and shall be joined using bell and spigot joints conforming to ASTM D 3212 and flexible watertight elastomeric seals conforming to ASTM F 913 or F 477.

1.5.4. Pipe Slope

Building sewer lines shall comply with Section 1.4.5 and if smaller than four inches (4") shall have a minimum slope of 0.025.

1.5.5. Building Sewer Cleanout

A two-way sewer cleanout shall be installed a maximum of five feet (5') from the building and spaced every one-hundred feet (100') as measured from the initial building cleanout, to the service connection. Cleanouts are also required at all bends of twenty-two degrees (22°) or greater.

Cleanouts shall be a minimum pipe diameter of three inches (3") and be SDR-26, schedule 40 PVC or ABS.

1.5.6. Backflow Prevention Valve

Each property owner will be required to provide and maintain a backflow prevention device on the building sewer line if any floor of a structure is at or below the sewer main or lateral top-of-pipe elevation. Each property owner will likewise be required to provide and maintain a backflow prevention device on the building sewer line if the lateral is lower than the sewer main at any point along its length.

1.6. Wastewater System Layout Requirements

1.6.1. Wastewater Line Locations and Clearances

Wastewater lines shall be placed in a public right of way unless the District deems the alignment impractical, in which case a twenty foot (20') easement is required. Wastewater lines shall be installed in the center of the required twenty foot (20') easement. Wastewater lines shall be placed seven feet (7') off centerline on south and east alignments when in public street right of ways. Back-lot line utilities are prohibited. Wastewater lines that are near or parallel sidewalks, drainage ditches, curbs, gutters, retaining walls, footings, foundations, concrete, rocks or other non-soil like structures shall not be installed under said improvements/structures, and shall have a minimum of five feet (5') horizontal clearance from improvements/structures, as measure from the outside of pipe.

When in a highway right of way and where required by the District, wastewater lines shall be cased. Minimum thirty-six inches (36") of cover required for pipe and casings in highway right of way. Casings shall extend five feet (5') beyond the right of way wherever possible. Wastewater lines parallel to paved roads shall be installed with a minimum of five feet (5') horizontal separation from the edge of pavement.

All parallel dry utilities and other utilities shall be installed with a minimum of twenty-four inches (24") horizontal separation and twelve inches (12") vertical separation from the wastewater line, except water lines as required by the California State Water Resources Control Board. At a minimum, unless otherwise listed as requiring additional separation, all parallel utilities, including other wastewater pipelines, shall be installed with a minimum of twenty-four inches (24") horizontal separation from the wastewater line.

Wastewater/sewer lines shall maintain a minimum of ten feet (10') horizontal separation and one foot (1') vertical clearance below any water line.

All crossing utilities shall be installed with a one foot (1') minimum vertical separation (nearest outside diameter to nearest outside diameter), and non-potable lines (e.g. sewer, backwash and recycled water lines) shall cross under the water lines. All crossings shall be made at a ninety degree (90°) angle unless otherwise approved by the District. No connection joints are allowed in a potable pipeline within eight (8) horizontal feet of the non-potable pipeline. All sewer/water crossings shall conform to California State Water Resources Control Board, and District standards and regulations, utilizing whichever is more stringent. All parallel and crossing utilities shall follow KMPUD Standards (KMW011 and KMW011A).

Unless otherwise approved by the District, all sewer locations shall not interfere with other existing utilities. Horizontal curves may only be allowed on pipe sizes eight inches (8") and larger but are not encouraged except where necessary to maintain required clearance from water pipelines. The minimum curve radius for sewers shall conform to the manufacturer's minimum recommendations. District approval of all horizontal curved sewer designs is required. Vertical curves shall not be permitted within sewer systems except with District approval in writing. Application for exceptions shall be in writing prior to plan check submittal and

include justification. The minimum depth of cover over the sewer pipeline should be sufficient to serve adjacent properties, where practical. Sewer installations near water pipelines shall be in accordance with State Department of Health Services, Title 17 & 22, or the District's criteria, whichever is most restrictive.

One hundred feet (100') of horizontal separation shall be provided from wastewater mains to any wells, being potable, non-potable, or water quality monitoring wells. Twenty-five feet (25') of horizontal separation shall be provided from wastewater mains to the nearest edge of any underground hazardous material storage tank.

Wastewater distribution lines shall be looped and connected wherever possible by development, even if outside the boundaries of the development and where required by the District. In all cases, wastewater lines shall be extended to the property lines of the development along all access roads or routes, where looping is possible, and where potential future development or connections may exist.

When an area outside the development, but in reasonably close proximity as determined by KMPUD staff, can be logically served by future extension of a proposed sewer, the sewer pipeline shall extend to the tract boundary or to the end of a paved street in a manner to facilitate the future extension and include any necessary diameter over sizing and extra depth.

Private or non-District facilities, service lines or other appurtenances shall not be allowed within District trench sections, without written approval from the District.

1.6.2. Service Lines

Service lines from the wastewater main to the property line or edge of easement shall normally be installed at the time the main is constructed. Service lines from mains installed in private roads shall extend one foot (1') beyond the edge of the pavement. Service boxes shall not be located in driveways unless they are H-20 traffic rated. An accessible walking path, from the street to each service box shall be provided with a maximum ten-percent (10%) slope.

Service lines shall be placed grouped at property lines and not placed on property lines having other utilities if possible. Service lines shall have a maximum length of one hundred lineal feet (100 LF). Manifold services to more than one parcel shall not be permitted. Services and service lines shall not serve multiple parcels. Services shall not cross property lines, other than the parcel to be served, even if the current ownership is the same.

For multi-family, commercial and industrial customers, each unit shall have a separate service.

1.6.3. Line Valves

The wastewater system shall be equipped with a sufficient number of line valves so that no single shut-down will result in shutting down a pressurized transmission main of more than one thousand feet (1,000') or necessitate the removal from service of length of pipe greater than five hundred feet (500') in other areas.

Valves shall preferably be located at street intersections. If it is necessary to install valves between street intersections, they shall be located on property lines.

All valves shall be flanged or flange x M.J. Valves are required on all sides of tees and crosses. Use three (3) valves on all tees and four (4) valves on all crosses. Exceptions shall be shown on the plans and approved by the District.

Valve size shall conform to pipe size, unless clearly stated and approved otherwise on the plans. Ten inch (10") and smaller valves shall be gate type. Twelve inch (12") and larger valves shall be plug type. Valves sixteen inches (16") and larger shall have a two inch (2") minimum bypass valve.

1.6.4. Combination Air-Vacuum Release Valve (CAVRV)

A combination air-vacuum release valve, with specific suitability and design for wastewater systems, shall be installed at all high points, of force mains and between valved sections of pipe as determined by the District. CAVRV installations shall be designed by a California Registered Professional Engineer and submitted to KMPUD for approval.

Charcoal lined lids or other suitable measures approved by the District for odor control shall be installed at all CAVRVs. Lids must be placed flush against a factory edge for proper attachment to the riser. Cut riser edges are not permitted.

1.7. Minimum Lift Station Requirements

- Lift stations shall be designed and installed with reliable or firm capacity design constraints. Reliable or firm capacity shall be full design capacity with the largest pump out of service.
- Inlet and outlet piping shall be PC 350 ductile iron or welded steel, with isolation valves on all inlet and outlet piping. All exposed piping shall have adequately sized and located thrust blocks. A check valve isolated by shut off valves is required on all inlet and outlet piping.
- Minimum storage capacity shall be one hundred and twenty-five percent (125%) of the anticipated, ultimate average daily flow, or one hundred and twenty-five percent (125%) of the required storage to account for loading, whichever is greater.
- Fall protection shall be provided where appropriate.
- Connectivity to District SCADA systems, and a backup transmitter shall be provided for systems communications.
- SCADA controls operating with the District SCADA system and compliant with District SCADA Standards shall be provided. All equipment shall be remotely controlled and alarmed via SCADA.
- Level sensing shall be via transducers. Additionally, a backup alarm system connected to an auto-dialer with battery back-up shall also be provided.
- Three phase power shall be brought to the site. The service shall be sized to allow startup of the largest pump, with all other equipment running.
- All electrical equipment shall be placed in minimum NEMA 4x rated enclosures.
- Arc Flash certification, labeling and working space requirements shall be provided.

- All above grade electrical conduit shall be PVC coated rigid conduit.
- Provide sun and weather protection as appropriate for all equipment and working spaces.
- Surge protection and lightning arrestors shall be provided.
- All lift station sites shall be equipped with inlet and outlet magnetic flow meters connected to District SCADA.
- Sufficient interior and exterior lighting shall be provided for District staff to perform night work. Interior and exterior receptacles shall be provided.
- The entire site shall be paved with a minimum of a) two inches (2") of Asphalt Concrete over five inches (5") of Class II Aggregate Base or b) four inches (4") of Portland Cement Concrete, or thicker, as determined by the site geotechnical report.
- The site shall be accessible either via a minimum twelve foot (12') commercial driveway with a hammerhead turnaround and constructed of a) two inches (2") of Asphalt Concrete over five inches (5") of Class II Aggregate Base or b) four inches (4") of Portland Cement Concrete. The driveway shall be accessible from a PUE or access easement dedicated to the District.
- The site shall be a separate lot deeded to the District and clear title shall be provided. The site shall be sized to allow for twenty feet (20') level clearance on all sides from any equipment, buildings, fencing or piping, and shall include an entire replacement site immediately adjacent to, in conjunction with and suitable for replacement of the entire facility.
- Complete as-built and O&M manuals shall be submitted to the District and the Contractor shall provide all training necessary for maintenance and operation of facility.

1.7.1. Minimum Lift Station Requirements

- Full size redundant/backup domestic pumps shall be installed, for a minimum of two full size domestic pumps. Pumps shall be designed for maximum use with largest unit out of service. Pumps shall operate lead-lag and cycle the lead pump.
- Pumps and Motors shall have a minimum combined efficiency of eighty percent (80%). All pumps shall be VFD controlled. Pumps shall run in automatic or hand mode.
- Rubber expansion joints are required on all suction and discharge piping.
- Full size pump bypass piping is required.
- Pumps, VFD's and pump control wiring shall be installed in a fully enclosed, secure, sound attenuated and waterproof concrete or CMU building. A maximum of 60 dBA at the nearest property line is allowed. Minimum three foot (3') working spaces shall be provided in front of all equipment and on three sides of all pumps. Minimum five foot (5') working spaces shall be provided in front of all electrical equipment.

Technical Standards

2. Construction Specifications

2.1. Gravity Collection Lines

2.1.1. Small Diameter PVC

Collection Lines sized three through fifteen inches(3-15") shall conform to ASTM D3034.

2.1.2. Larger Diameter PVC

Collection Lines sized eighteen through twenty-four inches (18-24") shall conform to ASTM F679.

2.1.3. Joints

Joints between PVC pipe and fittings shall be slip-on type and shall be sealed by means of rubber rings designated for use with the type of pipe being installed and conforming to ASTM D 3212 and F 477 or F 913.

Use of Calder type couplings shall not be permitted.

Joints between PVC and other types of pipe shall be made by means of the proper sized compression type adapter.

2.1.4. Fittings

Fittings for pipe four through twelve inches (4-12") shall conform to the same requirements as the pipe being used in the collection.

Fittings for pipe fourteen through twenty-four inches (14-24") shall be fabricated of the same material as the pipe and shall comply with ASTM F 679.

All ninety degree (90°) bends shall be long radius sweeps, "hard" ninety degree (90°) fittings shall not be permitted.

2.1.5. Mandrel for Field Testing of Pipe Deflection

The mandrel shall:

- Be a rigid, nonadjustable, odd-numbering-leg (nine legs minimum) mandrel having an effective length not less than its nominal diameter.
- Be fabricated of steel; be fitted with pulling rings at each end; be stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel OD (e.g., PVC, D 3034-8"-7.524"); and be furnished in a carrying case labeled with the same data as stamped or engraved on the mandrel.
- All costs incurred by the Contractor attributable to mandrel and deflection testing, including any delays, shall be borne by the Contractor at no cost to the District.

- Have a minimum mandrel diameter of 0.125" less than the pipe inside diameter.

2.1.6. Polyvinyl Chloride (PVC) Pressure Pipe – C900

PVC C900 shall also be permitted for Gravity Collection Lines upon written approval from the District. See Section 2.2 for requirements.

2.2. Force Mains

2.2.1. Small and Large Diameter PVC

Force Mains sized four through twenty-four inches (4-24") shall conform to AWWA C900 standards and Section 1.4.4.

2.2.2. Joints

Lengths of PVC shall be joined by a locked-in flexible elastomeric gasket coupling with bell and spigot configuration.

Joints between PVC pipe and fittings shall be slip-on type or mechanical type as shown on the plans. Slip-on type joints shall be sealed by means of rubber rings designated for use with the type of pipe being installed. Use of Caulder-couplings shall not be permitted.

Joints between PVC pipe and other types of pipe shall be made by means of the proper sized compression type adapter.

2.2.3. Ductile Iron Fittings

Fittings shall conform to AWWA C110 with a minimum pressure rating of two hundred and fifty (250) psi. Size bells specifically for OD of cast iron equivalent PVC pipe including rubber ring retaining groove. Mechanical joint fittings conforming to AWWA C153 may be used in lieu of AWWA C110 fittings. Mechanical joint ductile-iron fittings conforming to AWWA C110 (except for laying length) with a minimum pressure rating of two hundred and fifty (250) psi may also be used. Fittings shall be cement-mortar lined per AWWA C104, protected with bituminous coating, or fusion bonded epoxy lined and coated fabricated steel fittings.

Injection-molded, PVC, PC 235, gasketed fittings conforming to AWWA C907-04 shall be permitted in PC 235 applications from sizes four inch (4") to twelve inch (12"). Fabricated PVC fittings shall not be permitted.

2.2.4. Coatings

Above ground pipe, exposed pipe, in vault pipe, or pipe and fittings not otherwise buried shall be Epoxy Coated.

2.2.5. Restrained Joint Pipe

Provide Restrained Joint Pipe where restrained joints are specifically shown on the drawings or otherwise required. Restrained joints shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets)

for the restraining device. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial.

Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51 or PVC manufactured in accordance with AWWA C900 or C905. PVC bell restraints will not be allowed. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11 "Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings". Any pipe restraint in lieu of thrust blocks shall be designed by a California Registered Professional Engineer in accordance with applicable standards, guidelines and actual field soil and laying conditions. Restraint lengths and other requirements shall be clearly noted on the Drawings.

Restrained joint fittings and the restraining components shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.0 and/or C153/A21.53 with the exception of the manufacturer's proprietary design dimensions. Push-on joints for such fittings shall be in accordance with ANSI/AWWA C111/A21.11.

Restrained joint glands shall be EBAA 2000PV MEGALUG for PVC, or approved equal. Restraint gaskets shall be US Pipe "FIELD LOK", or approved equal. Pressure ratings for restrained joint glands shall at a minimum equal the pressure rating of the pipe required for the installation. Requests for use of any other restraint types, such as split restraint rings, shall be submitted to the District for approval on a case-by-case basis.

2.3. Sewer Laterals

2.3.1. Material

Sewer Lateral pipe shall conform to Section 1.4.4.

2.3.2. Fittings

All PVC fittings shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld connections. Fitting shapes shall conform to ASTM D 3311 and shall be of a type recommended by the pipe manufacturer. All ninety degree (90°) bends shall be long radius sweeps, "hard" ninety degree (90°) fittings shall not be permitted. Priming and solvent welding of pipe and fittings shall be per manufacturer's recommendations.

Threaded PVC pipe shall not be used. Molded threaded adapters may be used in transition joints.

Fabricated fittings shall not be used.

2.3.3. Installation

Each wye branch fitting shall have its barrel diameter equal to the diameter of the sanitary sewer main and the spur (or branch) diameter as indicated on the plans. Do not place wye branches within five feet (5') of any structure.

Install wye fittings so that the outlet branch is inclined upward at an angle of forty-five degrees (45°). Plug wye branch fittings that are to be left unconnected with a stopper or plug. Join laterals to wye branch fittings at the sanitary sewer main by eighth bends. Eighth bends and quarter bends are a part of sewer lateral.

Where possible, laterals shall run perpendicular to the sewer main at a minimum grade of two and a half percent (2.5%). Bed laterals the same as the sewer main into which they connect.

Plug laterals with stopper in the socket of the last joint. Seal stopper in place so that it will withstand the internal pressure during the test for leakage and so that it may be removed without damage to the socket.

2.4. Building Sewer

2.4.1. Joints & Fittings

Building sewer materials shall conform to Section 1.5.3.

2.4.2. Installation

Building sewer lines shall be assembled, inspected and installed per this standard, ASTM D 2321 and state and local requirements.

2.5. Valves and Appurtenances

2.5.1. Valves – Mains and Laterals

Valve installations shall be designed by a California registered Professional Engineer and reviewed for approval by the District. District staff should be consulted in the early planning stages to assess the need for such installations and to develop the site-specific design criteria, which shall be determined solely by the District.

2.5.2. Gate Valves

Gate valves shall be allowed on raw sewage collection lines and raw sewage force mains that are four inches (4") to ten inches (10") in diameter.

Gate valves shall be resilient seated wedge type, two hundred (200) psi WOG rated, conform to AWWA specification C509 and shall be mechanical joint, flanged, or mechanical joint by flanged type as required. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded epoxy coating, which shall be a minimum of eight (8) mils thick and per AWWA C550. Valves shall have a smooth inside bore on the bottom half so that sediment cannot accumulate. Valves shall open counter-clockwise, have a non-rising stem and a two inch (2") square operating nut that is accessible through a valve box.

Stems shall be Type 304 or 316 stainless steel. Stem nuts shall be made of stainless steel or solid bronze. Bronze shall be a low-zinc alloy conforming to ASTM B 61 or ASTM B 584 (Alloy C92200) or ASTM B 62 or ASTM B 584 (Alloy C83600).

End connections for exposed gate valves shall be flanged.

2.5.3. Eccentric Plug Valves

Plug valves shall only be allowed on raw sewage collection lines and force mains.

Plug Valves shall be eccentric type and shall comply with MSS SP-108 and the following. Provide a rectangular plug design, with an associated rectangular seat. Provide bidirectional seating design. The valve shall seat with the rated pressure both upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.

The metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs which result in there being a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Sleeve bearings shall be stainless steel. Provide enclosed worm gear actuators for valves 6 inches and larger. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded epoxy coating, which shall be a minimum of eight (8) mils thick and per AWWA C550. Eccentric plug valves, four inches (4") through twelve inches (12"), shall be nonlubricated type. Minimum pressure rating shall be one hundred and seventy-five (175) psi. Bodies shall be cast iron per ASTM A 126, Class B. Ends shall be flanged, Class 125 per ANSI B16.1. Plugs shall be cast iron (ASTM A 126, Class B), or ductile iron (ASTM A 536, Grade 65-45-12) with Buna-N facing. Valve body seats shall be Type 304 or 316 stainless steel or have a raised welded-in overlay at least one-eighth inch (1/8") thick of not less than ninety percent (90%) nickel. Body cap screws and bolts and nuts shall be Type 316 stainless steel. Packing shall be butadiene-filled Teflon. Valves shall be DeZurik, Clow or equal.

2.5.4. Check Valves

2.5.4.1. Swing Check Valves

Swing check valves shall only be allowed on backflow prevention devices and shall be stainless steel with threaded connections. Valve shall be a stainless steel swing check with removable flapper and self-lubricating hinge. Valve shall be watertight with a ten-foot (10') water column. The valve shall have a quick-open inspection cover and be installed in a valve access box for ease of inspection. Utility box shall be a minimum twenty-four inches by eighteen inches (24" x 18") with extensions as required and a lid to be installed at grade. Box shall be pre-cast concrete or fiber-lite.

Boxes for backflow prevention at lift stations shall be Hot Box brand.

Swing check valves shall have cast ductile iron (ASTM A 48, Class 30, or ASTM A 126, Class B) body and cover. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded epoxy coating, which shall be a minimum of eight (8) mils thick and per AWWA C550. The flapper shall consist of a steel disc insert and a stainless steel shaft (hinge pin) supported by stainless steel or polymer bearings and sealed by an adjustable packing gland. The seat ring shall be stainless steel and a Buna-N seal shall be furnished to provide zero leakage and shall be vulcanized to the flapper plate. Valve shall be designed for a minimum working pressure

of not less than one hundred seventy-five (175) psi, or fifty (50) psi higher than static pressures, and tested at three hundred fifty (350) psi. They shall be of the balanced, swing gate type with a clear opening at least equal to that of the connecting pipe and shall have an external lever and counter weight. Cast in place or pre-cast concrete vaults will be required for all buried swing check valve installations. Swing check valves shall be Cla-Val Series 501A or equal.

2.5.4.2. Globe Check Valves

Globe check valves shall be allowed on raw sewage collection lines and raw sewage force mains.

Globe check valves shall have a cast iron (ASTM A 48, Class 30, or ASTM A 126, Class B) body, stainless steel seat and disc, and stainless steel spring. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded epoxy coating, which shall be a minimum of eight (8) mils thick and per AWWA C550. The valve disc shall be center guided at both ends with an integral shaft and shall be spring loaded with a helical or conical spring. The flow area through the body shall be equal to or greater than the cross-section area of the equivalent pipe size. Globe check valves shall be Flomatic 402ST or equal.

2.5.4.3. Ball Check Valves

Ball check valves shall be allowed on raw sewage collection lines and raw sewage force mains.

Ball check valves shall have a cast iron (ASTM A 48, Class 30, or ASTM A 126, Class B) body. All interior ferrous surfaces shall be protected against corrosion by factory applied fusion-bonded epoxy coating, which shall be a minimum of eight (8) mils thick and per AWWA C550. The ball shall be Type 316 stainless steel and upon discontinuation of flow, automatically roll back to the closed position, providing a positive seal against back pressure or backflow. Ball check valves shall be Flomatic Model 408 or equal.

2.5.5. Combination Air and Vacuum Release Valves (CAVRV)

Combination air and vacuum release valves shall combine the operation features of both a vacuum valve and an air release valve in one housing. The inlet and outlet of the valve shall have the same cross-sectional area. The float shall be guided by a stainless steel guide shaft and seat drip-tight against a synthetic rubber seal. The float shall be of all stainless steel construction and capable of withstanding maximum system surge pressure without failure. The body and cover shall be cast iron (ASTM A 48, Class 30, or ASTM A 126, Class B) and concentrically located and the valve internal parts shall be of stainless steel with Buna-N rubber seat. Combination air and vacuum release valves shall be Cla-Val, or equal.

Provide one inch (1") CAVRV on line sizes up to three inches (3"), two inch (2") CAVRV on line sizes four inches (4") to ten inches (10") and three inch (3") CAVRV

on line sizes greater than ten inches (10"+). The CAVRV size shall be approved by the District.

Pipe taps for CAVRV shall always be at actual high points of wastewater lines.

2.5.6. Nuts and Bolts

Nuts and bolts, not specified elsewhere, shall be cadmium plated, zinc coated or Grade 2. They shall be coated with "Loctite" anti-seize. The bolt shall extend at least three (3) threads through the nut and no more than one half inch ($\frac{1}{2}$ ").

2.5.7. Plastic Film Wrap

This wrap shall be used around all buried valves, bolted flanges and other fittings. The polyethylene film shall be of virgin polyethylene as produced from DuPont Alathon resin and shall meet the requirements of ASTM D3350 or AWWA C105, and shall have a flow rate or nominal melt index of 0.4 g/min maximum.

The polyethylene film shall be colored 'green' and a minimum six (6) mils in thickness. The length shall be sufficient to firmly attach the film to the pipe on either side of the valve, flange or fitting with ten (10) mil tape. Plastic film wrap shall be completely sealed on all ends, edges, cuts and seams with ten (10) mil tape.

2.5.8. Valve Boxes

Valve boxes shall be provided for all underground valves and shall be pre-cast concrete. Christy G05 or equal. Lids shall be cast iron traffic type G5C and marked "SEWER." If noted on the plans additional markings may be necessary.

2.5.9. Valve Riser Extensions

Eight inch (8") diameter PVC conforming to AWWA C900 water pipe or SDR-26 sewer pipe shall be used and installed as shown on Standard Drawing KMS004.

2.5.10. Vaults

Cast in place or pre-cast concrete vaults will be required for all buried valves and appurtenances. Valve vaults shall provide twenty-four inches (24") minimum clearance from the inner wall of the vault to any piping, valves or appurtenances. Traffic rated lids shall be used in all traffic areas. Lids weighing over fifty (50) lbs. shall be equipped with mechanical lift assistance devices so that no more than fifty (50) lbs. of effort is required to open the lids. All vaults and boxes shall have a twelve inch by twelve inch (12" x 12") concrete collar with two horizontal #4 rebar placed vertically four inches (4") apart and four inches (4") from any edge. The exterior and interior of all vaults shall be thoroughly coated with Thoroseal (MasterSeal 581) or equal.

2.5.11. Locating Cable & Locator Tape

Direct burial green copper wire solid, Soft Drawn No. 10 insulated, shall be taped to the top of pipe every ten feet (10') before backfilling. 8 mil utility tape shall be used. The wire shall be procured from the vendor complete with an approved splice and insulation kit and cable joints shall be spliced in accordance with the manufacturer's instruction to form a set of continuous electrical conductors

throughout the pipe system. Where pipe branches occur, the wire shall be branched also so that wire is provided to each valve and to the locating wire of the branch if the existing branch has one.

All sewer pipe shall be marked with a three inch (3") green metallic locator tape, located twelve inch (12") directly above the pipe and bedding material. The tape shall be marked with one and a half inch (1½") black "CAUTION – SEWER LINE BURIED BELOW" lettering and be placed face up in the trench.

2.5.12. Manholes

All manholes shall be precast units and shall be manufactured and tested in accordance with ASTM C 478. Where precast units are not possible, written permission shall be required from the District. Riser sections shall be reinforced in accordance with ASTM C 478 and shall have a minimum wall thickness of five inches (5"). All cones shall be of the eccentric type and shall be reinforced with a minimum wall thickness of five inches (5"). All reinforcement shall have a minimum of two inches (2") of cover.

Joints shall be tongue & groove conforming to ASTM C 478 Section 14. All joints shall be sealed with a preformed plastic or rubber ring to form a water-tight seal. Rubber boot and stainless steel clamps, meeting the requirements of ASTM C 923 shall be supplied with the manhole bases to tie the pipe to the base section of the manhole.

Manhole bases, sections, grade rings, eccentric cones, covers, etc. shall all be made by the same manufacturer for each complete manhole.

The exterior and interior of grade rings, cones and rims shall be coated Thoroseal (MasterSeal 581) or equal. The interior of manholes with turbulent flows (e.g. drops, right angles, force main terminations, etc.) shall be coated and sealed with 100 mils of Hydro-Pox 204 UHB or equal.

See Standard Drawings KMS005 and KMS006.

2.5.12.1. Drop Sewer Manholes

Drop sewer manholes shall be required on all force main outlets, drops greater than twenty-four inches (24") and wherever necessary, as determined by the District. Manholes shall be precast units. All of the pipe for the sewer and the drop inlet shall be the same material as the sewer. Where two or more drop inlets are required in a single manhole, each drop inlet shall be constructed as a separate drop inlet.

See Standard Drawing KMS007.

2.5.12.2. Manhole Bases

Pre-cast manhole bases shall be a minimum six inches (6") thick. The depth of channel shall equal the pipe diameter for all sizes of pipe. Bedding for bases shall be a minimum of six inches (6") of three-fourths inch (¾") crushed rock. Manhole bases shall be of the precast type where possible.

Precast manhole bases shall conform to ASTM C 478 and shall have a minimum cover of the reinforcing steel of two inches (2").

Cast-in-place manhole bases shall be constructed of a minimum 3,500 psi concrete and shall be poured in one operation. Concrete finish of shelves shall be a rough broom finish or other non-skid finish as approved by the District.

See Standard Drawing KMS008.

2.5.12.3. Manhole Covers

Manhole covers shall be PAMTIGHT access covers or approved equal.

Joints between manhole risers and rims shall be made watertight and sealed with rubber rings or Sauereisen Manhole Chimney seal No. F-88 or equal.

2.5.12.4. Existing Manholes

Contractors may reuse the existing manhole frames and covers where they comply with current KMPUD standards and where they are undamaged as determined by the District. Existing steps located within removal limits shall be removed. Precast concrete manholes may be raised only by the use of grade rings with not more than two inches (2") of new mortar (1 part cement to 2.5 parts sand ratio) used for final adjustment. Precast manholes may be lowered by the removal of grade rings where not more than two inches (2") of new, Class "D" mortar per the "Greenbook" Standard Specifications for Public Works Construction 2021, is used for final adjustment. In no case shall removal of grade rings result in a shaft height less than twelve inches (12").

Breaking into existing manholes shall be accomplished by a core cut hole made with equipment specially designed to cut a smooth hole without spalling or damage to the reinforcing steel or structure. New stub invert elevations shall be a minimum of 0.10 feet higher than the existing outlet invert elevation. Sealing of penetrations may be accomplished by the use of Class "D" mortar per the "Greenbook" Standard Specifications for Public Works Construction 2021 or a flexible pipe-to-manhole connector such as KOR-N-SEAL, PSX or equal. The connector shall comply with ASTM C 923 and consist of EPDM and 304 stainless steel.

2.5.13. Sewer Cleanouts

A two-way sewer cleanout shall be installed a maximum of five feet (5') from the building and spaced every one-hundred feet (100') as measured from the initial building cleanout. Cleanouts are also required following all bends of twenty-two degrees (22°) or greater.

All cleanouts shall be constructed with standard fittings and have a screw cap located at or just below the final grade or paving surface. The frame and cover of all cleanouts shall be adjusted to match finish grade. Cleanouts shall have water proof frames and covers. Cleanouts on sanitary mainlines are prohibited.

Cleanouts shall be a minimum pipe diameter of three inches (3") and be SDR-26, schedule 40 PVC or ABS. Details are shown on Standard Drawing KMS009.

2.5.14. Sewer Flushing Inlets

Sewer flushing inlets shall be installed a maximum of five feet (5') from the wastewater pumping station and spaced every one-thousand feet (1,000') as measured from the initial flushing inlet. Flushing inlets are also required following all bends of twenty-two degrees (22°) or greater.

Flushing inlets shall be located at the edge of the road and within five-hundred feet (500') of a fire hydrant.

Flushing inlets shall be a minimum pipe diameter of two inches (2"), and be C900, schedule 80 or greater. Details are shown on Standard Drawing KMS010.

2.5.15. Waste Interceptors

Grease, oil-sand or other interceptors shall be provided for the proper handling of liquid wastes containing grease, oil, flammable wastes, lint, unprocessed food, solids, particulates or other constituents which may be harmful to or cause obstruction of the District's wastewater system. All interceptors shall be of a type and capacity in accordance with Section 1.2 and approved by the District. Interceptors shall be located as to be easily accessible for cleaning and inspection, constructed of impervious materials capable of withstanding abrupt and extreme changes in temperature. They shall be of substantial construction, watertight and equipped with easily removable covers which, when bolted in place, shall be gastight and watertight. A clean out or inspection tee shall be provided within two feet of inlet and outlet piping. Fiberglass tanks or vaults shall not be permitted. All interceptors shall be properly vented. The exterior of all interceptors shall be thoroughly coated with Thoroseal (MasterSeal 581) or equal.

The owner/lessee shall be jointly and severally responsible for the efficient cleaning and maintenance of the interceptor. The interceptor shall be placed in continuous efficient operation at all times. The interceptor shall be completely cleaned when grease, oil and solids occupy twenty-five percent (25%) of the holding capacity. The owner/lessee shall inspect interceptors monthly or more frequently if required by the District. Maintenance records shall be kept on site for at least three years.

No grey water from toilets, urinals, bathroom sinks or similar fixtures shall flow through interceptors. Interceptors shall not be installed in drive-through driveway locations or require the use of ladders or the removal of bulky equipment such as dumpsters.

The waste discharge from all facilities will be evaluated by the District to determine if other more appropriate interceptors shall be required.

2.5.15.1. Grease Interceptors

All drains from the kitchen, food preparation and dishwashing areas shall be connected to the grease interceptor. Fixtures to be connected include,

but are not limited to, scullery sinks, pot and pan sinks, garbage disposals, food waste disposal units, dishwashing and sanitizing machines, soup kettles and floor drains located in areas where grease containing material may exist. Grease traps are not allowed.

The minimum grease interceptor size is one thousand five hundred (1,500) gallon capacity.

Grease interceptors shall not be located in a food or utensil handling area.

See Standard Drawing KMS011.

2.5.15.2. Oil-Sand Interceptors

Oil-sand interceptors are required for any business that stores, washes, repairs, fuels or services motor vehicles or any similar facility which may introduce sand or oil into the wastewater system. Oil-sand traps will not be allowed.

The minimum oil-sand interceptor size is one thousand (1,000) gallon capacity.

See Standard Drawing KMS012.

2.5.16. Gaskets

Gaskets for fittings in wastewater applications shall be NBR or Neoprene

2.5.16.1. Flange Fitting Gaskets

Flange gaskets shall be "full face" and one eighth inch (1/8") thick. Flanged gaskets shall be U.S. Pipe FLANGE-TYTE II or pre-approved equal. The flange face shall be free of any foreign matter and/or rough surface.

2.6. Installation and Testing

2.6.1. Laying of Pipe

Pipe trenching and/or excavations shall not be permitted until the site has been brought to finish grade or the roadway has been brought to subgrade.

Pipe shall be laid and joined in accordance with the manufacturer's and/or KMPUD Inspector's directions, whichever is more stringent. Necessary facilities including slings shall be provided for lowering and properly placing pipe sections into the trench without damage.

Each section of pipe shall be thoroughly cleaned before it is lowered into the trench.

If clean pipe sections and fittings cannot be placed in the trench without getting foreign material into open pipe, the KMPUD Inspector may require protection of the ends of the pipe or fitting until it has been lowered into position in the trench. After the pipe has been lowered into the trench, all foreign matter shall be completely removed from the pipe before assembly.

The pipe shall be cut to provide closure pieces of correct lengths to permit the proper location of the pipe sections, or to locate valves, fittings and appurtenant structures where specified on plans.

The pipe and fittings shall be laid to the lines and grades specified on the plans and centered in the trench. Where pipe slopes are greater than ten percent (10%), pipe shall be laid uphill. Provide cut-off walls every two hundred feet (200') for slopes in between ten percent (10%) and twenty percent (20%), and every one hundred feet (100') for slopes greater than twenty percent (20%).

For force mains, all horizontal and/or vertical bends greater than or equal to eleven and one fourth ($11\frac{1}{4}$) degrees shall have thrust blocks as shown on Standard Drawing KMS015.

The alignment and elevation of the pipeline as shown on the drawings shall be designed to avoid conflict with new and existing underground utilities.

Trenches must be kept dry until pipe has been laid, joints closed and backfill completed to a depth of one foot (1') above top of pipe. Crushed rock for drainage and/or bedding shall be provided as necessary.

Temporary water tight plugs shall be provided for closure of the open ends of the pipelines each time pipe laying activity stops and at the end of each working day to prevent the entry of dirt and/or other contaminants. Plywood and plastic film shall not be acceptable means of closure.

2.6.2. Connections to Existing Pipelines

All connections to existing pipelines shall be made as shown on the plans and in accordance with these Specifications.

Where the existing main is provided with fittings for connecting to the new main, the face of the connection shall be clean and free of all foreign materials. The Contractor shall remove the plug, cap or blind flange, clean the ends and make the new joint.

Where the existing main is not provided with fittings for connecting to the new main, connections shall be made either by hot tap or by cutting and inserting sections of pipe and fittings, as shown on the plans or as directed by the KMPUD Inspector.

For hot tap installations, the tapping saddle shall have a test plug and shall be air tested at fifty (50) PSI for five (5) minutes. Tapping valves shall be flange by flange. All hot taps shall be witnessed by the KMPUD Inspector.

When deemed necessary by the KMPUD Inspector, shutdowns of existing in-service pipeline and other collection facilities shall be made by the District as required to complete pipeline connections. A shutdown shall be only for as short a period of time as necessary. This varies with each job and must be planned accordingly. Unless dictated by wastewater system consideration, or emergencies, in no case will a shutdown and/or connection be scheduled with less than ten (10) days' notice. Interference with the operation of the District's collection system shall be kept at a minimum. While an existing pipeline is shut down, the

connection work shall be performed without interruption, continuing after regular working hours if necessary, until completed, unless otherwise directed by the KMPUD Inspector. In some cases, shutdowns must occur at times other than normal working hours and/or days. Shutdowns shall not be scheduled Fridays through Mondays. All costs for labor, equipment and meals shall be the responsibility of the Contractor.

In all cases, shutdowns shall be made under the direction of the KMPUD Inspector. The District shall close all valves in making a shutdown and shall open all valves to restore the existing main, as well as initiate service to the new installation.

The KMPUD Inspector shall be notified at least ten (10) working days prior to any connection so that advance preparation on the part of the District can be made and shall confirm such advance notice in writing. In no case shall any connection operations occur prior to passing pressure tests.

2.6.3. Abandonment of Existing Facilities

Existing facilities shall be abandoned as indicated on the plans and specifications. Ends of pipelines four inches (4") and larger to be abandoned in place shall be plugged with concrete for a distance of not less than twelve inches (12"), unless otherwise shown on the plans. Valve boxes to be abandoned shall be removed and the valve risers shall be filled with concrete.

2.6.4. Hydrostatic Testing

The KMPUD Inspector shall be notified forty-eight (48) hours prior to testing and must approve any wastewater placement in any portion of the pipeline. All lines shall be cleaned via a ball and flush method prior to hydrostatic testing. The contractor shall remove and dispose of all debris generated during the cleaning process. All testing shall occur in the presence of a KMPUD Inspector or be subject to re-testing or rejection.

Building sewer lines, gravity collection lines and sewer service laterals shall be air or water tested for leakage. The internal pressure in the pipe shall be raised to five (5) psi and maintained for five (5) minutes. Any pressure loss over the five (5) minute period is unacceptable.

For pressurized pipelines, the pressure shall then be slowly increased to not less than: one hundred fifty (150) psi, one hundred fifty percent (150%) of the working pressure measured at the lowest elevation of the test section, or one hundred twenty-five percent (125%) of the working pressure measured at the highest elevation of the test section, whichever is greater. Pipeline design and installation shall account for pipelines operating continuously at this test pressure. The test pressure shall not exceed the thrust restraint design pressures, the rated pressure of closed valves, or 1.5 times the pressure rating of the pipe or joint, whichever is less, as specified by the manufacturer or Engineer. The test pressure shall be maintained in the line for the test period of two (2) hours.

During the test, any leakage or drop in pressure, shall constitute a failed test. All pipelines with failed tests shall be repaired, regardless of the amount of loss, at the

Contractor's expense. All leaks shall be repaired, regardless of the amount of leakage, at the Contractor's expense.

After successful completion of the hydrostatic test, the Contractor shall flush the pipeline for a minimum of thirty (30) minutes prior to video testing. The Contractor shall make the necessary piping connections and furnish and install all necessary equipment required for the high velocity flushing operations. The Contractor shall provide for safe and legal disposal of water from such flushing. The Contractor shall remove all temporary flushing facilities.

All or part of the pipeline may be drained as necessary to repair leaks. All leaks shall be repaired in a manner approved by the KMPUD Inspector and retested before acceptance by KMPUD. The Contractor shall provide all labor, equipment and materials required for filling, flushing and testing the pipelines.

2.6.5. Manhole Vacuum Testing

This practice covers procedures for testing precast concrete manhole sections to demonstrate the integrity of the installed materials and the construction procedures. This practice is used for testing concrete manhole sections utilizing mortar, mastic or gasketed joints.

Preparation of the manhole shall include plugging all lift holes and pipes entering the manhole. Care shall be taken to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

The test head shall be placed at the top of the cone of the manhole in accordance with the manufacturers' recommendations. A vacuum of nine and a half (9.5) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed and the vacuum pump shut off. The time shall be measured for the vacuum to drop to nine (9) inches of mercury. The manhole shall pass if the time for the vacuum reading to drop from nine and a half inches (9.5") of mercury to nine inches (9") of mercury meets or exceeds one minute.

If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained. Use or failure of this vacuum test shall not preclude acceptance by appropriate water infiltration or exfiltration testing, (See Practice C969), or other means.

2.6.6. Video Testing

The Contractor shall video all sewer collectors and laterals prior to pavement placement in accordance with the following.

The complete job is ready for television inspection when the following work has been completed and inspected by the District.

- All sewer pipelines are installed, backfilled and compacted.
- All manholes are in place and pipelines are accessible from manholes and pressure testing of pipelines and vacuum testing of manholes is completed.
- All other underground facilities, utility piping and conduits are installed.

- Final street subgrade is complete.
- Pipelines to be inspected have been cleaned and flushed for a minimum of 30 minutes per Section 2.6.4.

After the above work is complete, the Contractor shall schedule the video inspection. The video test shall be done in the presence of the District Inspector. Water is to flow through the lines for twelve (12) hours prior to the video work. During the video for service, some water must be flowing for camera orientation. The camera shall have a device to measure depths.

Contractor shall prepare and deliver an electronic copy of the video to the District. Should any corrective action be necessary, the District reserves the right to require another test of any repair, and the deficient areas shall be video tested again after the repairs are completed.

Observations from video inspections that will be considered defects and will require correction prior to paving include, but are not limited to:

- Low spots, one fourth inch (1/4") or greater.
- Offset pipe, joint separations.
- Cocked joints.
- Cracked, "ovalled", "egged" or otherwise damaged pipe.
- Infiltration.
- Debris or other foreign matter.
- Irregular condition without logical explanation.
- Standing water in service laterals.
- Other obvious deficiencies.

The Contractor shall also video all sewer collectors and laterals eleven (11) months after the wastewater system has been accepted, in accordance with the above conditions. The District shall be notified a minimum of seventy-two (72) hours before video of the system. The wastewater video shall be provided to the District by the Contractor no later than forty-eight (48) hours after completion of the video. Any defects observed will require correction and repair prior to the release of the warranty bond.

2.6.7. Continuity Testing

The Contractor shall test for the continuity of the locating wire at time of final walk-thru. The Contractor shall provide all labor, equipment and materials required for testing the continuity of the locating wire. Continuity testing shall be performed in the presence of the District Inspector. Should continuity not be present and/or observed, the Contractor shall repair, replace and retest as necessary, entirely at Contractor's expense.

3. Boring, Jacking and Tunneling for Wastewater Pipe

Allowable casings for wastewater pipe shall be steel, see Standard Detail KMS014. Alternate casings may be permitted by the KMPUD if they meet or exceed steel strength specifications and pose no health or safety hazards. Lap weld or corrugated pipe shall not be used for boring nor open cut casing. Casing shall be of a size to permit installation and removal of the carrier pipe. Multiple casing installations shall conform to the latest revised copy of the California Department of Transportation’s specifications.

When practical, the bores and tunnels shall be installed before open cut carrier pipe. If (due to permits, etc.) it is not possible to install bores or tunnels at the start of construction, then one hundred feet (100') of carrier pipe at the bore pit side, and three hundred feet (300') at the receiving pit side shall not be constructed until after completion of the bore or tunnel.

State highway casing installations shall be as specified in the California Department of Transportation specifications.

3.1. Steel Casing

Fabrication of casing shall be in accordance with AWWA C200, as modified below. Casing material shall conform to ASTM A 283, Grade C; ASTM A 139, Grade B; or ASTM A 36. Spiral weld steel casing shall have three sixteenths of an inch (3/16”) maximum weld height over plate thickness. Spiral welds shall be one hundred percent (100%) of the welds.

3.1.1. Outside Diameter Tolerances

The outside diameter (O.D.) shall not vary by more than the following (percent of O.D.):

6” O.D. through 18” O.D.	+0.75%	-0.75%
20” O.D. and larger	+1.00%	-1.00%

For casing used in any one bore, maximum variation between maximum and minimum outside diameter shall not exceed a quarter inch (1/4”) for six inches (6”) O.D. to forty-eight inches (48”) O.D. and one-half inch (1/2”) for over forty-eight inches (48”) O.D.

3.1.2. Wall Thickness Tolerances

The wall thickness in any one location on the casing shall not vary from the required thickness by more than the following (percent of wall thickness):

6” through 18”	+15.0%	-10.0%
23” and larger	+17.5%	-10.0%

3.1.3. Wall Thickness Minimums

Minimum wall thickness for steel pipe casing shall be as shown on the table that follows. However, in no case shall wall thickness be less than a quarter inch (1/4").

The Contractor may select a greater thickness and diameter to accommodate the method of work, loadings involved, the site and possible interferences, but at no additional cost to KMPUD.

Lengths listed as "Maximum" may be exceeded, if ground conditions are favorable, and the KMPUD can give larger alignment tolerances than shown in the Specifications.

For six inches to forty inches (6"-40"), a heavy wall lead joint may be required due to adverse ground conditions. If a heavy wall lead joint is required, it should be ten feet (10') long, but must be one (1) diameter long, and shall have a minimum wall thickness of one and a half (1½) times the wall thickness of the casing being used.

**Minimum Casing Dimensions
(Smooth Steel Pipe)**

Diameter Pipe	Min. Casing Diameter	Length (1'-100')	Length (100'-200')	Length (Over 200')
6"	18"	¼"	Max Length 100'	
8" – 10"	20"	¼"	Max Length 120'	
12" – 14"	24"	¼"	¾"	Max Length 150'
16" – 18"	30"	¼"	¾"	Max Length 200'
20" – 26"	36"	¼"	5/16"	¾"
Over 26"	Subject to Applicant Design & KMPUD Approval			

3.1.4. Casing Surface Conditions

Casing shall be bare or coated with pneumatically applied enamel. The enamel coating is not required, but when it is used, it shall not exceed three (3) mils in thickness. No wrapped casing shall be allowed.

3.1.5. Lengths and Ends

Unless otherwise approved, the casing shall be square cut by mechanical methods. Torches held by machinery shall be considered to meet this requirement. This does not apply to field cutting. All casing lengths shall be equal to the auger length.

3.1.6. Straightness

Casing shall be measured by the cord method with either string or wire stretched taut to take out all visible sag. Maximum cord measured along the casing shall be true length x 0.02 percent. This is to be measured on actual lengths before loading for delivery to the job site.

3.1.7. Welding

All welding shall be done by qualified welders in accordance with the requirements of the American Welding Society (AWS). Welders and welding operations shall be qualified by tests as prescribed in AWS D1.1. Section 5. Proposed operators may be examined at the site of work and upon satisfactory completion of test welds, designated by the KMPUD, may be permitted to perform welding operations on the project. The Contractor shall furnish to the District upon request records the welder has been engaged in similar processes of welding for which he/she is pre-qualified for a period of six (6) months prior to the work and records of all welding test results and certifications of any welder prior to and during that period.

3.2. Grouting

Fittings shall be put at the proper position to fill all known cavities. When grouting, the road surface and the casing being installed shall be watched closely so that the road surface, casing or other structure(s) nearby, are not altered or damaged. Grouting pressure shall be the minimum pressure to feed the grout, but in no case shall it be more than four (4) PSI measured at the grouting fitting. For safety reasons, the minimum size casing allowable for inside grouting shall be thirty inches (30"). Grouting shall be necessary only if there is reason to believe that voids, exceeding one inch (1") over the outside diameter of casing or liner plate, are present. If grouting is required, grout fittings shall be at a maximum of two (2) rows. Each row shall be twenty-two and a half (22½) degrees off top center, one (1) row left and one (1) row right. If casing joints are ten feet (10') or in multiples of ten feet (10'), each row shall have fittings spaced at a minimum of ten feet (10') on centers, staggered so there is one fitting for every five lineal feet (5 LF) of casing.

If the casing joints are eight feet (8') or in multiples of eight feet (8'), each row shall have fittings spaced at a minimum of eight feet (8'), on centers, staggered so one fitting for every four lineal feet (4 LF) of casing. In tunneling, when liner plates or sets are used, the fittings shall be placed uniformly in sets, but shall not exceed the five lineal feet (5 LF) on centers specified as maximum spacing. Small casings shall be grouted from top of ground in severe conditions only, and shall be five feet (5') on centers on center line of casing. Reinforced concrete pipe (RCP) grout fittings shall be at least two feet (2') from edge of the joint. After completion of grouting, close the grout connections with cast-iron threaded plugs.

3.3. Wing Cutters/Bands/Flairs

Wing cutters, if they are used shall cut a maximum of one inch (1") larger than the casing measured on the outside diameter. Any voids that occur from the use of wing cutters are required to be grouted in accordance with Section 7.2. Bands or flairs shall not create a hole over one inch (1") larger than the outside diameter of the casing.

3.4. Jacking and Receiving Pits

The distance from the edge of the pavement to each end of the bore shall be ten feet (10') or five feet (5') beyond the outside toe of the slope. Jacking and Receiving Pits shall conform to these specifications. Where Jacking and Receiving Pits are within Caltrans or County right-of way, it shall be subject to their requirements.

All boring, jacking, and receiving pits shall be:

- A. located at least ten feet (10') from edge of pavement on conventional highways in rural areas; and
- B. located five feet (5') outside toe of slope in embankment areas; and
- C. adequately protected with fencing and/or type "K" barriers; fence shall be a minimum of six foot (6') high, in panel sections, securely fastened together with reflectors secured to the side of the fence that faces the traffic. Partially buried posts with fencing attached to form a continuous fence, with reflectors secured to the side of the fence that faces traffic may also be used; and
- D. adequately shored in accordance with Cal/OSHA or FED-OSHA.

3.5. Alignment Tolerances

The centerline of the casing shall not vary in line or grade from the desired alignment by more than one percent (1%) or one foot (1') per hundred feet (100') of casing.

3.6. Rotary Drilling

The face must be mechanically cut (not cut with fluid pressure); the water must be mixed with bentonite, as required by ground conditions; the fluid must be supplied to the face from a controlled tank; under no circumstances shall the fluid line be hooked directly to the water system or the water truck while drilling; the controlled tank must be able to mix and agitate the fluid; the controlled tank must also be capable of regulating volume and pressure; and the fluid mix shall be used only for lubrication and to bring back cuttings, not to cut the face. This method can be used for various sizes, lengths and ground conditions.

3.7. Casing Insulators/Spacers

Lined steel casing insulators with plastic runners or skids shall be used to support and insulate the carrier pipe within the casing. The size, type, spacing, installation and manufacture of these insulators shall be per the manufacturer's recommendations and these Specifications. If a discrepancy exists between the two, these Specifications shall override. Casing insulators shall be by PSI Products, Cascade Waterworks Mfg. Co., Calpico Inc., or approved equal, see Standard Drawing KMS014.

3.7.1. Band/Shell

The band, shell, or body of the insulator shall be constructed of fourteen (14) gage 304 stainless steel, or shall be hot rolled, pickled, fourteen (14) gage steel with a coating of rust-inhibiting enamel or hot fused PVC.

3.7.2. Connecting Flanges

The connecting flanges shall be of the same material as the shell and shall be ribbed or gusseted for rigidity.

3.7.3. Bolts/Studs

All bolts or studs shall be five sixteenths of an inch (5/16") or larger in diameter and shall be cadmium plated steel or stainless steel.

3.7.4. Insulating Liner

The insulator shall have an insulating liner made of Polyvinyl Chloride. It shall have a thickness of 0.090 inches or greater and shall be 85-90 durometer.

3.7.5. Skids/Runners

The insulator shall have high density plastic skids. The skids shall have a high resistance to abrasion and a low coefficient of friction. The skids may be supported by a riser to be of the same material as the shell and welded thoroughly to the shell. The skids shall be either bolted or have a stud welded connection to the shell or riser. Glued connections are not acceptable.

Skids shall be greased before installation of carrier pipe into casing.

3.8. Carrier Pipe

Carrier pipe shall be ductile iron pipe. All carrier pipe joints shall be fully restrained using a method approved by the KMPUD, see Standard Drawing KMS014. All carrier pipe shall be installed with tracer wire.

WASTEWATER STANDARD DETAILS

LIST OF FIGURES

KMS001	WASTEWATER GENERAL NOTES
KMS002	WASTEWATER SYMBOLS LEGEND
KMS003	PIPE TRENCH BEDDING AND BACK FILL
KMS004	VALVE AND LOCATING WIRE INSTALLATION
KMS005	SEWER MANHOLE
KMS006	SHALLOW SEWER MANHOLE
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KMS008	PRECAST REINFORCED CONCRETE MANHOLE BASE
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KMS013	THRUST BLOCK DETAILS
KMS014	CASING AND CARRIER PIPE



WASTEWATER STANDARD DETAILS

DATE: 9/30/18	APPROVED BY: E.M.C.	DRAWING NUMBER: KMS000
SCALE: N.T.S.	DRAWN BY: L.P.B.	

GENERAL NOTES:

- 1) THE TYPES, LOCATIONS, SIZES, AND DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE IMPROVEMENT PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY AND ARE APPROXIMATE. A REASONABLE EFFORT HAS BEEN MADE TO LOCATE AND DELINEATE ALL KNOWN UNDERGROUND FACILITIES. HOWEVER, THE ENGINEER CAN ASSUME NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THE DELINEATION OF SUCH UNDERGROUND FACILITIES, NOR THE EXISTENCE OF OTHER BURIED OBJECTS OR FACILITIES WHICH MAY BE ENCOUNTERED BUT WHICH ARE NOT SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING THE EXISTING UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS AND TO FIELD VERIFY THE EXACT LOCATION OF ALL EXISTING UTILITIES. THE CONTRACTOR SHALL EXPOSE ALL UNDERGROUND FACILITIES THAT ARE TO BE CONNECTED TO OR THAT ARE IN THE PATH OF THE PROPOSED IMPROVEMENTS FOR VERIFICATION OF LOCATION AND ELEVATION PRIOR TO THE COMMENCING OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTING THE WATER LINE AND APPURTENANCES PER THE IMPROVEMENT PLANS DESPITE THE PRESENCE OF BURIED OBJECTS OR FACILITIES WHICH WERE NOT EXPECTED TO BE ENCOUNTERED, AND THE CONTRACTOR SHALL NOT BE REIMBURSED FOR ANY EXPENSES BROUGHT UPON BY SUCH BURIED OBJECTS OR UTILITIES. THE CONTRACTOR OR ANY SUBCONTRACTOR SHALL NOTIFY UNDERGROUND SERVICES ALERT (USA) AT (800) 227-2600 IN ACCORDANCE WITH THE SPECIFICATIONS PRIOR TO ALL EXCAVATION.
- 2) KIRKWOOD MEADOWS PUBLIC UTILITY DISTRICT ("KMPUD") INSPECTOR AT (209) 258-4444. THE CONTRACTOR SHALL CONTACT THE KMPUD INSPECTOR 48 HOURS OR TWO (2) BUSINESS DAYS, WHICHEVER IS GREATER, PRIOR TO COMMENCEMENT OF THE PRE-CONSTRUCTION MEETING AND INITIAL WATER LINE CONSTRUCTION, AND TWENTY-FOUR HOURS PRIOR TO EACH DAY WORK ON WATER LINE INSTALLATION OCCURS.
- 3) ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE MOST CURRENT KMPUD STANDARDS AND "STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION, 2015". WHERE THERE IS ANY CONFLICT, KMPUD STANDARDS SHALL PREVAIL.
- 4) THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS THAT ARE TO REMAIN IN PLACE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE AND INSPECTED BY KMPUD OR CONTROLLING AGENCY, WITHOUT ADDITIONAL COMPENSATION.
- 5) ALL WASTEWATER MAINS SHALL BE TELEVISION INSPECTED (CD PROVIDED TO KMPUD), FLUSHED AND TESTED FOR DEFORMATION WITH AN APPROVED SEWER BALL AND PASS A LEAKAGE TEST IN CONFORMANCE WITH KMPUD STANDARD SPECIFICATIONS PRIOR TO ACCEPTANCE. ALL TESTING SHALL BE PERFORMED AFTER SUB-GRADE COMPACTION AND PRIOR TO PAVING.
- 6) ALL PIPING SHALL HAVE 36" MINIMUM COVER EXCEPT WHERE SPECIFICALLY NOTED ON THE PROJECT PLANS. IF INVERT ELEVATION SHOWN ON PROFILE DRAWINGS RESULT IN LESS THAN 36" OF COVER, THEN 36" OF COVER SHALL PREVAIL, EXCEPT FOR COLLECTION LINES.
 - GREATER THAN 60" OF COVER MAY REQUIRE PIPE CLASS AND BACKFILL CHANGES AND WILL BE APPROVED ON CASE BY CASE BASIS ONLY.
 - 60" TO 36" OF COVER, COLLECTION LINES USE SDR-21, 26.35 OR GREATER PIPE, FORCE MAINS USE C900/C905 DR 25/CLASS 165 OR GREATER PIPE
 - 24" TO 36" OF COVER USE C900/C905, DR18/CLASS 235 OR GREATER PIPE, ENCASED IN 2-SACK SAND SLURRY
 - LESS THAN 24" OF COVER NOT ALLOWED UNDER ANY CIRCUMSTANCESWASTEWATER LINES GREATER THAN 12" OR WITH HAZARDOUS LAYING CONDITIONS REQUIRE DIFFERENT MATERIAL SPECIFICATIONS. SEE KMPUD STANDARDS AND DETAILS.
- 7) PIPE BENDS AND TIE IN DETAILS INDICATED ON THE PLANS ARE APPROXIMATE HORIZONTAL ANGLES AND ARE INTENDED TO SHOW THE ESSENTIAL ELEMENTS REQUIRED OF THE CONNECTION. ACTUAL FIELD PIPING ANGLES MAY BE DIFFERENT. THE CONTRACTOR SHALL SUPPLY ALL LABOR, STANDARD OR FABRICATED FITTINGS, AND APPURTENANCES REQUIRED FOR THE BEND OR TIE-IN INSTALLATION, WITH NO ADDITIONAL REIMBURSEMENT. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ALL CUSTOM FABRICATED FITTINGS.
- 8) THE CONTRACTOR SHALL NOT EXCEED THE MANUFACTURERS RECOMMENDATION FOR LAYING PIPE ALONG HORIZONTAL CURVES. WHEN SLOPES ARE GREATER THAN 10% PIPE SHALL BE LAID UPHILL UNLESS OTHERWISE NOTED. CUT OFF WALLS SHALL BE INSTALLED EVERY 200' FOR SLOPES BETWEEN 10% AND 20% GRADE AND EVERY 100' FOR SLOPES GREATER THAN 20% UNLESS OTHERWISE NOTED.
- 9) THE CONTRACTOR SHALL PROVIDE THE LABOR AND MATERIALS REQUIRED FOR HYDROSTATIC TESTING. ALL TESTING SHALL BE OBSERVED AND ACCEPTED BY KMPUD. ACTUAL CONNECTIONS TO EXISTING KMPUD WASTEWATER LINES WILL NOT BE PERMITTED PRIOR TO THE COMPLETION OF TESTING OF NEW WASTEWATER MAINS. ALL EXISTING WASTEWATER VALVES SHALL BE OPERATED BY KMPUD PERSONNEL ONLY.
- 10) THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT OF THE LINE AND GRADE OF ALL PIPING WITHIN THE PROJECT SITE.
- 11) THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING RECORD DRAWINGS FOR ALL WORK THROUGHOUT THE COURSE OF CONSTRUCTION. SUCH DRAWINGS SHALL RECORD THE LOCATION AND GRADE OF ALL UNDERGROUND IMPROVEMENTS CONSTRUCTED AND SHALL BE DELIVERED TO THE OWNER PRIOR TO, AND IN CONSIDERATION OF THE OWNER'S ACCEPTANCE OF WORK.
- 12) THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL SURPLUS EXCAVATION MATERIAL AND DEBRIS PROMPTLY FROM THE SITE AND SHALL MAINTAIN THE SITE IN A NEAT AND ORDERLY CONDITION. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY FILL AND GRADING PERMITS.
- 13) THE CONTRACTOR SHALL ADJUST ALL GRADE RINGS AND VALVE BOXES TO FINISHED GRADE UNLESS OTHERWISE SHOWN ON DRAWINGS OR DIRECTED.
- 14) PIPE STATIONING IS BASED ON HORIZONTAL DISTANCE AND DOES NOT REPRESENT ACTUAL LENGTH OF PIPE.
- 15) CONTRACTOR SHALL AT ALL TIMES COMPLY WITH THE SAFETY RULES AND REGULATIONS ESTABLISHED BY CAL-OSHA AND OTHER AGENCIES HAVING JURISDICTION OVER THE WORK AND SHALL BE REQUIRED TO OBTAIN ALL PERMITS. CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY.
- 16) WASTEWATER SERVICE LINES SHALL BE MARKED WITH THE LETTER "S" STAMPED ON THE BACK OF THE SIDEWALK OR ON THE TOP OF CURB. THE UNDERGROUND CONTRACTOR SHALL PROVIDE SUFFICIENT RECORDS AND SHALL LEAVE ADEQUATE MARKS IN THE FIELD FOR THE CONCRETE CONTRACTOR TO ACCURATELY STAMP THE LETTER "S" FOR ALL WASTEWATER SERVICES.
- 17) ALL EXISTING IMPROVEMENTS, INCLUDING BUT NOT LIMITED TO LANDSCAPING, DRIVEWAYS, DRAINAGE DITCHES AND MONUMENTS, SHALL BE RESTORED TO THE CONDITION IN WHICH THEY WERE PRIOR TO CONSTRUCTION, OR BETTER.
- 18) ALL TREES REQUIRING TRIMMING OR REMOVAL SHALL BE IDENTIFIED BY THE CONTRACTOR AND THE CONTRACTOR SHALL COMPLY WITH ALL KIRKWOOD TRI-TAC COMMITTEE REQUIREMENTS REGARDING TRIMMING OR REMOVAL WORK. WHERE APPROPRIATE, CONTRACTOR SHALL ALSO NOTIFY THE PROPERTY OWNER, HOMEOWNER ASSOCIATION AND KMPUD.
- 19) ALL DRAINAGE DITCHES SHALL BE GRADED TO DRAIN IN ORIGINAL DIRECTION AND PROTECTED FROM EROSION. DRIVEWAYS ARE TO BE REPLACED IN KIND.
- 20) THRUST BLOCKS SHALL BE INSTALLED PER KMS013.
- 21) PLAN APPROVAL IS VALID FOR TWO YEARS FROM DATE OF KMPUD SIGNATURE OR CONDITIONAL WILL SERVE COMMITMENT, WHICHEVER COMES FIRST.
- 22) INSTALLATION OF SEWER AIR RELEASE VALVES WILL REQUIRE SPECIAL PERMISSION OF KMPUD.

WASTEWATER GENERAL NOTES

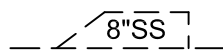
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SCALE:	N.T.S.	DRAWN BY:	L.P.B.	

KMS001

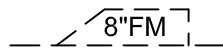
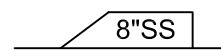


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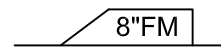
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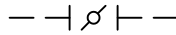
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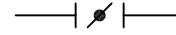
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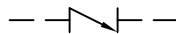
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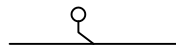
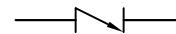
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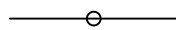
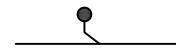
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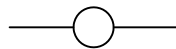
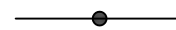
CHECK VALVE



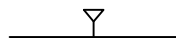
FLUSHING INLET



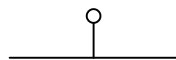
CLEAN OUT



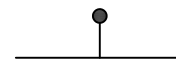
MANHOLE



CAVRV



SS SERVICE



NOTES:

1. THESE SYMBOLS SHALL BE USED ON ALL PLANS TO BE APPROVED BY KMPUD.
2. VALVE SIZE IS THE SAME AS LINE SIZE UNLESS OTHERWISE NOTED.



WASTEWATER SYMBOLS LEGEND

DATE:
3/30/22

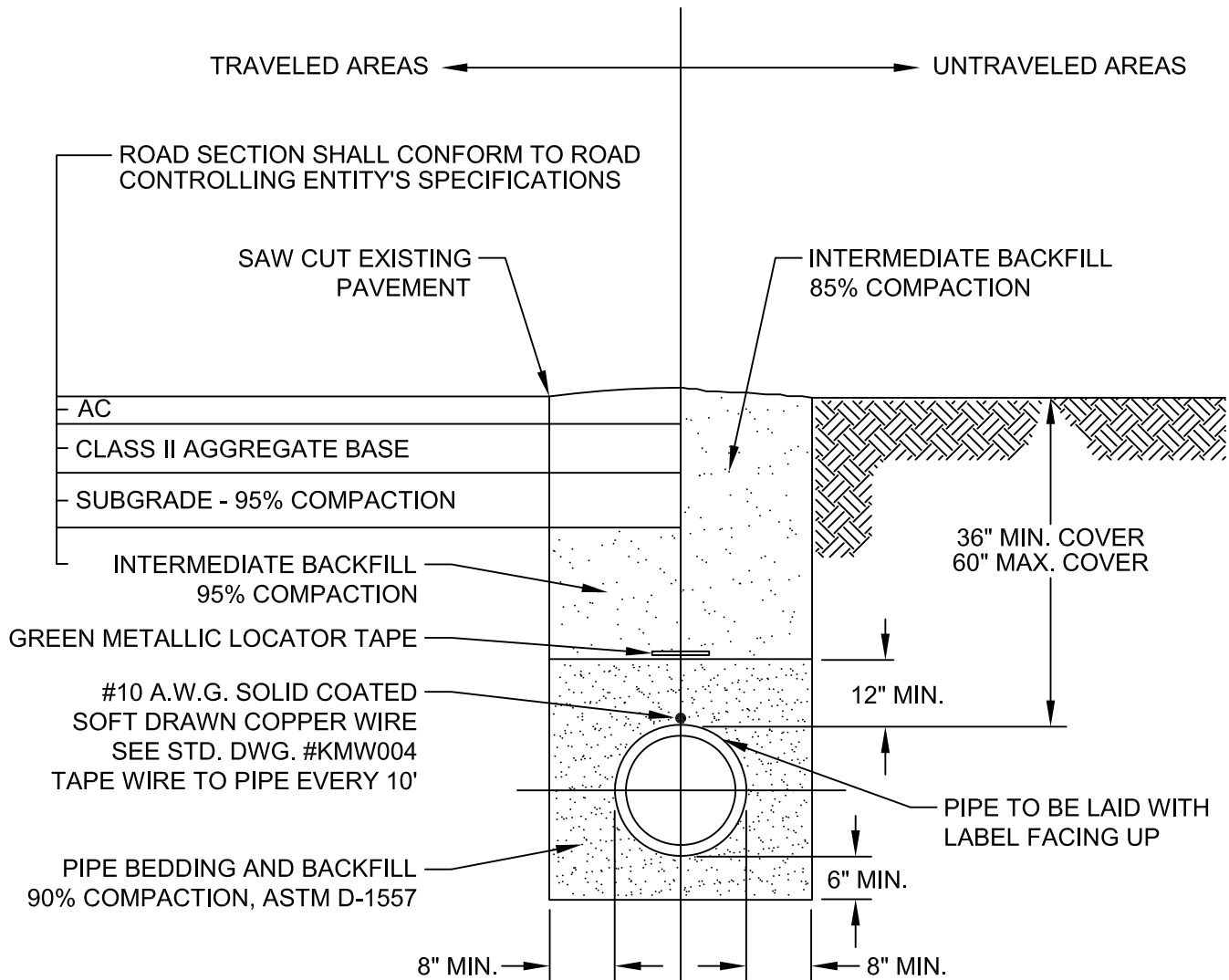
APPROVED BY:
E.M.C.

DRAWING NUMBER:

SCALE:
N.T.S.

DRAWN BY:
L.P.B.

KMS002



PIPE BEDDING: WELL GRADED CLEAN SAND CONFORMING TO THE FOLLOWING GRADATION:

- NO.4 SIEVE: 75-100% PASSING BY WEIGHT
- NO.30 SIEVE: 12-60% PASSING BY WEIGHT
- NO. 100 SIEVE: 5-20% PASSING BY WEIGHT
- NO. 200 SIEVE: 0-10% PASSING BY WEIGHT

INTERMEDIATE BACK FILL: IMPORTED OR NATIVE MATERIAL WITH ALL ROCKS OVER 3" REMOVED AND FREE OF VEGETATIVE MATERIAL.

NOTES:

1. MINE TAILINGS ARE UNACCEPTABLE FOR ANY TRENCH BACKFILLING.
2. 40" OR GREATER PIPE COVER MUST BE PRE-APPROVED BY KMPUD
3. GREEN LOCATOR TAPE AT TOP OF SAND TO BE MARKED: "CAUTION - SEWER LINE BURIED BELOW".
4. USE $\frac{3}{4}$ " CRUSHED ROCK AS BEDDING AND BACKFILL IN AREAS WITH GROUNDWATER. USE C900 PIPE IN THESE AREAS.



PIPE TRENCH BEDDING AND BACKFILL

DATE: 3/30/22

APPROVED BY:
B.B.

DRAWING NUMBER:

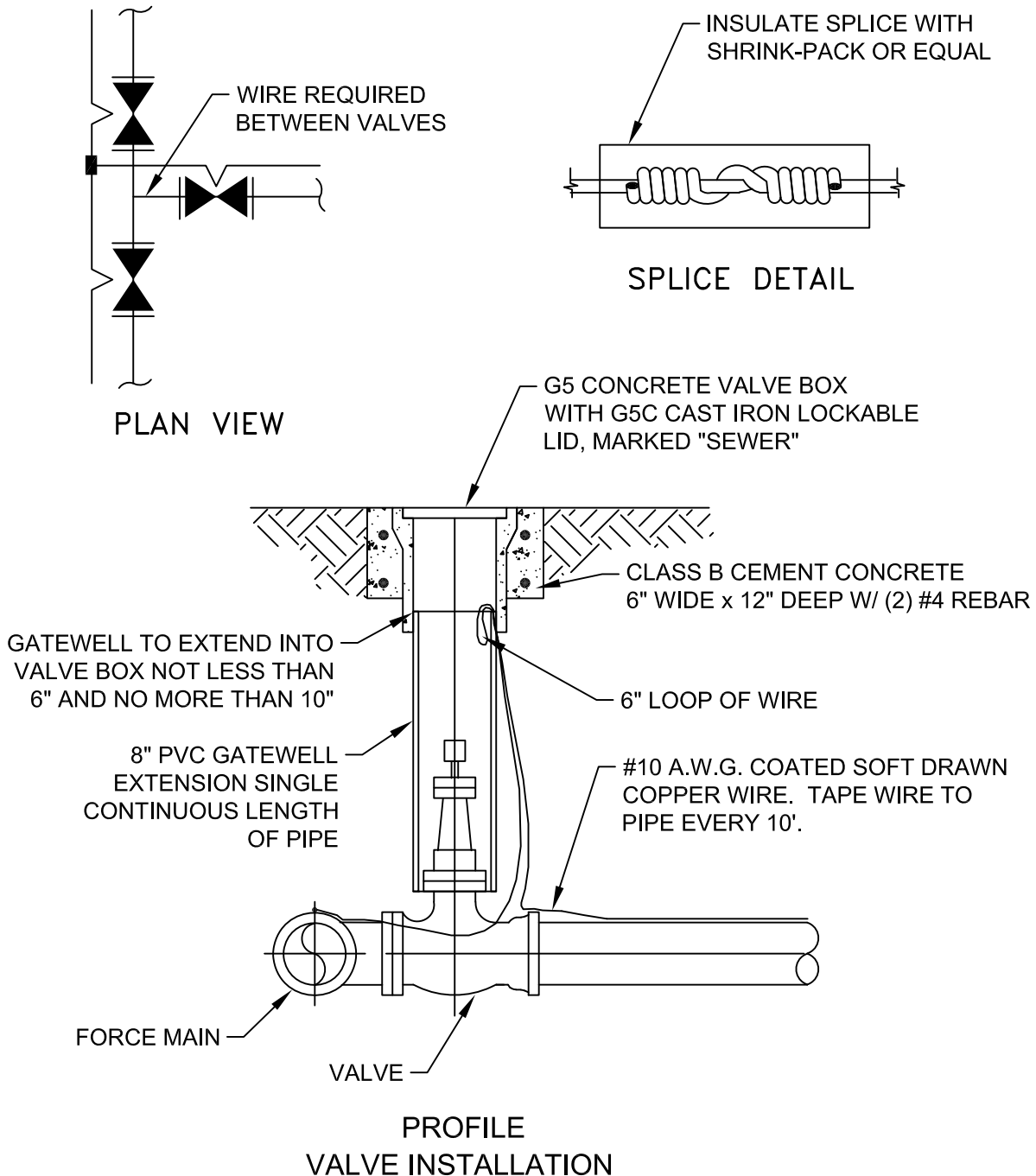
SCALE:
N.T.S.

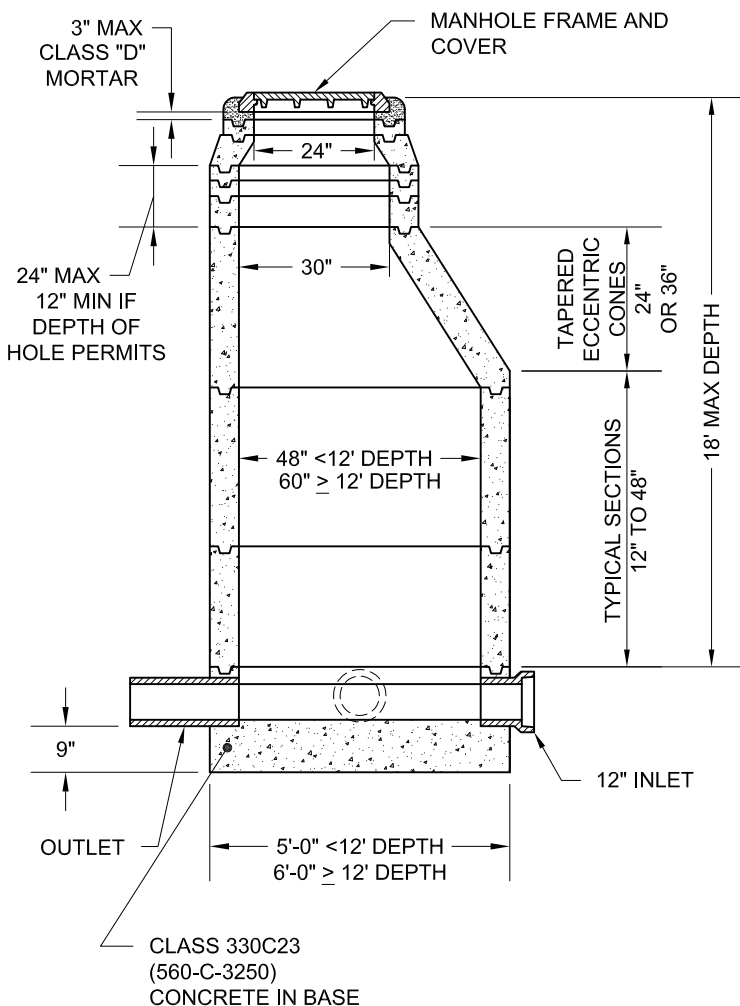
DRAWN BY:
L.P.B.

KMS003

NOTES:

1. WIRE TO BE CONTINUOUS BETWEEN VALVE BOXES. A CONTINUITY TEST SHALL BE PERFORMED BY CONTRACTOR PRIOR TO FINAL ACCEPTANCE BY KMPUD.
2. ALL FITTINGS TO BE WRAPPED WITH MINIMUM 6 MIL. POLYETHYLENE FILM.

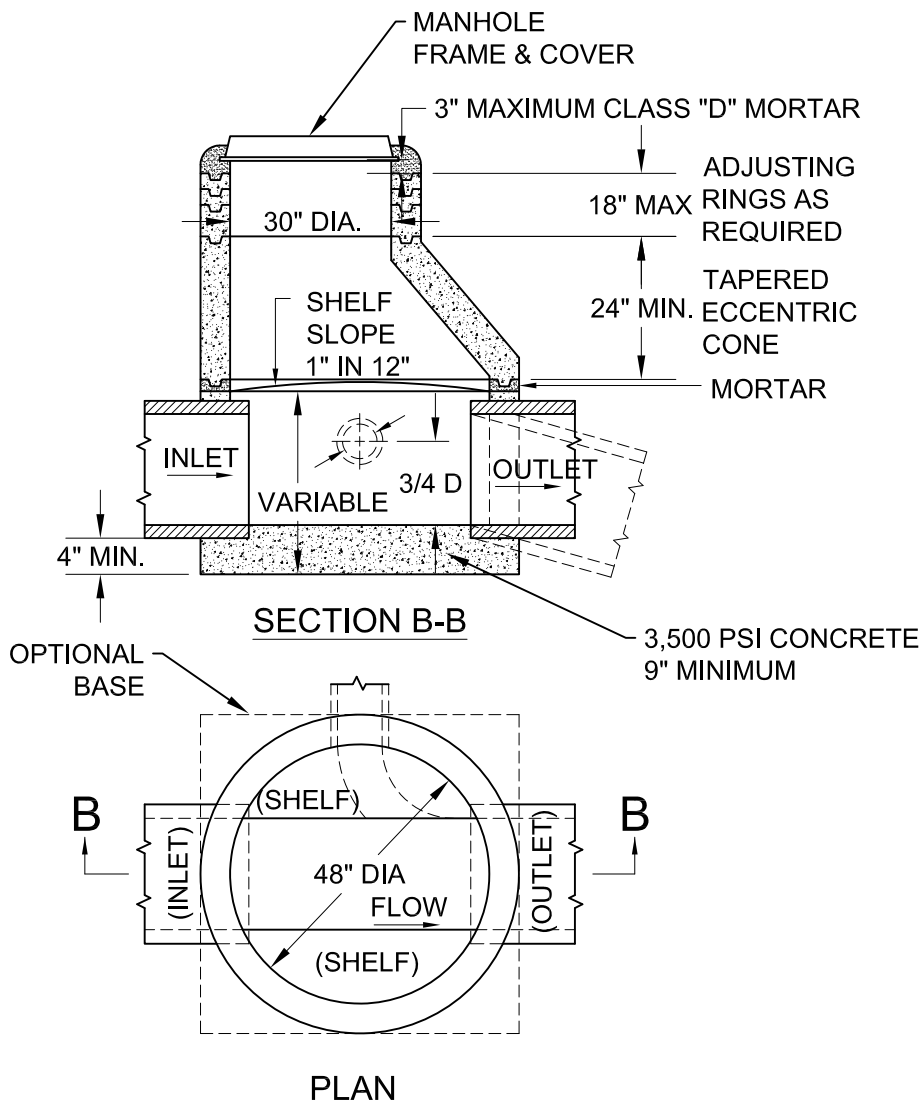




SECTION A-A

NOTES:

1. EXCEPT AS NOTED HERIN, THE PRECAST UNITS SHALL BE MANUFACTURED AND TESTED IN ACCORDANCE WITH ASTM C 478.
2. RISER SECTIONS SHALL BE REINFORCED IN ACCORDANCE WITH ASTM 478 AND SHALL HAVE A MINIMUM WALL THICKNESS OF 5".
3. THE 24" X 48" ECCENTRIC CONES SHALL BE REINFORCED. THE WALL THICKNESS SHALL BE NOT LESS THAN 5".
4. JOINTS SHALL BE TONGUE AND GROOVE AND SHALL CONFORM WITH ASTM C 478 SECTION 14.
5. ALL JOINTS SHALL BE SEALED WITH A PREFORMED PLASTIC OR RUBBER RING TO FORM A WATERTIGHT SEAL.
6. IF 30" DIAMETER MANHOLE FRAME AND COVER IS REQUIRED, IT SHALL BE INSTALLED WHERE THE REDUCER RING IS SHOWN IN THE SECTION.
7. ALL REINFORCEMENT SHALL HAVE A MINIMUM OF 2" OF COVER OVER THE STEEL ON THE INSIDE FACE.
8. THE TOP OPENING OF THE MANHOLE SHALL BE PLACED DIRECTLY OVER THE OUTLET OF THE STRUCTURE EXCEPT AS OTHERWISE NOTED ON PLANS.
9. CONCRETE BASE AND STUB WALLS SHALL BE POURED IN ONE OPERATION TO A POINT 2" ABOVE THE INLET AND OUTLET PIPES. ALL PIPES SHALL BE RIGIDLY SUPPORTED BY TEMPORARY PIERS OR OTHER METHODS DURING THE OPERATION. CONCRETE SHALL SET FOR 24 HOURS BEFORE PLACING PRECAST UNITS.
10. THE INTERIOR AND EXTERIOR OF MANHOLE GRADE RINGS, CONES AND RIMS SHALL BE COATED & SEALED WITH THOROSEAL OR EQUAL. THE INTERIOR OF MANHOLES WITH TURBULENT FLOWS SHALL BE COATED AND SEALED WITH 100 MILS OF HYDRO-POX 204 UHB OR EQUAL.
11. IN LOCATIONS WITH STANDING WATER, ALL JOINTS SHALL BE SEALED INTERIOR AND EXTERIOR WITH SIKAFLEX 2cNS EZ MIX, OR APPROVED EQUAL.
12. PAMTIGHT COVERS SHALL BE PROVIDED FOR ALL MANHOLES.
13. MANHOLE BEDDING SHALL BE PER KMPUD WASTEWATER STANDARDS SECTION 2.5.12.1.



NOTES:

1. EXCEPT AS NOTED HEREIN OR ON APPROVED PROJECT PLANS, MANHOLES SHALL CONFORM TO STANDARD SEWER MANHOLE DETAIL KMS005.
2. MANHOLE BEDDING SHALL BE PER KMPUD WASTEWATER STANDARDS SECTION 2.5.12.1.



SHALLOW SEWER
MANHOLE

DATE:
3/30/22

SCALE:
N.T.S.

APPROVED BY:
E.M.C.

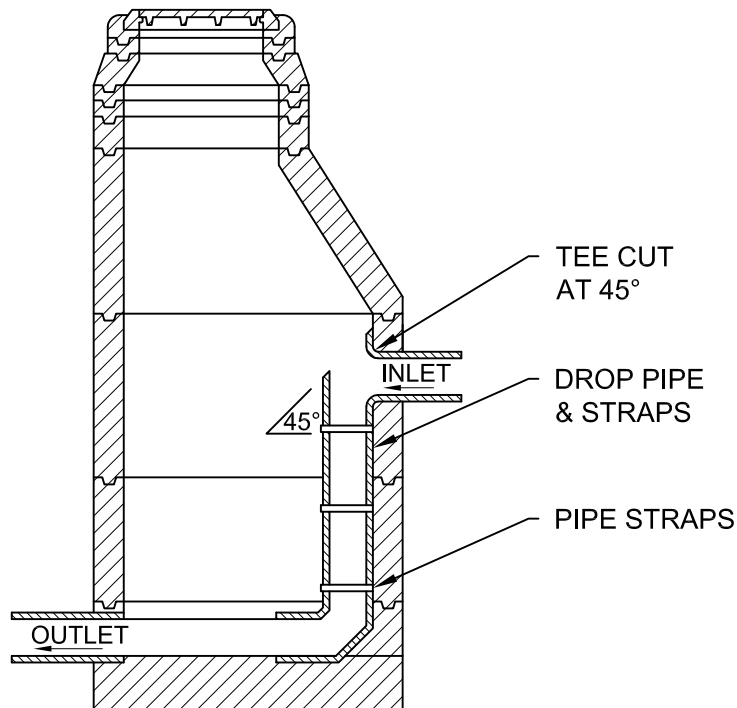
DRAWN BY:
L.P.B.

DRAWING NUMBER:

KMS006

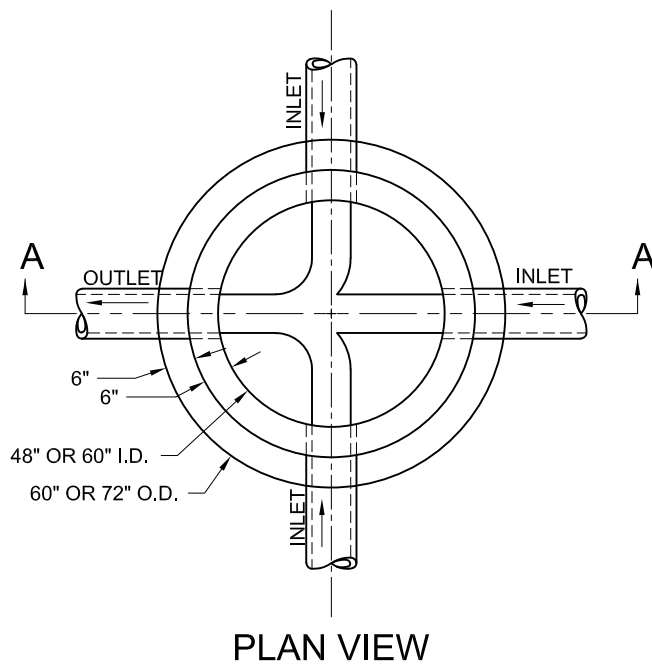
NOTES:

1. ALL PIPE FOR THE DROP INLET SHALL BE OF THE SAME SIZE, TYPE AND MATERIAL AS THE INLET PIPE.
2. PRECAST CONCRETE MANHOLES SHALL BE PLUGGED DURING FABRICATION AT REQUIRED LOCATIONS TO PROVIDE FOR SEWER PIPE INLETS AND OUTLETS.
3. WHEN THE PROJECT PLANS INDICATE TWO OR MORE DROP INLETS ARE REQUIRED IN A SINGLE MANHOLE, EACH DROP INLET SHALL BE CONSTRUCTED AS A SEPARATE DROP INLET.
4. DROP PIPE SHALL BE FLUSH WITH THE INSIDE OF THE MANHOLE BARREL.
5. PIPE STRAPS SHALL BE FASTENED TO THE WALL WITH 3" STAINLESS STEEL WEDGE ANCHOR BOLTS OR EPOXY ANCHORS. STRAPS SHALL BE MADE OF 2" MINIMUM WIDTH, 10 GAUGE, TYPE 304, STAINLESS STEEL. STRAPS SHALL BE SPACED EVERY 4' ON CENTER WITH A 3 STRAP MINIMUM.
6. EXCEPT AS NOTED HEREIN OR ON APPROVED PROJECT PLANS, MANHOLES SHALL CONFORM TO STANDARD SEWER MANHOLE DETAIL KMS005.
7. MANHOLE BEDDING SHALL BE PER KMPUD WASTEWATER STANDARDS SECTION 2.5.12.1.

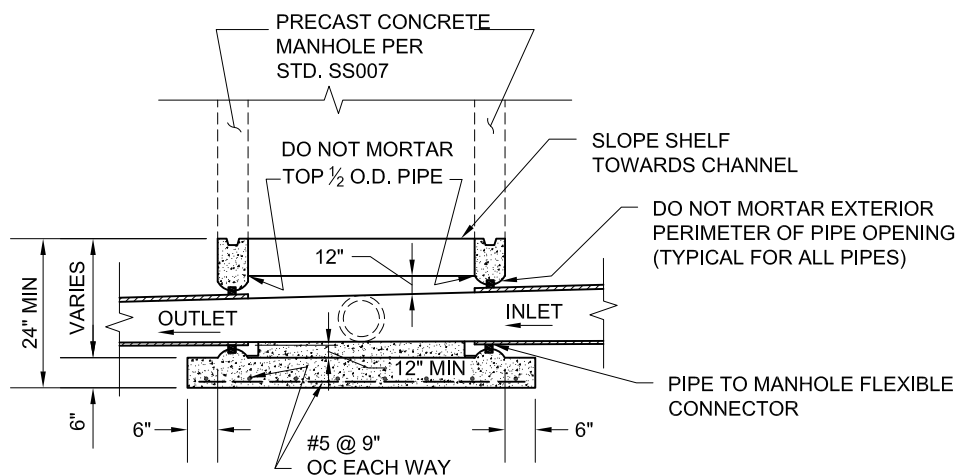
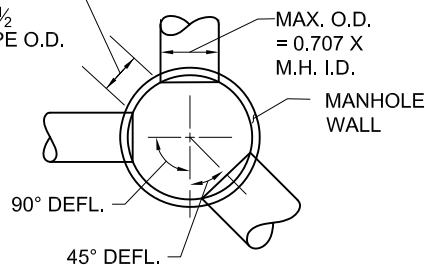


DROP MANHOLE

DATE: 3/30/22	APPROVED BY: E.M.C.	DRAWING NUMBER: KMS007
SCALE: N.T.S.	DRAWN BY: L.P.B.	



MIN. DISTANCE BETWEEN HOLES APPROX. $\frac{1}{2}$ OF SMALLEST PIPE O.D.



NOTES:

1. CONCRETE BASE AND STUB WALLS SHALL BE POURED IN ONE OPERATION.
2. CONCRETE FOR ALL PRECAST UNITS SHALL BE COMPACTLY VIBRATED IN THE FORMS. IT SHALL BE CURED ACCORDING TO APPROVED PRACTICE EITHER BY STEAM, SPRINKLING, MEMBRANE SOLUTION OR A COMBINATION OF THESE. IT SHALL DEVELOP 3500 PSI OR GREATER STRENGTH IN 28 DAYS.
3. THE DEPTH OF CHANNEL SHALL EQUAL THE PIPE DIAMETER FOR ALL SIZES OF PIPE. FOR SPECIAL CHANNELS IN TRAP OR GAUGING MANHOLES, SEE SPECIAL PLANS.
4. CEMENT MORTAR INSIDE JOINTS SHALL BE NEATLY STRUCK AND POINTED AND SHALL NOT EXCEED $\frac{3}{8}$ " IN THICKNESS.
5. STUB WALLS AND BASE SHALL CONFORM TO ASTM C 478 AND SHALL HAVE A MINIMUM OF 2 IN. COVER THE STEEL ON THE INSIDE FACE.
6. INVERT CHANNELS AND SHELF MAY BE POURED AT THE FACTORY OR IN THE FIELD AT THE OPTION OF THE CONTRACTOR.
7. BEDDING FOR PRECAST BASE SHALL BE EQUAL TO BEDDING FOR PIPE. USE 6 IN. MINIMUM CRUSHED ROCK UNDER BASE OVER UNDISTURBED NATIVE MATERIAL.
8. MANHOLE BEDDING SHALL BE PER KMPUD WASTEWATER STANDARDS SECTION 2.5.12.1.



PRECAST REINFORCED CONCRETE MANHOLE BASE

DATE: 3/30/22

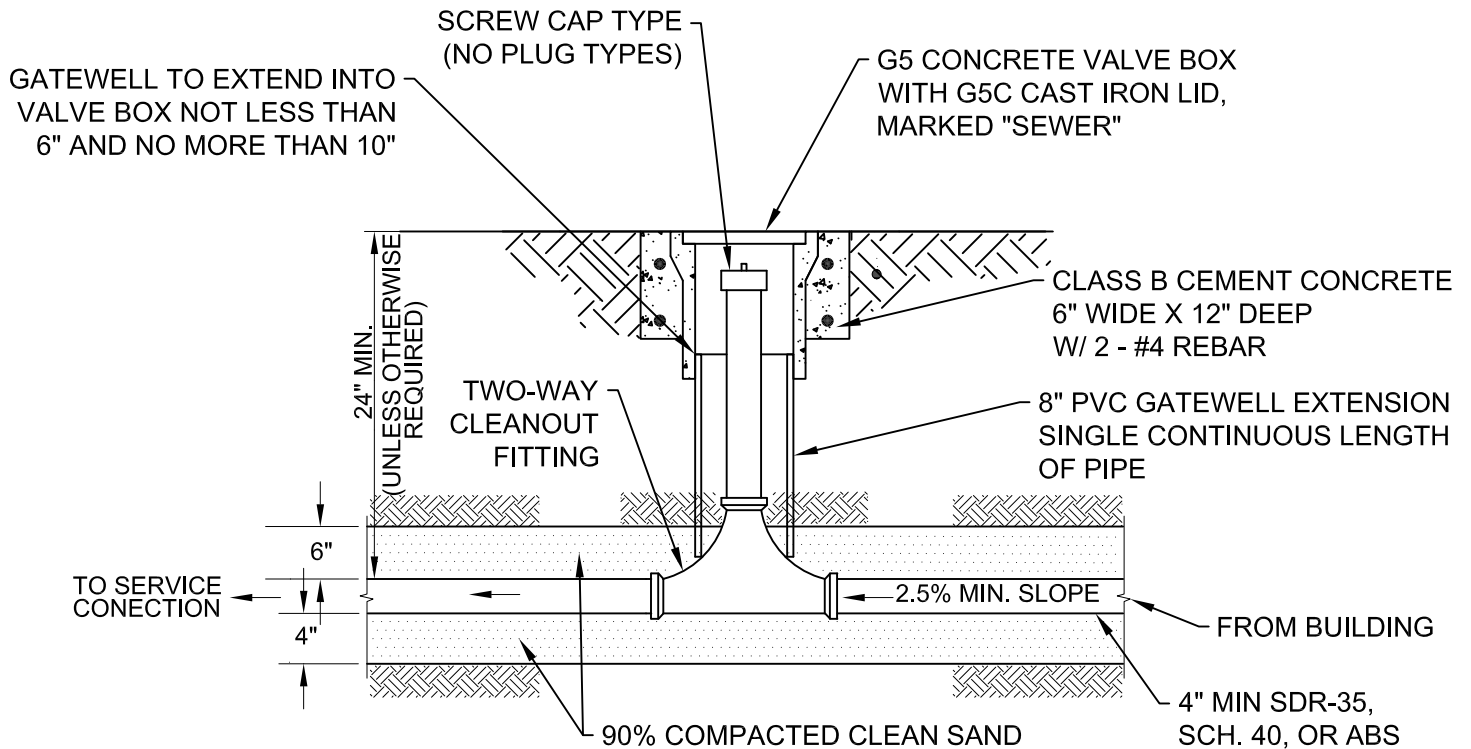
APPROVED BY: E.M.C.

DRAWING NUMBER:

SCALE: N.T.S.

DRAWN BY: L.P.B.

KMS008



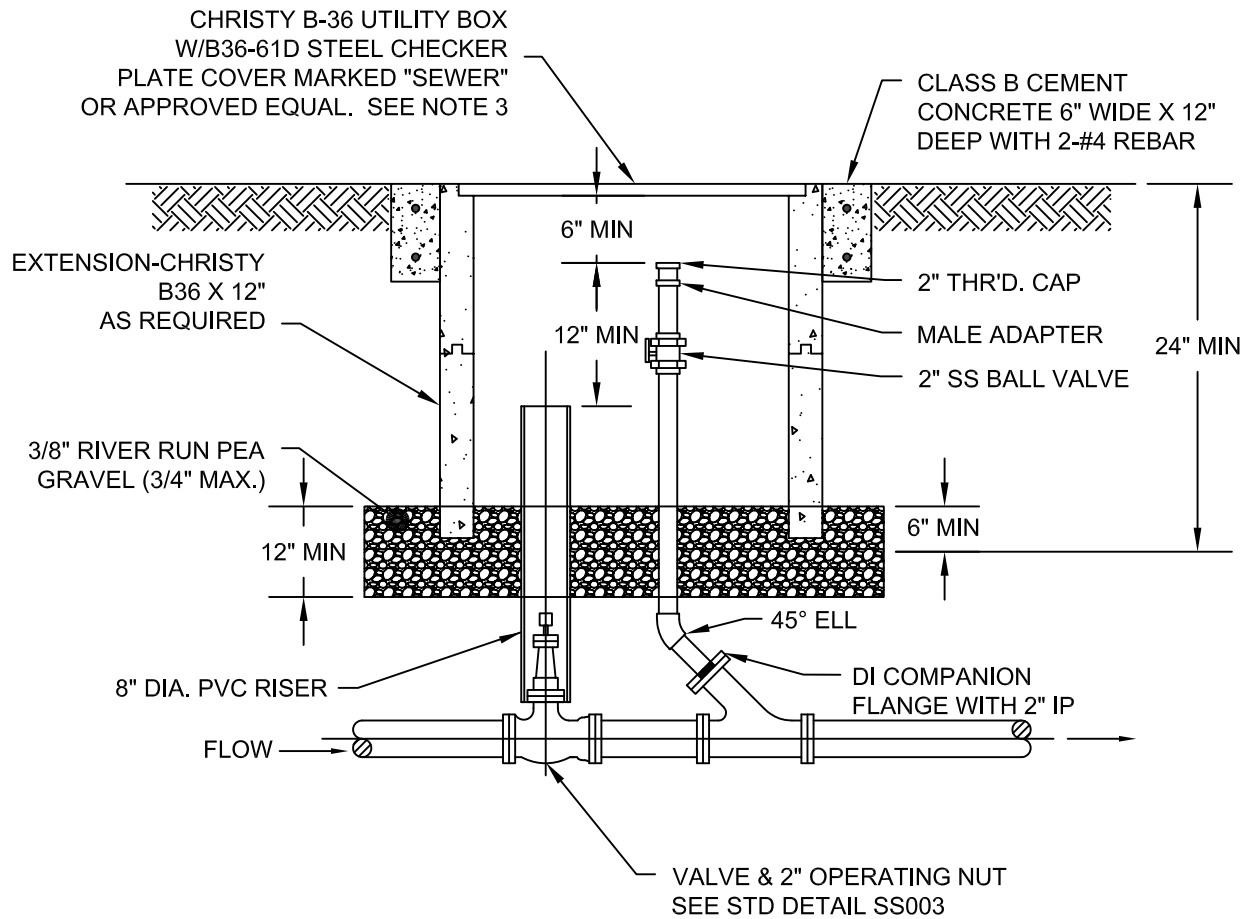
NOTES:

1. 6" WIDE BY 12" THICK STEEL REINFORCED CONCRETE COLLAR SHALL BE INSTALLED AROUND CLEANOUT BOX IN ALL AREAS.
2. CLEANOUTS SHALL BE SPACED EVERY 100' FROM THE INITIAL CLEANOUT AT THE BUILDING TO THE SERVICE CONNECTION.
3. PIPE MATERIAL SHALL BE SDR-35, SCH. 40 SOLVENT WELDED PVC OR ABS (4" MIN.)
4. CLEANOUTS REQUIRED FOLLOWING ALL BENDS 22 ½" OR GREATER.



**BUILDING SEWER
CLEANOUTS**

DATE: 9/8/25	APPROVED BY: E.M.C.	DRAWING NUMBER:
SCALE: N.T.S.	DRAWN BY: L.P.B.	KMS009



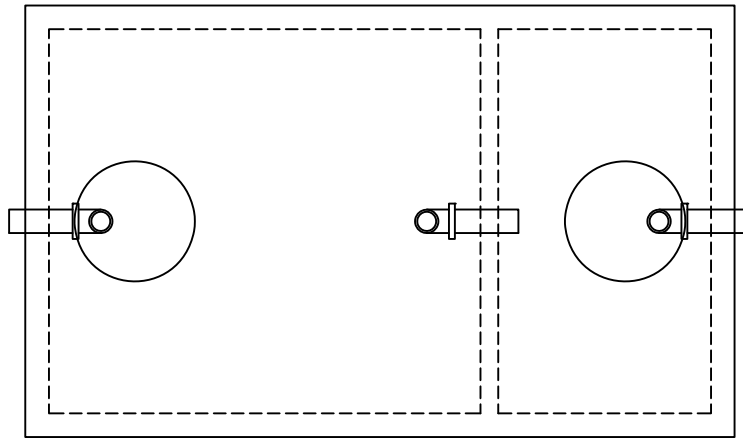
NOTES:

1. FLUSHING INLETS SHALL BE PLACED ON SEWER MAINS AND FORCE MAINS EVERY 1,000', LOW POINTS, AT HORIZONTAL ANGLE POINTS OF 22° OR GREATER, AND AS REQUIRED.
2. FLUSHING INLET SHALL BE THE SAME MATERIAL AS MAIN.
3. CHRISTY B17X30 UTILITY BOX WITH STEEL CHECKER PLATE H/20 LOADING MARKED "SEWER", OR APPROVED EQUAL, FOR ALL TRAFFIC RATED AREAS.
4. FIRE HYDRANTS SHALL BE PROVIDED WITHIN 500' OF FLUSHING INLETS.

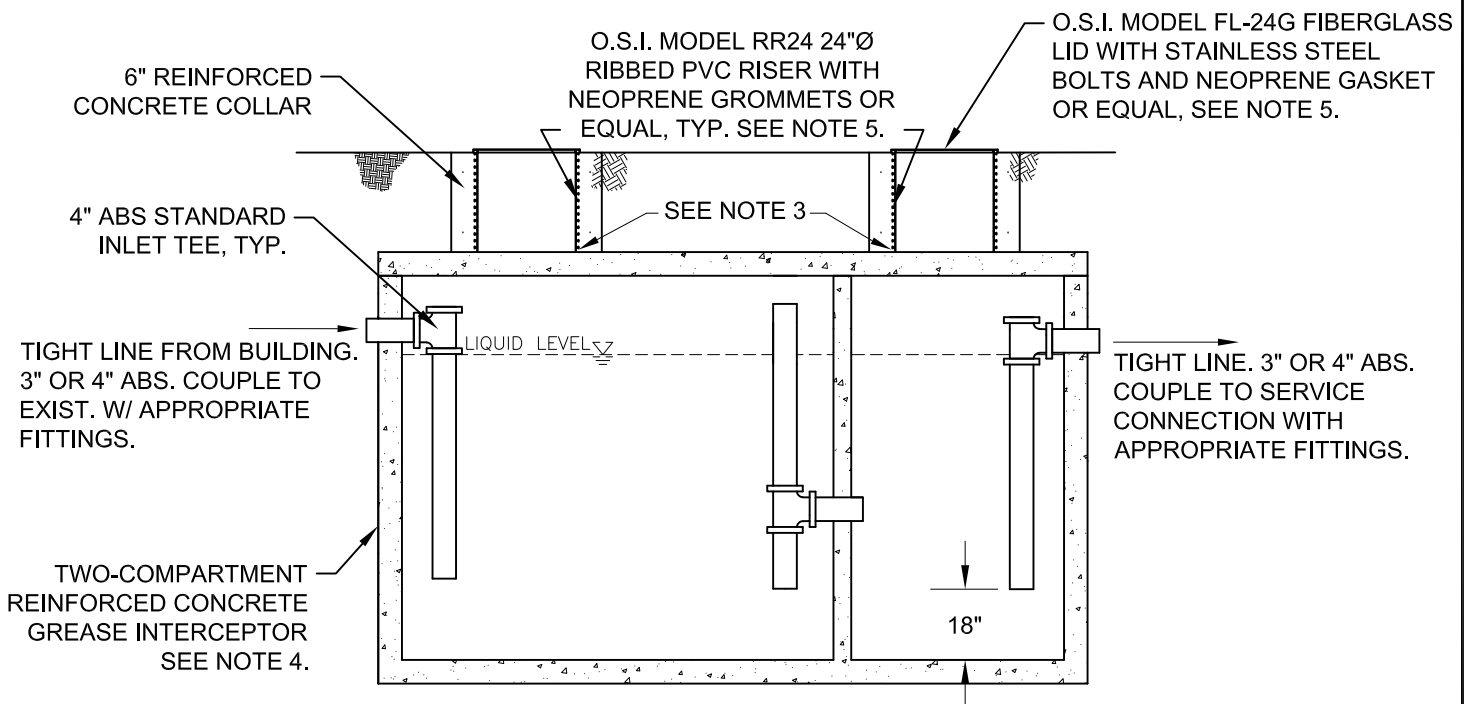


FLUSHING INLET

DATE: 3/30/22	APPROVED BY: E.M.C.	DRAWING NUMBER: KMS010
SCALE: N.T.S.	DRAWN BY: L.P.B.	



TOP VIEW



SIDE VIEW

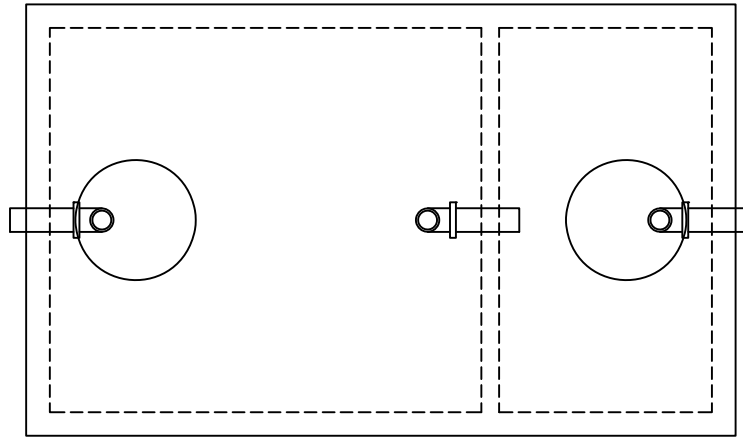
NOTES:

1. GREASE INTERCEPTOR REQUIRED FOR ALL COMMERCIAL KITCHEN OR FOOD PREPARATION FACILITIES.
2. BEDDING MATERIAL SHALL BE A MINIMUM OF 6" IN DEPTH OF EITHER 3/4" CRUSHED ROCK, OR CLEAN SAND.
3. INSTALL RISER WITH BUTYLE TAPE AND ORENCO TANK ADAPTER FRTA24 OR PRTA24, OR APPROVED EQUAL. ALL JOINTS MUST BE WATER TIGHT.
4. TANK MUST BE WATER TIGHT, MONOLITHICALLY CONSTRUCTED AND THOROSEALED INSIDE AND OUT.
5. TRAFFIC LIDS AND RISERS REQUIRED FOR ALL TRAFFIC RATED AREAS.

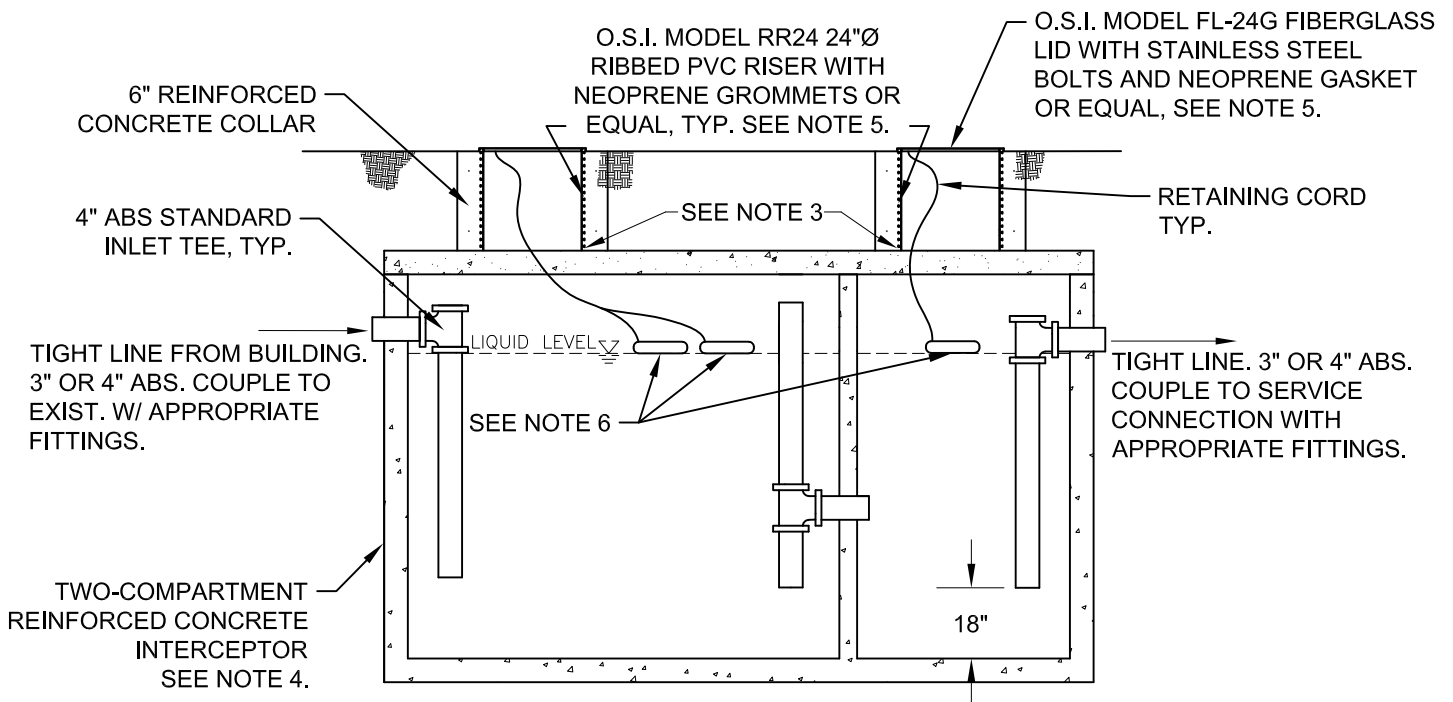


**1,500 GALLON
GREASE INTERCEPTOR**

DATE: 3/30/22	APPROVED BY:	DRAWING NUMBER: KMS011
SCALE: N.T.S.	DRAWN BY: L.P.B.	



TOP VIEW



SIDE VIEW

NOTES:

1. OIL-SAND INTERCEPTOR REQUIRED FOR ALL SERVICE STATIONS, MAINTENANCE SHOPS OR ANY FACILITY WHICH MAY INTRODUCE OIL OR SAND INTO THE SEWER SYSTEM.
2. BEDDING MATERIAL SHALL BE A MINIMUM OF 6" IN DEPTH OF EITHER 3/4" CRUSHED ROCK, OR CLEAN SAND.
3. INSTALL RISER WITH BUTYLE TAPE AND ORENCO TANK ADAPTER FRTA24 OR PRTA24, OR APPROVED EQUAL. ALL JOINTS MUST BE WATER TIGHT.
4. TANK MUST BE WATER TIGHT, MONOLITHICALLY CONSTRUCTED AND THOROSEALED INSIDE AND OUT.
5. TRAFFIC LIDS AND RISERS REQUIRED FOR ALL TRAFFIC RATED AREAS.
6. OIL ABSORBENT BAGS SHALL BE SPILLTECH WPIL10 6"X16"X21" POLYPROPYLENE BAGS OR APPROVED EQUAL AND SHALL BE EQUIPPED WITH RETAINING CORD, SECURED TO OR UNDER COVER FRAME, FOR HAND ACCESS BY OTHERS.



**1,500 GALLON
OIL-SAND INTERCEPTOR**

DATE:
3/30/22

APPROVED BY:

DRAWING NUMBER:

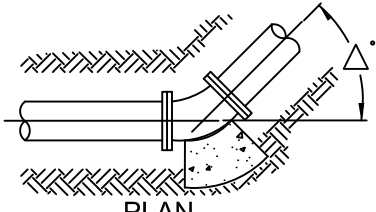
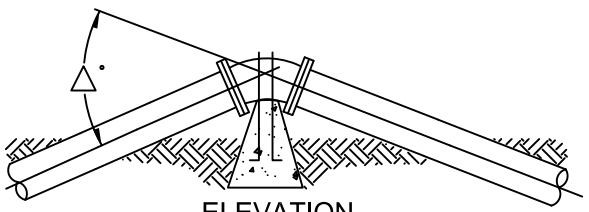
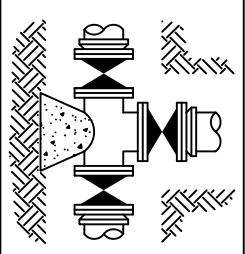
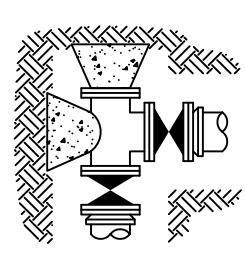
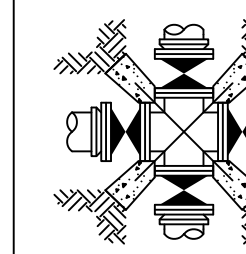
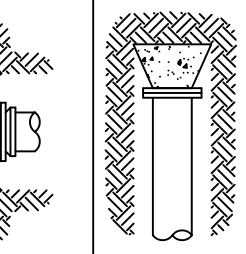
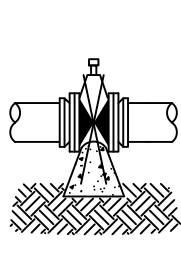
SCALE:
N.T.S.

DRAWN BY:
L.P.B.

KMS012

NOTES:

1. THRUST BLOCK AREAS & VOLUMES GIVEN ARE FOR A TEST PRESSURE OF 150 PSI, A SOIL LATERAL PRESSURE OF 1000 lb/sf AND 3 FEET OF COVER. INSTALLATIONS WITH HIGHER TEST WATER PRESSURES, LOWER SOIL BEARING PRESSURES OR LESS THAN 3 FEET OF COVER WILL REQUIRE ADJUSTMENT OF THRUST BLOCK SIZE; SUBJECT TO APPROVAL BY KMPUD. ALTERNATE THRUST BLOCK DETAILING FOR INSTALLATIONS WITH HIGHER SOIL LATERAL PRESSURES OR GREATER COVER, AS CONFIRMED BY A SITE SPECIFIC GEOTECHNICAL REPORT AND PREPARED BY A LICENSED ENGINEER MAY BE ALLOWED, SUBJECT TO REVIEW AND APPROVAL BY KMPUD.
2. THRUST BLOCKS SHALL BE CONSTRUCTED OF MIN. 2,500 PSI CONCRETE & SHALL BE POURED AGAINST UNDISTURBED SOIL.
3. DOUBLE WRAP ALL FITTINGS, NUTS, & BOLTS WITH 6 MIL. POLYETHYLENE FILM.
4. JOINTS, FACE OF PLUGS AND NUTS & BOLTS TO BE KEPT CLEAR OF CONCRETE AND MUST BE ABLE TO OPERATE WITHOUT DISTURBING THRUST BLOCK.
5. VERTICAL BENDS SHALL USE RESTRAINED JOINTS AND A FULL LENGTH OF PIPE ON EACH SIDE OF FITTING.
6. (2) #5 REBAR SHALL BE PLACED AS SHOWN, REBAR TO BE SHAPED WITH 90° BEND AT EACH END, AND COATED WITH TWO COATS OF CHRISTY'S HD50 OR APPROVED EQUAL, 18 MILS EACH COAT. 12" 90° AND 45° VERTICAL BENDS AND 10" 90° VERTICAL BENDS SHALL UTILIZE #6 BARS. ALL REBAR SHALL BE GRADE 60 AND BE EMBEDDED A MINIMUM OF 30" INTO CONCRETE FOR THRUST BLOCKS GREATER THAN OR EQUAL TO 1 CY.
7. THRUST RESTRAINT FOR PIPE GREATER THAN 12" SHALL BE SUBMITTED TO KMPUD FOR REVIEW AND APPROVAL. CONCRETE THRUST BLOCKING FOR THESE LARGER PIPE SIZES MAY BE REJECTED.

								
NOMINAL PIPE DIA. (IN.)	HORIZONTAL THRUST BLOCK				VERTICAL THRUST BLOCK			
	BEARING AREA (SQ. FT.)				VOLUME OF CONCRETE (CU. YD.)			
	Δ° =11 1/4°	Δ° =22 1/2°	Δ° =45°	Δ° =90°	Δ° =11 1/4°	Δ° =22 1/2°	Δ° =45°	Δ° =90°
4"	1.0	1.0	2.0	3.0	0.1	0.2	0.5	1.0
6"	1.0	2.0	4.0	7.0	0.3	0.5	1.1	2.0
8"	2.0	3.5	7.0	13.0	0.5	1.0	2.0	3.5
10"	3.0	5.5	11.0	20.0	0.8	1.5	3.0	5.5
12"	4.0	8.0	15.5	29.0	1.1	2.2	4.5	8.0
NOMINAL PIPE DIA. (IN.)								
	TEE		TEE W/ BLD. FLG.		CROSS		DEAD END	IN LINE VALVE
4"	2.5		2.5		2.5		2.5	2.5
6"	5.0		5.0		5.0		5.0	5.0
8"	9.0		9.0		9.0		9.0	9.0
10"	14.0		14.0		14.0		14.0	14.0
12"	20.0		20.0		20.0		20.0	20.0
EACH HORIZONTAL THRUST BLOCK BEARING AREA (SQ. FT.)								



THRUST BLOCK DETAILS

DATE: 5/2/22

SCALE: N.T.S.

APPROVED BY: E.M.C.

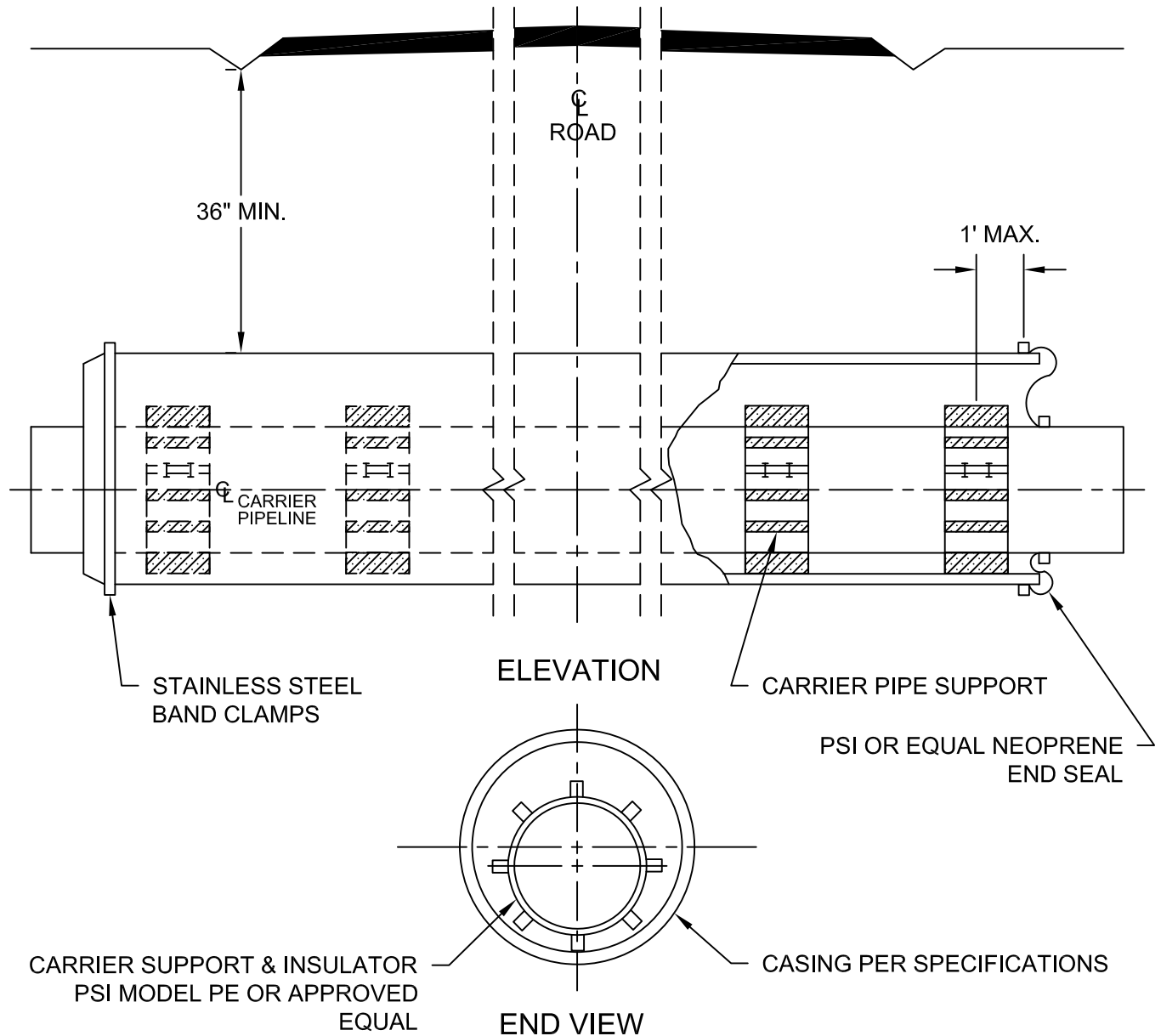
DRAWN BY: L.P.B.

DRAWING NUMBER:

KMS013

NOTES:

1. SKIDS OF CARRIER PIPE SUPPORTS SHALL BE GREASED BEFORE INSTALLATION.
2. SPACING OF CARRIER PIPE SUPPORTS SHALL BE PER MANUFACTURERS' RECOMMENDATION OR 9', WHICH EVER IS LESS.
3. CARRIER PIPE SHALL BE TESTED BEFORE SEALING ENDS.
4. BELLS OF CARRIER PIPE SHALL NOT REST ON CASING PIPE.
5. CASING LENGTH & THICKNESS SHALL CONFORM TO KMPUD STANDARDS OR ROADWAY CONTROLLING AGENCY'S SPECIFICATIONS WHICH EVER IS MORE STRINGENT.
6. CARRIER PIPE TO BE RESTRAINED DUCTILE IRON PIPE.
7. VALVES SHALL BE LOCATED ON EACH SIDE OF CASING.



CASING & CARRIER PIPE

DATE: 9/30/18

APPROVED BY: E.M.C.

DRAWING NUMBER:

SCALE: N.T.S.

DRAWN BY: L.P.B.

KMS014