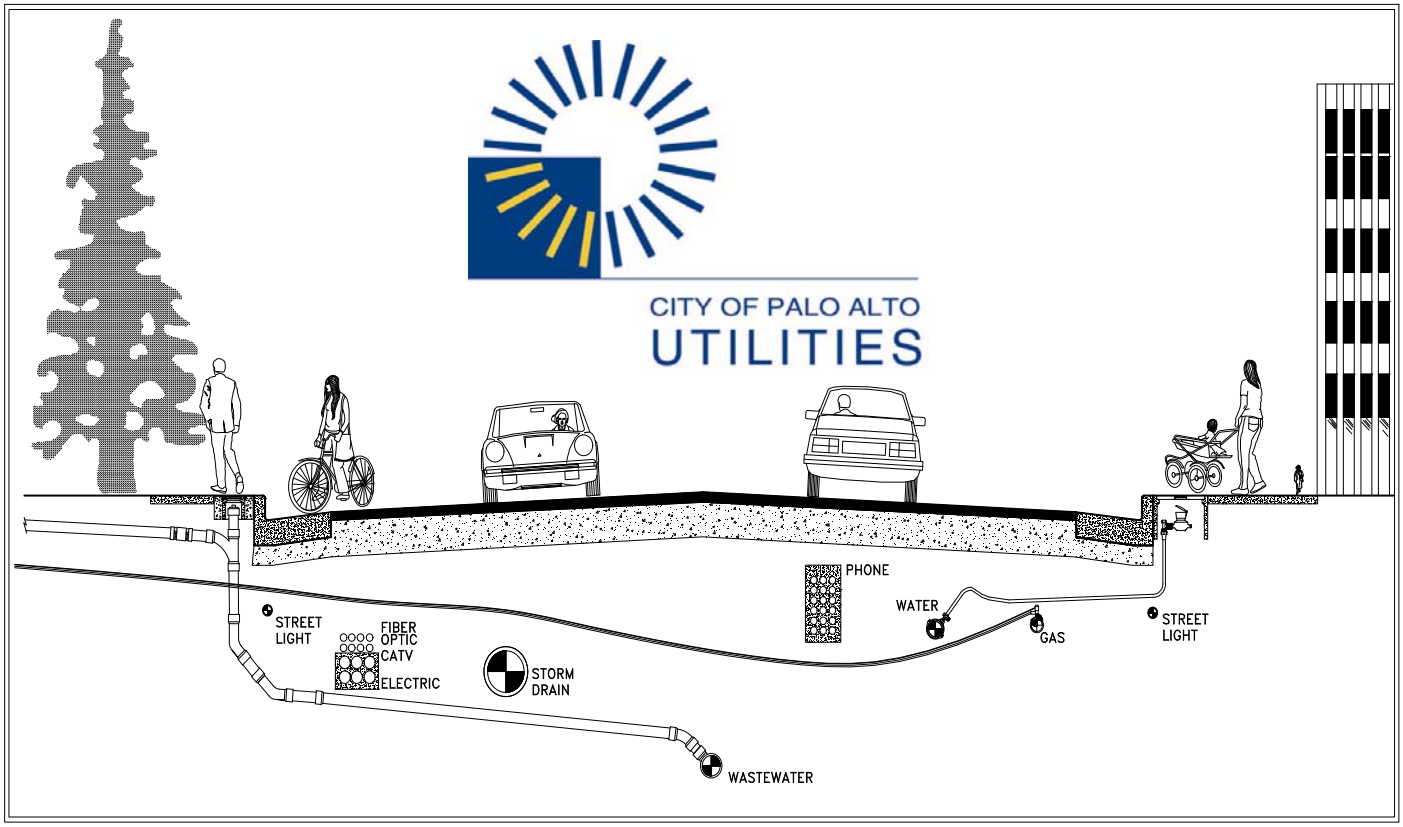
City of Palo Alto
Water Gas & Wastewater
Utility Standards
2013



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SECTION 2200
EXCAVATION, BACKFILL, RESTORATION AND GENERAL

PART 1 -- GENERAL

1.01 DESCRIPTION

A. General

Excavation, Backfill and Restoration shall conform to The City of Palo Alto Department of Public Works Standard Drawings and Specifications and as specified on the project plans. Excavation and backfill shall conform to the safety requirements of the Contract and the approved traffic control plans.

B. Work Included:

1. Potholing
2. Trenching
3. Backfill
4. Boring
5. Tree Trimming
6. Surface Restoration

1.02 APPLICANT INSTALLED WATER , WASTEWATER, AND GAS MAINS OR SERVICES

For applicant installed water and wastewater mains or services (gas shall only be installed by Palo Alto Utilities crews or City Contractor), the applicant shall submit to the WGW engineering section of the Utilities Department:

1. **Four** copies of the installation of water and wastewater utilities off-site improvement plans in accordance with the Utilities Department design criteria. All utility work within the public right-of-way or the public portion of the utilities shall be clearly shown on the plans that are prepared, signed and stamped by a registered civil engineer.
2. A complete schedule of work,
3. Method of construction including abandonment details
4. The manufacture's literature on the materials to be used for approval by the Utilities Engineering Section.

The applicant's contractor will not be allowed to begin work until the improvement plan and other submittals have been approved by the Water, Gas and Wastewater Engineering Section. WGW inspections shall be scheduled at least 5 days in advance.

After the work is completed but prior to sign off, the applicant shall provide record drawings (as-builts) of the installation of water and wastewater utilities to be owned and maintained by the City in accordance with **3.20 RECORD DRAWINGS** at the end of this Section**.**

PART 2 -- BACKFILL AND RESTORATION MATERIALS

Contractor shall prepare submittals for sand, 1/2" crushed rock, and controller density fill (CDF), for Engineer's approval, and prepare all submittals required by public works.

2.01 BACKFILL

All backfill materials shall comply with the drawings and be in accordance with latest edition of the California Department of Transportation, Standard Specifications. Excavated material shall not be used for pipe bedding or trench backfill.

2.02 SAND shall conform with Section 19-3.025B of Caltrans State Standard Specifications and shall be imported clean natural sand, free from clay, salt, sea shells, or organic material, suitable for the purpose intended and shall conform to the following gradation:

No. 4 sieve……. 90% - 100%
No. 200 sieve……. 0% - 5%

Dredged sand from San Francisco Bay is not acceptable.

2.03 Class 3 Permeable 1/2" CRUSHED ROCK

1/2" Crushed rock will be designated by nominal size and shall conform to the following gradation when tested in accordance with section 6 and 68-1.025 of Caltrans State Standard Specifications

Class 3 permeable base:

Passing a 3/4" sieve.....	100%
Passing a 3/8" sieve.....	40% - 100%
Passing a No. 4 sieve.....	25% - 40%
Passing a No. 8 sieve.....	18% - 33%
Passing a No. 30 sieve.....	5% - 15%
Passing a No. 60 sieve.....	0% - 7%
Passing a No. 200 sieve.....	0% - 3%

This material shall contain at least 75% of the particles having one or more fractured faces. Not over 25% shall be particles showing no such faces.

Crushed Rock shall meet the test grading requirements of ASTM C 131 test grading B.

2.04 CLASS 1B - 3/4" MINUS

Class 1B - 3/4" minus will be designated by nominal size, shall conform to the following gradation, and shall meet the requirements of Sections 6 and 68-1.025 of Caltrans State Standard Specifications:

Passing a 2" sieve.....	100%
Passing a 1.5" sieve.....	95 - 100%
Passing a 3/4" sieve.....	50% - 100%
Passing a 3/8" sieve.....	15% - 55%
Passing a No. 4 sieve.....	0% - 25%
Passing a No. 8 sieve.....	0% - 5%
Passing a No. 200 sieve.....	0% - 3%

2.05 CONTROLLED DENSITY FILL (CDF)

A. Materials:

1. Cement: ASTM C150, Type II or V, 1-1/2 to 2 sack mix
2. Aggregate: Mixture of clean sand and pea gravel, 3/8 inch maximum size
3. Fly Ash: ASTM C-618 Class F
4. Water: Potable water or water of similar quality which is free of deleterious impurities
5. May use suitable admixture(s)

B. Mix Design and Performance:

1. CDF shall be non-segregating, flowable, self consolidating, low-shrink material that flows into place without leaving voids and cures into a stiff nonplastic material
2. Compressive strength: 28 day strength between 50 psi and 200 psi
3. CDF shall be supplied by a concrete manufacturing plant
4. Place CDF so as not to float the pipes

C. Submittals:

Submit in accordance with the submittal requirements of Section 700 General Conditions:

1. Mix design
2. Samples of the material to be used
3. Results of laboratory trial mix compressive strength testing using 6” diameter by 12” test cylinders with cylinder breaks at 7 and 28 days (28 day test shall be average of 2 or more cylinder breaks)

PART 3 -- EXECUTION

3.01 POTHOLING

The Contractor shall be required to locate and pothole all the utilities in the work area. The Contractor shall pothole as necessary to determine the exact locations of pipes in critical situations

prior to or during construction. Critical situations shall be defined by the Engineer. For trenchless construction, potholed crossing utilities shall remain exposed and visible throughout the boring operation and shall be inspected by the WGW Utilities Inspector prior to backfill.

Where connecting to or crossing existing underground utilities, the Contractor shall uncover these utilities and verify the locations and elevations prior to performing any installation Work within 100 feet of these locations. The cost of uncovering and verifying locations/elevations of the existing utilities shall be included in one or more Bid items for Utilities contracts and no extra compensation shall be paid to the Contractor.

For Utilities contracts, the cumulative paved surface area opened at any given time due to potholing excavations shall not exceed 500 square feet. Potholes shall be classified as open until final pavement resurfacing has been completed.

3.02 SAWCUTTING, DEMOLITION, AND REMOVAL FOR UTILITIES CONTRACTS

Trenching shall include the removal of all materials or obstructions of any nature, including asphalt and concrete pavement. **Areas in which sawcutting is performed shall be wet vacuum cleaned to remove the cutting residual, inclusive of the sawcutting fluid. Sawcut slurry shall not be permitted to enter storm drains.** Areas in which sawcutting is performed shall be cleaned to remove the cutting residual, inclusive of the sawcutting fluid, at the end of each work day or more often as required by the Engineer.

Existing street sections shall be removed in such a manner so as not to destroy or damage the structural integrity of the adjacent street section. Trench cutting shall be accomplished by using a pavement saw, cutting through the full pavement thickness of the pavement section. No equipment mounted pavement breakers shall be used. The top portion of the trench (i.e. the pavement thickness) shall be twelve inches wider than the portion extending to the bottom. Lines shall be marked along each side of the trench 6" beyond the edge of the trench and the pavement cut along these lines. To achieve the "T" section required by the City of Palo Alto Public Works Standard Drawings and Specifications "Typical Trench Sections" detail, generally four (4) parallel sawcuts are necessary for any given trench.

All pavement broken out of the trench will be removed by jackhammer, ripper teeth or backhoe. No equipment mounted pavement breakers will be allowed due to the minimal cover over some existing utilities. Valve boxes over abandoned utility main valves shall be removed from the street sections, the risers filled with sand, jetted and the street section restored to match the existing section.

When any portion of the trench, counting from saw cut line, is within three (3) feet of the edge of pavement or curb and gutter, this area shall be removed.

If the separation between the adjacent potholes is less than three (3) feet, the pavement between these potholes shall be saw cut and removed as well.

Where the trench is to be located in a Portland cement concrete or asphaltic-concrete paved street, lines shall be marked along each side of the trench and the pavement cut along these lines with a

concrete saw to the full thickness of the concrete. Only concrete saws for PCC-based pavement shall be used to remove PCC pavement.

It is the Contractor's responsibility to locate a suitable disposal or recycling site for all material removed from the trench. Asphalt concrete and Portland cement concrete must be disposed of at an inert solids recycling facility, approved by the Engineer. Documentation of each load recycled is required for payment.

Removal of concrete sidewalks, driveways, curbs and gutters shall be to existing joints or to sawcuts made at existing score marks.

Where an existing gutter is to be removed and replaced, the Contractor shall remove in a straight line 12 inches of abutting asphalt concrete to permit the placing of a form between the adjacent asphalt concrete surface and the new gutter to be poured. The Contractor shall plug the void caused by the removal of the form with compacted asphalt concrete.

Tunneling under street, sidewalk, curb and gutter is not permitted except with directional or percussion bore devices and as noted on the construction plans.

3.03 TRENCHING

Unless indicated otherwise in the drawings, excavation for pipe lines shall be by open cut.

Trench Excavation (Ref. the City of Palo Alto Public Works Standard Drawings and Specifications). The bottom of the trench shall be a minimum of 8 inches wider than the outer diameter of the pipe. The depth of trench shall be at least: the minimum depth of cover (30" for gas main and 36" for 8" water main) plus 4" for pipe bedding plus the outer diameter of the pipe. The Contractor shall support all existing utilities within the excavation or trench as required to avoid damage to the existing utilities. A plan for supporting the existing utilities shall be submitted for approval by the Engineer. The Contractor may not start work prior to approval of the utility support plan.

For Utilities contracts (CIPs), a maximum of 500 feet or one City block of trench, whichever is greater, may be opened at one time. For CIPs no more than one crew working and no more than one continuous trench shall be opened at any given time unless approved by the Engineer.

For Utilities contracts, no excavation shall be left open during nonworking hours. All open trenches and excavations shall be steel plated **with non-skid steel plates** or backfilled and paved with temporary asphalt concrete (cutback) at the end of each work day. Steel plates shall be shimmed with wooden wedges to prevent rocking and cutback shall be used at the edges to provide a smooth transition from the pavement surface to the top of the plates (one foot wide minimum ramp or 12:1 slope). Steel plates subject to turning vehicles or vehicle acceleration and de-acceleration shall be welded together and/or anchored to prevent movement. All steel plates shall be non-skid type with a surface roughness capable of producing a coefficient of friction equal to or greater than the level specified by the latest version of applicable CALTRANS specifications. Additionally, steel plates shall not have any protrusions above the top surface of the plate. Plates also shall be checked for proper placement at the end of each work day and adjusted/leveled/shimmed as required. Steel plating shall be avoided in designated bicycle lanes by backfilling and in installing

temporary pavement at the end of each day. If skid resistant steel plating must be used in a designated bicycle lane, then the paving on either side of the trench shall be milled down such that the plating is flush with the paving on either side of it.

Handling of Pipes and Materials into the Trench. All fittings, valves, hydrant buries, manholes and pipe lengths shall be carefully lowered into the trench by means of suitable tools and equipment, in such a manner as to prevent damage to materials. **Under no circumstances shall utility main materials be dropped or dumped onto the work area or into the trench.** Pipe support stands shall be utilized to support pipe during fusion joining, directional boring pull in, lining sewer mains, and while lowering of the pipe into the trench. Pipe support stands shall not be spaced greater than 15' for directional boring pull in and lining sewer mains. Dragging of pipe on paved surfaces is not allowed. Pipe showing evidence of dragging on pavement shall be removed, disposed of, and replaced by the contractor at his/her own expense.

Throughout the duration of the job, the Contractor shall have a crew available to promptly backfill and repair paving at trench and manhole locations where settlement or cave-ins have occurred. The Contractor shall make periodic inspections of the trench at least once a week as well as immediately after rain, and repair any defect at once.

Sufficient pumping equipment shall be provided to maintain the bottom of the trench dry during placement of the pipe bedding and other backfill material. The pump discharge water shall be pumped into sewer or as otherwise directed by the Engineer. The pump discharge water shall not be routed to natural drainage channels or storm sewers (Refer to Section 760, Public Works Department Storm Water Pollution Prevention policy).

All crossing pipelines shall be protected from damage during excavation by using hand tools or Hydro-Vac to expose them. All exposed gas lines shall be inspected for wrapping damage by the WGW Utilities Inspector prior to backfill. It is the Contractor's responsibility to inform the WGW Utilities Inspector when gas lines are exposed to facilitate an inspection.

3.05 SHORING FOR UTILITIES CONTRACTS

Shoring shall be in accordance with Section 6705 of the California Labor Code. The Contractor shall submit a detailed plan showing design of bracing, sloping or other provisions to be made for worker protection from the hazards of caving ground. Such plan shall be submitted for acceptance at least 5 days before the Contractor intends to begin work on the trenches or shoring pits. If such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by a registered civil or structural engineer. Said plan shall be accepted by the Engineer prior to any excavation.

When shoring is required at locations other than those specified in the bid items, the Contractor shall, at no additional expense to the City, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below pipe grade) and to prevent any movement which could in any way diminish the required trench section, or otherwise damage or delay the work.

Nothing herein shall be deemed to allow the use of a shoring, sloping or protective system less effective than that required by the Construction Safety Orders of the Cal. OSHA.

The Contractor shall support all existing utilities within the excavation or trench as required to avoid damage to the existing utilities.

3.06 BACKFILL

A. Bedding.

All excavated material shall be removed from the site. It is the Contractor's responsibility to locate a suitable disposal site for all material removed from the trench. Asphalt concrete and Portland cement concrete must be disposed of at an inert solids recycling facility, approved by the Engineer. Documentation of each load recycled is required for payment. No shoring or bracing shall remain in the trench after backfilling. No wedging or support of the pipe with wood or any other type of material other than the pipe bedding material shall be permitted.

Soil Stabilization: Pipe bedding shall not be placed on unsuitable material. Any unsuitable material encountered at the base of a fully excavated trench for the pipes or below the grades shown for manhole excavation shall be removed as directed by the CPA Inspector. The unsuitable material shall be replaced with subgrade stabilization material (Class 1B ¾" minus rock) wrapped in geotextile fabric. The Contractor shall remove such unsuitable material to a minimum depth of 12 inches below the bedding to a maximum of 24 inches below the bedding. Subgrade stabilization material shall be compacted to the satisfaction of the CPA Inspector. Geotextile fabric shall be Mirafi 600x or equal. Overlap the seam running along the trench 12 inches minimum; overlap the seam perpendicular to the trench 24 inches minimum.

Trench bed shall be smooth, uniform, and free of debris, sharp rocks, etc. before adding the pipe bedding.

Pipe Bedding For Wastewater Plastic Pipe Construction: The bedding material shall be washed, ½" crushed rock from 4" to 6" below the pipe to the springline of the pipe compacted to a density of at least 90% of the maximum density as determined by the California Test Method 216.

Pipe Bedding For Water and Gas Construction: The bedding material shall be sand bedding 4" to 6" deep below the pipe compacted to a density of at least 90% of the maximum density as determined by the California Test Method 216.

After compaction, bell holes (if required) shall be cut in the material where required so that the pipe, when laid, will have a uniform bearing under the full length of the barrel. The depth of compacted select material shall be at least four (4) inches under the barrel, bell or couplings of the pipe and maximum of six (6) inches.

After the pipe has been properly laid in the trench, select material shall be placed on both sides of the pipe and forced under the haunches of the pipe as shown in standard detail WGW-04 of appendix A.

B. Initial and Subsequent Backfill

Initial backfill shall be placed uniformly on both sides of the pipe and in such a manner as to avoid damage or movement to the placed pipe. Initial backfill shall be placed to a compacted depth of 12 inches above the top of the pipe and compacted to 90% of maximum density per ASTM D-1557. When sand is selected the Contractor may elect to "jet" provided excess water is collected at the low points and removed by pumping. Jetting and vibration shall be at intervals not to exceed six (6) feet, in accordance with Public Works Standard Drawing (401).

Subsequent backfill shall be placed in 8 inch lifts or less compacted to 90% of maximum density per ASTM D-1557, with the final twenty four (24) inches mechanically compacted to 95% of maximum density per ASTM D-1557.

C. Controlled Density Backfill (CDF)

CDF Backfill shall only be used as approved by the Engineer. A 12 inch sand layer shall be installed above the gas or water pipe before installation of CDF.

3.07 COMPACTION TESTING FOR UTILITIES CONTRACTS

Compaction testing will be performed by the City's contract soils laboratory under the general direction of either the WGW Inspector or the Public Works Inspector. The Contractor shall cooperate, by adjustment of his operation, in order to permit soils compaction testing on all backfill materials. The City will pay for the initial compaction test; all subsequent compaction tests required will be at the Contractor's expense.

One (1) full day advance notice will be required for any soil compaction test request. The City Inspector will schedule the compaction testing according to the date and time provided by the Contractor. If the Contractor is unprepared at the scheduled time, the Contractor shall pay for delaying the soil compaction testing.

All other testing required by the Contract shall be provided at the expense of the Contractor.

3.08 PLAN MODIFICATIONS

Field conditions may necessitate minor revisions to the details shown on the project plans. The Contractor shall obtain the Engineer's approval of any changes necessary for proper crossing of existing utilities. The revisions will be directed by the Engineer and are not anticipated to be of a magnitude causing a change in the nature and scope of work.

3.09 EXISTING UTILITIES AND USA

Underground Service Alert **(USA) NOTIFICATION. It is the Contractor's responsibility to notify Underground Service Alert (USA at 8-1-1)** a minimum of five (5) Working Days in advance of starting excavation. The Contractor shall delineate the areas of work with white paint. Contractor shall only request utility markings at those locations where underground work will occur during the following two weeks (USA tags are only valid for fourteen (14) Calendar Days).

The Contractor shall completely remove all USA markings and all other markings associated with this project from pavement, sidewalk, curbs, driveways, etc. The method used for removal of the markings shall be approved by the City. The cost to remove the USA markings shall be included in one or more Bid items and no extra compensation shall be paid to the Contractor.

The Contractor shall verify or cause to be verified that all of the utilities shown on the project plans have been USA marked and notify the Engineer if any utility shown on the plans has not been marked. If the contractor is unable to locate underground utilities based on USA marks provided, the contractor will contact the responsible utility owner to remark the facilities in question.

Where underground utility mains such as water, gas, wastewater, electric, telephone, or cable television are shown on the project plans, the Contractor shall assume that every property parcel adjacent to or on the same street as the underground utility mains has an underground service for each type of utility present. In addition, the Contractor shall assume that each property parcel with either an above ground or at grade facility, such as a water meter box, gas meter, or sanitary sewer clean out, has an underground service for the respective utility. If a service is not shown on the project plans for any parcel, not marked, or marked in the incorrect location according to the project plans, the Contractor shall bring it to the attention of the WGW Utilities Inspector at least one working day prior to digging to allow time to resolve the conflict.

Methods of protection of existing utilities shall be approved by the Engineer prior to the start of crossing the existing utilities. All utilities crossing or lying along the trench shall be supported. The work of bracing and the care of all encountered utilities below grade shall be considered a part of excavation and backfill.

If it is necessary to relocate or temporarily remove and replace existing underground utilities, the Contractor shall first obtain permission from the utility concerned and comply with its requirements in performing the necessary work. Gas and water line relocations shall be performed by the City. All costs incurred shall be paid by the Contractor. Property owners shall be notified at least 24 hours before the planned disruption of any utility service.

Shut down of City WGW Utilities shall be performed by City of Palo Alto Utilities WGW Operations Division. The Contractor shall not disconnect or shutdown any part of the existing City of Palo Alto WGW Utilities System except by expressed written permission of the Engineer. Contact WGW Utilities Inspector five (5) working days in advance of required shutdowns and submit a schedule of the estimated shutdown time to obtain said permission.

It is the Contractor’s responsibility to find all known utilities regardless of USA and plan inaccuracies. The contractor shall pothole all crossing and nearby parallel utilities both public and private within the work area. The Contractor shall proceed with caution during the trenching operation to avoid damage to the existing underground utilities. Caution must also be exercised

when installing new pipe by directional boring methods. All existing utilities crossing the proposed bore path must be prospected prior to establishing the pilot bore path. Locator devices, careful probing, vacuum, and hand methods of excavation shall be employed to determine the exact horizontal or vertical alignment of underground facilities. All exposed gas lines and electric facilities shall be inspected for damage by the WGW Utilities and Electric Utilities Inspectors prior to backfill. **The Contractor shall immediately notify the Engineer if any Underground Facility is disturbed or damaged.** Repairs to existing City wastewater utilities shall be performed by the Contractor, unless otherwise directed by the Engineer. City forces shall repair, relocate, or replace all other City utilities. The Contractor shall accommodate City forces in his or her operations. **The Contractor shall pay for the full cost to repair the existing utility mains or services damaged by his or her operations and any other damages resulting from the damaged utilities, unless such mains were not shown on the project plans and were not marked by the owner of the respective utility**. The cost of repairs performed by City crews will be billed to the Contractor by the WGW Operations Division and shall be paid independently by the Contractor to the City's WGW Operations Division. Final approval or payment will not be made until these bills have been paid.

Repairs on gas and water mains and electric substructures and associated service laterals will be made by the City's Utilities Department, unless otherwise directed by the Engineer. The cost for these repairs will be paid directly to the Water, Gas and Wastewater or Electric Operations Divisions. Payment must be made when submitting monthly progress payment request. Wrapping on any exposed steel gas lines shall be inspected by the City prior to backfill.

Repairs of customer-owned sprinkler systems shall be made by the Contractor at his expense.

Contractor shall repair **customer owned portions** of water and gas services, damaged by the Contractor, at his expense. The repair work must be performed by a licensed plumber in accordance with the requirements of UPC and City of Palo Alto Building Department. The Contractor will be responsible for coordinating access to private property with the owners.

Sewer Laterals location verification (this procedure must be followed on all new directionally bored mains and services):

The Contractor is required to locate all sewer laterals on public and private property prior to installing new mains and services by directional boring methods. After installation of new infrastructure has been completed, the Contractor shall positively identify that all sewer laterals and mains that were crossed by the new mains or services, installed by directional boring methods, were not damaged.

The Contractor must video-inspect all sewer laterals on the affected property to determine if damage is present. The Contractor is also required to perform video inspection at all locations where reconnection is specified. The video inspection must include entire length of the lateral from the house clean out to the sewer main including braches and cleanout risers. The Contractor will be compensated for this Work through the appropriate bid items.

The Contractor will be required to video inspect sewer mains that were crossed by directional boring if positive identification that the mains were not damaged cannot be established (it includes

location of all laterals). This work (sewer main video verification) is considered a necessary step for installation of new mains and services and all costs associated with this work shall be incorporated in one or more bid items and no separate payments will be made.

If Contractor is unable to find an existing clean out or clean out is not present, the Contractor shall locate and expose the sewer lateral and install a double WYE clean out per City standard to facilitate video inspection.

The video shall be submitted in Pic Ax 2.0 software (RedZone Robotics (925) 824-3200) format. GPS points shall be taken at the main, at the property line cleanout and at the structure. There shall be a multilevel QA/QC process that involves at least 3 reviews (field, office-general, and coding process). Completed 'cleared' laterals shall be noted on a provided by the City SHAPE file that overlays our GIS maps. Contractor shall provide files to the City on a portable USB flash drive.

Storm Drain mains: The Contractor may be required to video inspect storm drain facilities crossed by directionally installed mains and services if positive identification that the mains were not damaged cannot be established. This work is considered a necessary step for installation of new mains and services and all costs associated with this work shall be incorporated in one or more bid items and no separate payments will be made. The video shall be submitted on a portable USB flash drive

It is the Contractor's responsibility to ensure the quality of submitted video. If the Contractor cannot perform the video verification due to presence of the excessive water in the lateral or other obstructions, the Contractor is required to notify the City to perform the cleaning of the lateral.

3.10 BORING

If the percentage of solid rock exceeds 75% of the soil volume, open trench method shall be used instead of directional boring method.

The pilot bore for utility mains and services shall be a minimum of 24" clear from other crossing underground facilities. Utility mains and services shall have a minimum 12" horizontal separation from other crossing underground utility pipes, services, and facilities.

All underground utilities, crossing the bore path, shall be located and potholed prior to the start of boring. One tracer wire shall be attached to the pipe prior to insertion in the borehole. All pipe ends shall be sealed with a butt fusion end cap or similar fitting prior to pulling into a borehole.

A. Boring Machine.

The contractor shall provide a utility line boring machine(s) capable of installing the required pipe sizes pipe by directional boring.

1. **Service Line Boring Machine**. The contractor shall provide a boring machine or pneumatic gopher capable of installing 1" and 2" pipe.

2. **Directional Boring Machine.** The Contractor shall provide a directional boring machine capable of drilling a pilot hole along a predetermined path to a specified target location, then enlarge the pilot hole to desired size while pulling in specified size pipe. The boring machine shall be equipped with mechanical and hydraulic deviation equipment capable of changing the direction of pilot drilling course. The boring machine shall also include a fluid mixing/pumping system capable of lubricating the bore hole with drilling fluid to insure complete consolidation of the soil after pipe installation and to minimize friction forces during pull back.

3. **Locating System**. The Contractor shall provide a locating system able to monitor the location and orientation of the drilling head assembly along a predetermined course. The locating system shall be capable of locating the drill head both horizontally and vertically to an accuracy of ± 1" at 10' depth, and detect the rotation angle of the head. The Contractor shall supply bore logs of each boring leg.

4. **All compaction and reaming devices** shall be pulled through the borehole. Pushing reamers/boreheads through existing bore holes will not be allowed.

5. **No open boreholes will be allowed.** Upon completion of the pilot hole, the Contractor will not be allowed to leave the pilot borehole open. Either product pipe shall be pulled back by the pilot string or, if expansion of the pilot hole is required by product pipe diameter, rods shall be ferried between the launch and receiving pits.

6. **Maximum diameter of the pilot drill bit** shall not exceed 3.5 inches in diameter, unless approved by the Engineer.

B. Directional Boring Method

1. Drill a pilot hole with fluid assisted mechanical cutting head along a predetermined path to a specified target location. Drilling fluid can be a mixture of water and bentonite, polymers, or other approved additives. No fluid shall be discharged into the streets, gutters, or sewers. Fluid pressure and flow rate shall be minimized through the use of relief holes during the drilling operation to prevent fracturing the subgrade material around and above the pilot hole. Uncontrolled jetting is prohibited. Any fluid discharged onto streets, sidewalks or customer property, shall be properly disposed of including cleaning of the affected area. Excess drilling fluid must be removed from the surface of relief holes prior to paving.

2. Enlarge pilot hole with cutters or reamers to desired size and pull in specified size pipe while injecting fluid mixtures to hold reamed hole open and lubricate the utility line being pulled. Reamers shall be minimum: 4" for 2" pipe, 8" for 4" pipe, 12" for 6" pipe, 14" for 8" pipe, 18" for 10" and 12" pipe, and for larger than 12" pipe, reamers shall be at least 50% larger than the pipe diameter and approved by the Engineer.

3. A commercially available weak link approved by the Engineer shall be used, in accordance with manufacturer's recommendations, between the puller and the pipe. The maximum pull force shall be **less than:**

   - MDPE 2406 (gas pipe) 1,400 lbs for 2", 4,200 lbs for 4", 9,100 lbs for 6", and 15,400 lbs for 8" pipes.
   - HDPE 4710 (water pipe) 15,900 lbs for 6", 27,000 lbs for 8", 42,000 lbs for 10", 59,000 lbs for 12", 71,000 lbs for 14", and 93,000 lbs for 16" pipes.

4. The Contractor will be allowed to leave drill rods in the ground overnight, however pipe pulling must be completed on the same day as it is initiated.

5. The Contractor is required to protect pipe from scratching on edge of trench, plate or pavement during pull in. Methods of protection shall be submitted for review and approved by the Engineer prior to performing the Work. Dragging of the pipe on paved surface is not allowed.

C. Bore and Jack.

At railroad and major street crossings where open excavation cannot be made, a steel casing shall be installed by boring and jacking after permitting and coordinating with agency having jurisdiction. The grade shall be as shown on the Plan and Profile drawings and the casing shall be installed to permit the carrier pipe to be spaced as shown in the drawings. The size of the casing shall be as specified in the Drawings and Specifications. Link Seals® or approved equal, shall be installed at both ends of the casing and manufactured casing insulators shall be installed at 5 foot maximum intervals on the carrier pipe prior to insertion as shown on the project drawings.

Joints between sections of the casing shall be welded for the entire circumference of each joint. This weld shall be a minimum of two complete passes.

The contractor shall furnish casing for locations shown on the Plan and Profile drawings. If for convenience of construction, the contractor should select to install casings at locations other than those shown on the Plan and Profile drawings, he or she may do so at his/her

expense provided the Engineer approves and required permits allow installation at the new locations.

Note: All equipment must be in good working order and properly maintained during project installation. The City will inspect the preceding items and reject those not in compliance. The City shall have the right to reject any or all equipment judged inadequate.

3.13 INSPECTION

All work shall be subject to inspection by the appropriate City departments at all times. Any work concealed before it has been inspected by the Engineer shall, at the request of the Engineer, be reopened or uncovered at the Contractors expense. If deficiencies are found, these deficiencies shall be corrected at the Contractor's expense.

The City reserves the right to inspect all materials or equipment during the production, manufacturing or fabricating process, before shipment, or when delivered to the site.

Neither acceptance of the work, nor final payment, shall relieve the Contractor of the responsibility for performing the work in accordance with the contract requirements. The Contractor shall remedy any work not conforming to the contract without expense to the City.

Contractors working on City CIP projects shall pay for the City Inspector’s overtime at 1.5 times the Council approved inspection rate if work is performed beyond the allowed construction hours (see Section 00700-1.19-A) unless the work is requested by the City.

Contractors working on private projects shall pay all inspection costs including the City’s WGW Utility Inspector’s overtime at 1.5 times the Council approved inspection rate for inspections scheduled outside the hours of 8:00 AM to 3:00 PM Monday through Thursday excluding City holidays.

3.14 LICENSES, PERMITS AND FEES

The Contractor shall provide, procure and pay for all licenses, permits, and fees including but not limited to street-opening permit, encroachments permits (including but not limited to the following agencies: Caltrans, SCWVD, SFPUC, Caltrain, Santa Clara County, PG&E, Stanford, VTA, and etc.), water use, electricity, building permit, noise exception permit, storage of materials, office trailer, erection of construction shack, etc. required by the City or other government jurisdictions or agencies to carry out and complete the work. The Contractor shall provide the City with copies of permits and licenses.

For any work in railroad’s right of way, the Contractor shall pay for the costs incurred by the railroad company such as inspectors’ wages, safety flagman’s wages, safety training, and rail supports if necessary.

It is the Contractor’s responsibility, while preparing the Bid, to evaluate what permits need to be obtained and estimate fees necessary to procure the required permits in order to complete the

Work. Payment of all costs and expenses for such licenses, permits and fees shall be included in one or more bid items. No other compensation shall be paid to the Contractor for these items or for delays caused by non-City inspectors or conditions set forth in the licenses or permits issued by other agencies.

3.15 SUBMITTALS

All submittals must be approved prior to starting the portion of work, or delivery of the material or equipment to the job site that the submittal relates to. Unless specifically stated elsewhere in the Contract Specifications, make submittals in advance of ordering the materials to provide time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery. For Utilities contracts, the Engineer may withhold progress payments pending receipt and approval of required submittals.

In scheduling, allow at least 15 working days for review by the Engineer following the receipt of the submittal.

The Engineer will supply a checklist of items that shall be submitted by the Contractor for approval.

Unless otherwise specified, make submittals in groups containing all associated items to assure that required information is available for checking when the submittal is received. Partial submittals may be rejected as not complying with the provisions of the Contract and the Contractor may be held liable for delays so occasioned.

All submittal information shall be e-mailed or two (2) copies transmitted to the Engineer.

Submittals shall be addressed to:

Project Manager
Project Name (CIP #)
City of Palo Alto
Department of Utilities
P.O. Box 10250
Palo Alto, CA 94301

Ultimate responsibility for the accuracy and completeness of the information contained in each submittal shall remain with the Contractor.

The Engineer will return one (1) copies of each submittal to the Contractor with comments noted thereon, within fifteen (15) working days following their receipt by the Engineer. The Contractor shall make a complete and acceptable submittal to the Engineer by the second submission of a submittal item. The City reserves the right to withhold monies due the Contractor to cover actual additional costs of the Engineer's review beyond the second submission. The Engineer may withhold progress payments pending receipt and approval of required submittals.

If the submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED", formal revision and resubmission of the submittal will not be required.

If the submittal is returned to the Contractor marked "REVISE AND RESUBMIT" or "REJECTED", the Contractor shall revise the submittal and shall e-mail or transmit two (2) copies of the revised submittal to the Engineer.

When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number; on re-submittals, cite the original submittal number for reference.

Revisions indicated on submittals shall be considered as changes necessary to meet the requirements of the contract and shall not be taken as the basis of claims for extra work. If the Contractor considers any required revision to be a change, he shall so notify the Engineer as provided for in the General Conditions.

Fabrication of an item shall not commence before the Engineer has reviewed the pertinent submittals and returned copies to the Contractor marked "NO EXCEPTIONS TAKEN."

All submittals shall be carefully reviewed by an authorized representative of the Contractor, prior to submission to the Engineer. Each submittal shall be dated, signed, and certified by the Contractor, as being in compliance with the project plans and specifications. No consideration for review by the Engineer of any submittal will be made for any items, which have not been so certified by the Contractor. All non-certified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

The Contractor shall maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times, and keep it available to the Engineer for his review upon request.

Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.

The Engineer's review of the Contractor's submittals shall not relieve the Contractor of the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for any work not conforming to the contract. Any fabrication or other work performed in advance of the receipt of approved submittals shall be entirely at the Contractor's risk and expense.

3.16 PROTECTION OF TREES, PROPERTY, AND SERVICE STRUCTURES

Trees, shrubbery, fences, poles and other property and service structures shall be protected unless their removal is shown on the drawings or authorized by the Engineer. Trees shall be protected per the City’s Tree Protection Manual.

Where the City (street) trees obstruct the Contractor's equipment, the Contractor shall be responsible for all trimming necessary to create clearance for his or her operations.

Trimming shall be done by an International Society of Arboriculture (ISA) certified tree trimmer in accordance with the Standard Drawings and Specifications. All trimming is subject to review by the City's Arborist Consultant. The City Arborist shall be notified in advance of all limbs and tree roots greater than 3 inches in diameter, which need to be removed. The removal of these limbs or tree roots shall be approved by the Arborist prior to removing.

When boring below a tree with a tap root the minimum depth of boring shall be 5'.

The Contractor will be assessed charges for any damage to City trees including, but not limited to, broken limbs and damaged trunks. Charges will be determined by the City Arborist.

Any damage to private trees including, but not limited to, broken limbs and damaged trunks shall be remedied to the homeowners' satisfaction.

3.17 ASPHALT CONCRETE PAVING

Place asphalt concrete in accordance with the Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications. The minimum pavement section restored shall be two (2) inches asphaltic concrete on eight (8) inches of Class 2 aggregate base or the existing pavement and base section whichever is greater. Class II aggregate base shall be compacted to 95% compaction.

Prior to asphaltic concrete pavement installation, all debris (leaves, twigs, trash, etc.) laying on the top of the compacted trench shall be removed and paint binder (RS-1) shall be applied to all vertical edges of the surrounding pavement around the perimeter of the trench at a rate of 0.05 to 0.10 gallons per sq. yd. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50^{o} F, or during fog, rain, or other unsuitable conditions.

When any portion of the trench is within three (3) feet of the edge of pavement or curb and gutter, the AC cap in this area shall be replaced in kind, or with two (2) inches of asphaltic concrete, whichever is greater.

If the separation between the adjacent potholes is less than three (3) feet, the pavement between these potholes shall be replaced in kind as well.

The new asphalt concrete shall be placed to the same grade as the surrounding asphalt concrete grade, such that the originally designated cross-sectional geometry of the road is maintained. Excess asphalt shall be removed from the working area and not rolled into the mat. Asphaltic concrete shall be placed with an asphaltic paving machine. A paving box may be used only with the approval of the Engineer. A maximum of a 3 inch lift is allowed for asphalt concrete pavement. Final lift of asphalt for trench restoration shall be 3/8" fine.

Upon completion of all asphalt paving, a seal coat (fog seal or sand seal) shall be applied to all restored surfaces. On streets with slurry seals, the restored trench shall receive a slurry seal coat in accordance with Section 37-2 of the California Specifications.

Unless otherwise authorized by the Engineer, all construction and restoration shall be completed within fifteen (15) working days from start of work at any specific location, and final surface restoration shall be completed within 10 working days from the last day pipe was installed on any particular continuous section. No more than 1,000 feet of temporary pavement will be allowed before the contractor must install permanent paving prior to proceeding with new trenching operations.

3.18 PCC PAVEMENT, CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

Place Portland cement concrete in accordance with the Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications, Section 40.

All PCC pavement shall be 6-sack minimum with 2 pints liquid lampblack per cubic yard in accordance with the Public Works Standard Drawings and Specifications and complying with CALTRANS Class A concrete standards.

The PCC plug shall be placed to the same grade as the surrounding PCC pavement grade, such that the originally designated geometry of the roadway is maintained. Excess concrete shall immediately be removed from the working area and disposed of properly. After placing, the concrete shall be consolidated sufficiently to produce a dense mass, struck off and floated.

All concrete shall be placed against existing sawcut concrete or 2" thick wood forms. If a gutter exists, twelve inches of AC will have to be removed at the lip of gutter for the placement of these forms. *No concrete shall be placed against asphalt or spalled/broken concrete.*

Forms shall be checked by the WGW Utilities Inspector and Public Works Inspector before any pouring of concrete.

PCC shall not be poured when air temperature is below 40 Deg. F or during rain or within two hours before sunset. No on-site mixing of PCC shall be allowed.

All new PCC (at sidewalks, curb and gutter, and concrete roads) shall be doweled into existing PCC using #4 rebar 12" long dowels spaced at a maximum of 2' centers. Dowel holes shall be drilled in the vertical section center. Dowel holes shall be drilled 6" into the existing concrete without causing damage. Dowels shall be epoxied into the existing concrete.

Concrete shall be placed and compacted in forms without segregation. After placing, the concrete shall be consolidated sufficiently to produce a dense mass, struck off and floated. Final finishing operations shall not proceed until all bleed water has evaporated from the surface. Sprinkling of dry

cement to absorb excessive surface moisture shall not be allowed. The surface texture of finished concrete shall conform to adjacent concrete. Forms shall not be removed less than twenty-four hours after the concrete has been placed. In no event shall forms be removed while the concrete is sufficiently plastic to slump.

If any portion of sidewalk is sawcut or damaged during the course of work, the Contractor will be required to remove and replace the entire width of sidewalk from the planting strip or property line edge of the walk to the curb edge between the nearest undamaged joints.

As soon as the concrete is set, it shall be cured for a period of at least 72 hours by spraying with an approved pigmented impervious membrane-curing compound.

The Contractor shall protect from damage all completed Work. All discolored concrete shall be cleaned to a uniform color. Repairs and cleaning of new concrete shall be at the expense of the Contractor.

3.19 PAVEMENT STRIPING AND LEGENDS

Contractor shall replace all pavement striping, legends, signs, and curb painting damaged due to the Contractor's activities in kind unless a redesign is ordered by the Engineer. Place pavement striping, legends, signs, and curb painting in accordance with the Public Works Standard Drawings and Specifications, and Caltrans Standard Specifications.

Temporary traffic striping and legends shall be placed on the newly paved street prior to the release of the street to the public. These materials shall be either pop-up temporary markers (for arterial streets) or tape (for residential streets). The proposed materials must be submitted to the Engineer for approval prior to use. Permanent striping must be installed within 7 days.

Alignment lines shall be established by the application of cat tracks or dribble lines, the use of laser guidance devices or a combination of both, as detailed in Caltrans Specifications Section 84-1.01 through 1.03.

Pavement markers and Stimsonite fire hydrant markers shall be placed in accordance with the California Standard Specifications, Section 85, and manufacturer's installation procedures.

Tape striping, legends, signs, markings, or other facilities removed or damaged during construction shall be repaired or replaced in kind at no expense to the City within 10 working days of the last day pipe was installed on any given continuous section.

All materials, equipment and labor required to perform surface restorations shall be included in one or more of the bid items and no further compensation will be allowed for surface restoration.

Thermoplastic material and paint for traffic stripes and pavement markings shall be applied in accordance with the California Standard Specifications, Section 84, and manufacturer's installation procedures.

Tape shall be applied using a mechanical applicator furnished by the tape vendor. Installation shall be in accordance with the manufacturer's recommended installation procedures.

3.20 TRAFFIC LOOPS

In the event the Contractor severs any part of a traffic loop, the Contractor is responsible for replacing the entire traffic loop at the Contractor's expense, in accordance with the following standards:

A. The Contractor shall replace the affected loop within 72 hours of the damage. If this replacement is not done by this deadline, this work will be done by the City at the Contractor's expense.

B. The Contractor shall coordinate all signal loop work with the City of Palo Alto Traffic Signal Division.

C. Loops shall conform to City of Palo Alto wiring diagram quadrapole detector loops, Drawing K-1184. Each loop shall be identified in the pull box as to location, I.E. "2WR" or "2WL".

D. No separate bid item is made for the cost of replacing or repairing any traffic loop. It is the contractor’s responsibility to determine the expense of potential damage to traffic loops and include cost in the bid items.

E. Diagrams for City owned traffic detection loops are available from the City of Palo Alto Transportation Division of the Planning Department. For non-City owned traffic detector loops, contact the appropriate agencies (CALTRANS, Santa Clara County, etc.)

3.21 LANDSCAPING AND MISCELLANEOUS

All monuments within the project site shall be preserved as required by the State and local regulations. Damaged or destroyed monuments shall be replaced by a California licensed Land Surveyor hired by the Contractor. The Contractor shall submit the method and procedures of tying out the monuments for the City Surveyor’s approval. The Contractor shall also provide a recorded copy of the “corner record” to the City Surveyor. No separate bid item was made for the cost of any surveying or monument replacement work. The cost shall be included in one or more of the bid items.

The Contractor shall restore any special surface treatments encountered in the execution of this Work to an equivalent or better condition than existed prior to the commencement of this Work.

After each site has been completed, the Contractor shall restore landscaping and areas abutting the work to the condition existing at the start of work.

All materials, equipment and labor required to perform surface restorations shall be included in one or more of the bid items and no further compensation will be allowed for surface restoration.

3.22 STATE AND COUNTY ENCROACHMENT AND CONSTRUCTION PERMITS

1. For work in State of California right of way (El Camino Real, 101 Freeway, 280 Freeway), the applicant shall obtain an encroachment permit from Caltrans for all utility work in the State right-of-way. The applicant must provide a copy of the permit to the WGW engineering section.

2. For work in the County of Santa Clara right of way, the applicant shall obtain an encroachment permit from Santa Clara county department of transportation for all utility work in the county road right-of-way. The applicant must provide a copy of the permit to the WGW engineering section.

3. For work in the Santa Clara County Valley Water District right of way, the applicant shall obtain a construction permit from Santa Clara county valley water district for all utility work in the water district right-of-way. The applicant must provide a copy of the permit to the WGW engineering section.

3.23 RECORD DRAWINGS

The Contractor shall maintain on a daily basis a complete set of record drawings. Drawings shall include actual locations of utility crossings, field dimensions, and changes in the work. Drawings shall be marked "Record Drawings", shall be legible, and shall be available for City review at all times. Prior to final acceptance of the project, completed "Record Drawings" shall be submitted to the Engineer for final review and approval.

For Utility contracts, the Contractor shall meet with the City Inspector at the end of each work day to agree on the work performed in terms of quantities for each bid item. The Engineer will review the record drawings with each partial payment request. Payment may be withheld pending updating of the record drawings. The cost to prepare the record drawings shall be included in one or more bid items and no extra compensation shall be paid to the Contractor.

Required Attribute Data for Utility Features (to be included on the full size redline record drawings): For CIP and Customer Service Projects

1. Mains: Required Data
Pipe Diameter
Pipe Material
Pipe SDR or Pipe Class
Pipe Install Date (date pipe went in the ground)
Pipe Installed Method
Pipe Length
Pipe Manufacturer
Pipe Manufacturer Code
Pipe Depth
Pipe Installer Name
Pipe Test Date and Time
Pipe Pressure Test Data
Abandon Date or Removal Date (if applicable)

2. Services/Laterals: Required Data
Pipe Diameter
Pipe Material
Pipe SDR or Pipe Class
Pipe Function Type
Pipe Install Date (date pipe went in the ground)
Pipe Installed Method
Pipe Length
Pipe Manufacturer
Pipe Manufacturer Code
Pipe Depth
Pipe Installer Name
Service Connection Method to Mains
Marker Ball
Abandon Date or Removal Date (if applicable)

3. Manholes: Required Data
Manhole Install Date (date MH went in the ground)
Manhole Installer Name
Manhole Material
Manhole Type
Manhole Depth
Abandon Date or Removal Date (if applicable)

4. Cleanouts: Required Data
Cleanout Install Date (date CO went in the ground)
Cleanout Installer Name
Backflow Device
Abandon Date or Removal Date (if applicable)

5. Other Features: Required Data

Pipe Fitting Type
Pipe Fitting Connection Type
Pipe Fitting Size
Pipe Fitting Manufacture
Pipe Fitting Manufacture Code
Pipe Fitting Depth
Gas Riser Manufacture
Gas Riser Dimensions
Gas Riser Type
Gas Riser Dimensions
Gas Riser Pipe SDR
EFV Equipment Manufacture
EFV Size ID
EFV Trip Point

6. Valves: Required Data

Valve Install Date (date valve went in the ground)
Valve Installer Name
Valve Application
Valve Type
Valve Manufacturer
Valve Model
Valve Serial
Operable
Valve Actuator Type
Valve Access Type
Valve Function Type
Valve Lid Type
Valve Depth (valve cover to top of nut)
Abandon Date or Removal Date (if applicable)

7. Meters (installed by CPA Operations): Required Data
Meter Install Date (date meter went in the ground)
Meter Installer Name
Meter Number
Meter Type
Meter Location
Meter Box Model
Backflow Device
Abandon Date or Removal Date (if applicable)

General Scope for Survey Data Collection:

All survey data shall be collected by a California Licensed Land Surveyor. The Consultant or Contractor is responsible to setup all control points needed to perform the survey work. The accuracy for all survey data shall be +/- 1cm; with an exception of gas meter risers on private properties to be +/- 1m.

All survey points shall be collected using the California State Plane Coordinate System – Zone 3 in units of feet. The horizontal datum shall be the North American Datum of 1983 (NAD83) and the vertical datum shall be based on Bestor 93 (Refer to "Bestor0663P0027.zip" file for benchmark information – available upon request)

Use CPAU WGW Engineering's "feature codes" for naming convention and refer to the feature capture-positions in the attached 'Feature Codes and Feature Capture-Positions' list.

When applicable, survey data shall be collected within the entire width of the street and on private properties to include all features identified below. The extents of the survey area shall cover the full intersections to curb returns. The consultant/contractor shall obtain approval from business/home owners or occupants to access private properties for collecting required survey data. No additional compensation will be made for delays due to private property accessing issues. The Consultant/contractor shall provide necessary traffic control to meet the CPA Transportation Department's standards. No additional compensation will be made for traffic control on major streets.

Deliverables:

a. AutoCAD record drawings showing street, sidewalk, buildings and all required attribute data as detailed below for new/existing utilities highlighting all changes made from the approved drawings.
b. Survey data in 2008 or 2010 AutoCAD format with bench marks, surveyed points, and feature codes.
c. Coordinate text files (PNEZ) of survey points for all new utility features in .csv format, including feature code of each point in the spreadsheet.
d. The above deliverables need to be updated to the City once monthly for projects extending more than one month.

Data to be collected (what's applicable):

I. Collect horizontal and vertical data for:
   1. Sanitary sewer manholes (rim and invert elevations and depth)
   2. Storm drain manholes and catch basins (rim and invert elevations and depth)
   3. Gas and water valves (cover and stem elevations)
   4. Street surface along the crown of the pavement (i.e. along the approximate center line of the street width) at grade breaks and every 50' maximum
   5. Service/lateral connections to mains (at the top of the pipes, to be collected in open holes during construction)
   6. Changes in pipe alignment (at the top of the pipes, to be collected in open holes during construction)

II. Collect horizontal data for:
1. Electrical manholes and boxes
2. Fiber optic manholes and boxes
3. Telephone manholes and boxes
4. Fire hydrants
5. Anode boxes
6. Air relieve valves
7. Water meters
8. Sanitary sewer cleanout boxes
9. Gas meter risers or meter boxes
10. Monuments
11. Front and back of sidewalk, face of curb, lip of gutter, and edge of pavement on both sides of the street. For linear alignment, collect data at both ends of the block. For non-linear alignment, collect data at every turning point.

Feature Codes and Feature Capture-Positions

Feature Description	Feature Code	Feature Capture-Position
SURVEY REFERENCE POINT		
Benchmark	BM	
Back Site Point	BSPT	
ROAD FEATURES		
Back of Curb	BOC	Back of curb
Back of Rolling Curb	BORC	Back of rolling curb
Bridge, Edge	BREDGE	Edges of bridge outline
Back of Sidewalk	BSW	End pts. on straight alignment & every turning pt.
Back of Valley Gutter	BVG	At flow line
Crown of Street	CROWN	End pts. on straight alignment & every turning pt.
Ditch	DITCH	At flow line
Driveway	DWY	Edge of driveway both sides
Edge of Pavement	EOP	Both ends of the block and every turning pt.
Fence	FENCE	End pts. on straight alignment & every turning pt.
Flow Line	FL	End pts. on straight alignment & every turning pt.
Face of curb	FOC	End pts. on straight alignment & every turning pt.
Lip of Gutter	LOG	End pts. on straight alignment & every turning pt.
Loop Detector	LOOPDE	As needed
Street Monument	MONSTR	Center of lid/cover
Swale at Flow Line	SWALE	As needed
Traffic Speed Control	TRSPCN	As needed
Traffic Speed Donut	TRSPDON	As needed
Street Turn Around	TURNARO	As needed
Guard Rail	GUARDR	As needed
Parking Lot	PARKING	Edges of parking lot
Speed Bumps	SPEEDB	As needed
BUILDING		
Building	BLDG	Building corners

WATER		
Air Relief Valve	WTARV	Center of valve
Detector Check Valve	WTDCV	Center of valve
Fire Hydrant	WTFH	Center of hydrant at ground elevation
Water Main	WMAIN	End pts. on straight alignment & every turning pt.
Water Main Tapping Tee	WTTEE	Service connection point to main
Water Service	WTSVC	End pts. on straight alignment & every turning pt.
Water Valve - Main	WTVMAIN	Center of lid/cover
Water Valve - Service	WTVSVC	Center of lid/cover
Water Valve - Fire Hydrant	WTVFH	Center of lid/cover
Water Valve - Blow-Off	WTVBO	Center of lid/cover
Water Meter	WTM	Center of meter
GAS		
Existing Anode Box	ANOBOX	Center of lid/cover
Gas Meter	GM	Center of meter
Gas Meter Curb	GMCURB	Center of valve
Gas Riser	GRISER	Front of riser perpendicular to main
Gas Main	GMAIN	End pts. on straight alignment & every turning pt.
Gas Main Tapping Tee	GTEE	Service connection point to main
Gas Service	GSVC	End pts. on straight alignment & every turning pt.
Gas Valve - Main	GVMAIN	Center of lid/cover
Gas Valve - Service	GVSVC	Center of lid/cover
WASTEWATER		
Wastewater Main	WWMAIN	End pts. on straight alignment & every turning pt.
Wastewater Main Tapping Tee	WWTEE	Lateral connection point to main
Wastewater Lateral	WWLAT	End pts. on straight alignment & every turning pt.
Wastewater Clean Out	WWCO	Center of lid/cover
Wastewater Flushing Inlet	WWFI	Center of lid/cover
Wastewater Lamp Hole	WWLH	Center of lid/cover
Wastewater Manhole	WWMH	Center of lid/cover
ELECTRIC		
Electrical Vault 1,2,3,4 Lids	ELVLT	Center of vault
Electrical Manhole	EMH	Center of lid/cover
Fiber Optic Manhole	FMH	Center of lid/cover
Fiber Optic Vault	FVAULT	Center of vault
Telephone MH	TELMH	Center of lid/cover
Telephone Vault	TELVAULT	Center of vault
STORM DRAIN		
Box Culvert	BOXCLV	Center line
Catch Basin	CB	Center of grate
SD Headwall	SDHW	As needed
SD Inlet	SDIN	As needed
SD Manhole	SDMH	Center of lid/cover

END OF SECTION

SECTION 02300
POLYETHYLENE PIPE INSTALLATION
FOR WATER, GAS AND WASTEWATER

PART 1 GENERAL

1.01 DESCRIPTION

Work Includes fusion and installation of 1" through 16" medium and high density polyethylene services and mains, all appurtenances and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section 02200 Excavation, Backfill, Restoration and General
B. Section 02660 Water Distribution System
C. Section 02685 Natural Gas Distribution system
D. Section 02734 Sanitary Sewer Lateral
E. Section 02735 Polyethylene Sewer Pipe

1.02 POLYETHYLENE PIPE

Gas: 2406 medium density polyethylene (MDPE). Pipe wall thickness shall be SDR 11.5 for 1" CTS, SDR 11 for 2" IPS and SDR 13.5 for 4" through 8" IPS pipe. Refer to Section 2685 of these Standards for additional requirements.

Water: 4710 high density polyethylene (HDPE). Pipe wall thickness shall be SDR 9 for 2" IPS pipe and SDR 11 for 4" through 16" IPS pipe. Refer to Section 2660 of these Standards for additional requirements.

Wastewater: 3408 or 4710 high density polyethylene (HDPE). Pipe wall thickness shall be SDR 17. Refer to Section 2735 of these Standards for additional requirements.

1" CTS and 2" IPS pipe shall be supplied in coils. The coils shall be furnished in either 500 or 1000 foot lengths specified at the time of order (2" straight 20' or 40' lengths can be used for shorter services and connections). Pipe 4" IPS through 16" IPS shall be supplied in 40 foot or longer straight lengths. Straight lengths shall consist of a single length of pipe without couplings or any intermediate joints.

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Pipe markings shall be in a color that contrasts with that of the pipe and space at intervals not exceeding 2 feet. All required markings shall be legible and so applied as to remain legible under normal handling and installation practices. These markings

shall consist of the Utility (GAS, WATER or SEWER), the designation (ASTM D2513-gas, ASTM D3350 – water and wastewater), ANSI/AWWA C906 and Cell Classification 445574E for water pipe, the manufacturer's name or trademark, the nominal pipe or tubing size (including the sizing system used, such as, IPS, CTS or OD), the type of material, SDR number, the month and year of manufacture, and identification of resin supplier (if other than pipe manufacturer), and manufacturer (P for Performance Pipe, or I for Ineos, etc.).

All pipe shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Polyethylene pipe shall be no older than 6 months from the date of manufacture to the date of shipment to CPA. All pipe shall be packaged in standard commercial coils or bundles that provide protection from shipping injuries and shipped with end caps. When storing the pipe on site, the Contractor shall protect pipe from direct sunlight by UV resistant cover.

1.04 POLYETHYLENE FITTINGS

All polyethylene fittings shall have butt end outlets. Molded and fabricated fittings shall have a pressure rating equal to the pipe.

Minimum pipe wall thickness for fitting butt outlets shall be equal to the pipe wall thickness .

All fittings shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Fittings shall be no older than 6 months from the date of manufacture to the date of shipment to CPA. All fittings shall be packaged in standard commercial cardboard boxes that provide protection from shipping injuries.

Fittings shall be molded except fittings larger than 12” which are allowed to be factory fabricated (unless molded fittings are available). Fabricated fittings shall be fabricated on machinery specifically manufactured for that purpose. Fabricated fittings shall be manufactured using Data Loggers recording heating iron face temperatures, fusion pressure and a graphic representation of the fusion cycle. The Data Logger printout shall be part of the required submittal for the fabricated fitting. Fabricated fittings shall be manufactured by ISCO or approved equal. All fabricated fittings must be approved

by the Engineer prior to installation.

Fittings shall be marked with the following: ASTM D3261 (Butt type); manufacturer's name or trademark; material designation (PE 2406 for gas); date of manufacture or manufacturing code; size (including the sizing system used, such as, IPS, CTS or OD). Where the fitting size does not allow complete marking, marking may be omitted in the following sequence: size, date of manufacture, material designation, manufacturer's name or trademark.

1.05. Electro Fusion Tapping Tees and Couplings

Electro fusion type polyethylene fittings shall conform with the latest edition of ASTM F1055 (Standard Specification for Electro fusion Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing) and be manufactured in accordance with the latest listed edition of ASTM D-2513 by Friatec Gas Water Inc. under the trade name of Frialen Safety Fittings or approved equal.

All electro fusion tapping tees will be DAA designated: 2" x 1", 4" x 1", 6" x 1", and 8" x 1" (IPS x CTS) and 4" x 2", 6" x 2", and 8" x 2" (IPS x IPS) - main size x outlet size.

Electro fusion couplings for gas used on the tapping tee outlets to connect the EFV with the 1" CTS and 2” IPS service lines and shall have socket outlets.

All electrofusion couplings 2” and larger shall be 4710 HDPE SDR 11 and ANSI/NSF 61 listed.

3.01 POLYETHYLENE PIPE JOINING EQUIPMENT

All polyethylene pipe joining equipment to be used shall be certified by the City of Palo Alto to be in good working condition and suitable for the intend purpose prior to being brought on site. Any equipment without a City issued certification tag shall be removed from the site.

The Contractor shall have all equipment necessary to install the pipe and appurtenances referred to in the Plans and Specifications, including but not limited to:

A. Pipe Trailer

Contractor shall provide a trailer capable of transporting 40' or longer lengths of polyethylene pipe without damaging pipe.

B. Pipe Spool

Contractor shall provide a reel type spooling device capable of dispensing 500' long 2" polyethylene pipe coils. Spool can be trailer mounted or suspended from a truck or

backhoe (SpeedReel).

C. Pipe Support Stands

Pipe support stands shall be utilized to support pipe during fusion joining, directional boring pull in, and while lowering of the pipe into the trench. Pipe support stands shall not be spaced greater than 15' apart for directional boring pull in. Pipe shall be supported with stands at all times and not placed on pavement to avoid scratching the pipe surface.

Additionally, manufactured pipe support stands outfitted with rollers shall be used at the pavement or plate edge where pipe is pulled into the trench/bore hole to avoid scratching of the pipe.

D. Pipe Cutter

Pipe cutter shall be guillotine style cutter outfitted with a ratchet drive or power driven designed to cut high density polyethylene pipe. No other cutting tools will be allowed unless approved by the Engineer.

E. Butt Fusion Machine

Contractor shall provide McElroy or approved equal butt fusion machine(s) capable of fusing the range of pipe sizes required in the contract/plans with the following features:

1. **Butt Fusion Machine.** Machine shall be the hydraulic fusion machine with built-in hydraulic pipe lift to assist with the pipe handling and incorporating centerline guidance system and DataLogger™ compatible, and capable of butt fusion of most fittings without special holders or removal of jaw.

2. **Facer.** Pipe facer that attaches to the butt fusion machine. Facer shall have sharp properly aligned blades.

3. **Heating Iron.** Electrically powered heating iron with unscratched clean Teflon coated faces. Heating iron shall have a thermometer and temperature set screw for calibration.

F. Electro Fusion Machine

The Contractor shall provide a Friatec universal electro fusion control box or approved equal, capable of storing a minimum of 100 fusion records, pipe alignment clamp, tapping tee alignment clamp, tapping wrench, pipe scraper, and all other tooling specified by the electro fusion machine manufacturer installation procedures.

G. Electric Generator

Contractor shall provide the necessary power supply to meet the power requirements

as specified by the manufacturer of the fusion equipment. Generator shall be in new condition and have a minimum rated capacity of 5 kW for 8" and smaller and 10 KW for 10" and larger.

H. Pyrometer

The Contractor shall provide a pyrometer capable of testing the temperature of the heating iron, while at fusion temperature, to an accuracy of 0.5% (±3°F). The fusion temperature of the heating iron shall be verified each morning in the presence of the WGW Inspector. More frequent testing may be required at the discretion of WGW Inspector.

Note: The Contractor shall keep a binder on site containing the fusion procedures, names of approved fusers and serial numbers of the approved fusion equipment. All equipment must be in good working order and properly maintained during project installation. The City will inspect the preceding items and reject those not in compliance. The City shall have the right to reject any or all equipment judged inadequate to properly fuse polyethylene pipe and its fittings.

3.12 POLYETHYLENE PIPE INSTALLATION

The City will test the person(s) intending to fuse polyethylene pipe for the purpose of Certifying that person(s) to fuse on City piping. The fuser must recertify every 12 months. All polyethylene pipe fusions (butt, sidewall and electrofusion) must be performed by the person(s) qualified by the City for that specific project or within the last 12 months whichever is shorter. The person may only fuse pipe for the utility (water, gas or wastewater) they were certified by the City for. All fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. Qualification testing is required for all Contractor employees that will be performing polyethylene pipe fusions. The Contractor will perform the qualification testing using his own equipment and materials, including but not limited the equipment to be used in the field (generator, fusion machines, scrapers, etc.) The Contractor will schedule fusion testing two weeks prior to the start of Work. Notify WGW Inspector for scheduling.

A. Underground Clearance

Unless approved by CPA WGW Utilities Engineering, the Contractor shall maintain a minimum clear separation of 12 inches vertically to crossing utility lines and 48 inches horizontally to parallel utility lines, duct banks or adjacent foreign structures surfaces.

If horizontal separation is between 1' to 4', review and approval by WGW Engineering Department is required. Horizontal separation less than 1' is prohibited.

B. Location

1. Mains and services shall be located per WGW Utilities standard drawing WGW 01, unless otherwise specified on the Project Drawings.

2. Services shall be installed perpendicular from the main in the shortest straight line to the meter or clean out. Water meters, services and sewer laterals shall be installed 10' minimum from trees.

C. Handling of Polyethylene Pipe

Extreme care must be exercised when moving plastic pipe, support stands and rollers shall be used when fusing and lowering pipe into the trench or bore hole. **POLYETHYLENE PIPE SHALL NOT BE DRAGGED ON THE GROUND OR ON PAVED SURFACES**. Support stands/rollers must be used at all times that pipe is above paved surfaces/ground level including during directional boring pull-in.

D. Pipe Scratches or Cuts

Pipe that has scratches, notches, cuts or any other abrasions that exceed 10% of the pipe wall thickness shall be disposed of. The Contractor shall use pipe stands, rollers, spooling devices, or other means to avoid damaging the pipe during installation. Observe pipe during installation for scratches, gouges or other defects. If defects are present, remove and discard defective section of pipe. The WGW Inspector must be notified of all defects and subsequent repairs.

E. Snaking Pipe

Polyethylene pipe shall be installed in the trench by “snaking” method and additional pipe length shall be allowed for the possible thermal contraction of the pipe.

F. Maximum Pull Force

A commercially available weak link approved by the Engineer for the specific application shall be used, in accordance with manufacturer’s recommendations, between the puller and the pipe.

G. Butt Fusions

1. All butt fusions must be performed by the person(s) certified by the City to butt fuse in the presence of the City's WGW Inspector. Contractor’s supervisor shall be present during all pipe fusions to insure that all required procedures are adhered to and to witness the quality of each joint. Fusion certified Contract employees found to not be following manufacturer’s guidelines or performing fusions with inadequate/defective equipment will have their fusion certification revoked and will not be allowed to perform fusions for the remaining duration of the contract.

2. Pipe fusion shall be conducted in accordance with the manufacturer’s recommended fusion procedure and in compliance with ASTM F2620, PPI Technical Report TR-33 and accordance with the "City of Palo Alto,

Polyethylene Gas Pipe Training Procedures", see Appendix E.

Ambient temperature shall be between 55° F and 85° F prior to pipe fusion; otherwise pipe shall be protected from direct sunlight and cooled down until the ambient temperature falls within the above temperature range.

3. Fusion joints shall be allowed to cool for the times recommended by the pipe manufacturer prior to any movement of the fused joint.

4. Gas pipe used for Railroad crossings shall be 4710 HDPE joined by butt fusion in accordance with the Manufacturer's recommended/certified procedures in accordance with the applicable section of DOT CFR 49 Part 192, paragraph 192.283. The Contractor shall be responsible for Caltrain (PCJPB) permits and ensuring that personnel have received proper training in accordance with the Manufacturer's recommended procedures and in compliance with DOT CFR Part 192 paragraph 192.285.

5. All fusions shall be made using a Data Logger recording heating iron face temperatures, fusion pressure and a graphic representation of the fusion cycle. The Data Logger printouts shall be reviewed by inspector prior to pipe being pulled in and submitted to the City WGW Utilities Inspector at the end of each day.

H. Inspection

1. The City will provide a polyethylene certified Inspector at the job site. The Inspector has the right to reject any fusions not meeting City requirements. The Contractor shall replace all fusions not meeting City requirements at its own expense.

2. The Contractor shall also designate a polyethylene certified supervisor who will be present on site at all times to observe pipe fuser(s). The Contractor's supervisor will be responsible for inspecting all fusions performed. The City will test and certify this supervisor. Said supervisor must be present on job site at all times fusions are being performed to inspect, guide, advise, and supervise their own qualified fusers on site.

3. At the City's discretion the Contractor will remove fusion(s) and supply it to the City for testing to insure quality control.

4. Records of all electro and butt fusions shall be downloaded and provided to the City on a daily basis in electronic format and weekly in paper format.

5. Any failure recorded by the fusion equipment must be immediately brought to the attention of City's Inspector to avoid the City requiring the contractor to

remove fusions to the last recorded acceptable fusion.

6. The fusion number corresponding to each joint shall be written on the pipe at the fusion location with an indelible marker.

7. Fusion number shall also be noted on the Contractor's record drawing at the exact location of the fusion.

8. The City's Inspector will observe plastic fusions and reject all connections which are deficient. All fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. The City's Inspector will review the Data Logger or non-destructively test plastic fusions and reject all connections that are deficient. The contractor will replace all fusions failing non-destructive testing at his expense. The contractor will replace all fusions failing visual inspection or non-destructive testing at his expense.

I. Sealing Installed Piping

Contractor shall seal open piping with butt fusion end caps or with an approved manufacturer end cap at the end of each workday. No open pipe ends will be allowed at the end of the day.

J. Marker Balls shall be placed above all fittings, taps, changes in main alignments and other locations as determined by the Engineer.

K. Minimum Bending Radius

The minimum bend radius for polyethylene water pipe SDR 9 is twenty (20) times and for SDR 11 is twenty five (25) times the outer pipe diameter. If fusions, fitting, or flange are present or to be installed in the bend, the minimum bend radius shall be one hundred (100) times the outer pipe diameter.

END OF SECTION

WATER DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

Work Includes installation of 16" ,14", 12", 10" and 8" high density polyethylene (HDPE) water mains, 2", 4", 6", 8" water and fire services, fire hydrants, tracer wire, water valves and boxes, flange adapters, all appurtenances and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section 02200 Excavation, Backfill and Restoration

PART 2 -- MATERIALS

2.01 WATER DISTRIBUTION SYSTEM MATERIALS

"Wetted surfaces" of all materials, piping, or plumbing fixtures intended for conveying or dispensing potable water, supplied under these specifications, must contain less than 0.25% lead by weight in compliance with AB 1953.

A. POLYETHYLENE PIPE

GENERAL

All potable water polyethylene pipe supplied under this Specification shall be High Density Polyethylene Pipe (HDPE) PE 4710 conforming to the latest edition of ANSI/AWWA C901 and C906 and ANSI/NSF Standard 61. Resin used in the extrusion of water polyethylene pipe shall conform to the latest addition of the ASTM D 3350 Cell classification 445574E with the specifications stated herein.

1. All pipe shall be extruded from Dow 2490 blue resin if available, or approved black pipe with blue stripe or wrapped in blue PE for water pipe.

2. PENT test values of 500 hours min.

3. Pipe dimensions and tolerances:

   The outside diameter and wall thickness shall be within the limits specified in Table 1.

Table 1: Dimensional Standards for IPS 4710 High Density Polyethylene Pipe

Nominal IPS Size	Actual Outside Diameter (inches)	Minimum Wall Thickness (inches)	Average Inside Diameter (inches)	Standard Dimension Ratio (SDR) (unitless)
2" IPS	2.38	0.264	1.816	9
4" IPS	4.5	0.409	3.633	11
6" IPS	6.625	0.602	5.348	11
8" IPS	8.625	0.784	6.963	11
10" IPS	10.750	0.977	8.678	11
12" IPS	12.750	1.159	10.293	11
14" IPS	14.00	1.273	11.302	11
16" IPS	16.00	1.455	12.916	11

Approved Manufacturers: CP CHEM Performance Pipe or CSR Poly Pipe Industries, or approved equal

B. Polyethylene PE Fittings

All potable water polyethylene fittings supplied under this Specification shall be high density PE 4710 polyethylene manufactured by the injection molding process, pressure class 200 or greater, and conform to the latest edition of ANSI/AWWA C901 and C906 and ANSI/NSF Standard 61. Resin used in the molding shall conform to the latest addition of the ASTM D 3350 Cell classification 445574E (HDPE 4710) with the specifications stated herein.

1. All fittings shall have the AWWA specification stamp embedment or permanent line print. All fittings shall be pressure class 200 or greater. Additional pipe thickness required for saddle fusion fittings and other fittings to reach pressure class 200 shall be on the outside of the pipe so as to not constrict the flow.

2. **Approved Manufacturers:** CP CHEM Performance Pipe, CSR Poly Pipe Industries, Central Plastics/Georg Fischer, ISCO, or approved equal

C. Installation in Contaminated Areas

For areas of known contamination or where contaminated soil is found the following materials must be used:

Mains: Ductile iron water pipe (DIP), Class 52 restrained joint push-on type conforming to the latest editions of ANSI/AWWA C151/A21.51, ANSI/AWWA C150/A21.50. DIP shall be asphalt coated in accordance with ANSI/A21.51 and lined with cement mortar lining of 1/16-inch minimum thickness, conforming to ANSI/AWWA C104/A21.4. Push-on joints for restrained joint pipe shall be in accordance with ANSI/AWWA C111/A21.11.

All DIP pipe and fittings shall be encased in polyethylene tubing, 8 mil thick minimum, in accordance with the latest edition of ANSI/AWWA C105/A21.5.

Gaskets: DIP installation in contaminated soil will require special gasket (EPDM or Fluro-Carbon depending on the contamination type/levels). Gasket submittal shall be approved by the Engineer. Gasket lubricant shall be as specified by the pipe manufacturer.

Services: All services in contaminated soils shall be installed or reconnected in accordance with AWWA C800 using 2 CTS inch diameter copper tubing type K meeting ASTM B88 copper tubing specification. If the existing service is not copper, the service shall be replaced with new copper tubing. All services shall be replaced or reconnected in the original size or 2" copper whichever is larger. Four inch and larger services shall be installed using DIP pipe.

Service Saddle: Shall be Mueller BR2B series

Gate Valves:

a.) 12" or smaller

Gate valves in contaminated areas shall be Mueller A2360 series, 250 psi, resilient wedge gate valves with iron body and modified wedge disk, NRS type complying with AWWA C515, AWWA C111, and ANSI A21.11; NSF 61 listed. Valves shall have a protective epoxy two part thermal setting coating on the interior and on the exterior per AWWA C550. Valves shall have mechanical joint to mechanical joint end (M.J. x MJ) or flange joint ends (FL x FL.). Joints shall be in accordance with ANSI/AWWWA C110/A21.10 or ANSI/AWWWA C111/A21.11 requirements. All bonnet and stuffing box bolts shall be 304 stainless steel. Valves shall open counter clockwise.

b.) 14" and 16"

14" and 16" gate valves in contaminated areas shall be Mueller A2361 series (or approved equal), 250 psi, resilient wedge gate valves with iron body and four point wedging mechanism, NRS type complying with AWWA C515, AWWA C111, and ANSI A21.11; NSF 61 listed. Valves shall have a protective epoxy two part thermal setting coating on the interior and on the exterior per AWWA C550. Valves shall have mechanical joint to mechanical joint end (M.J. x MJ) or flange joint ends (FL x FL.). Joints shall be in accordance with ANSI/AWWWA C110/A21.10 or ANSI/AWWWA C111/A21.11 requirements. All bonnet and stuffing box bolts shall be 304 stainless steel. Valves shall open counter clockwise.

D. Main Tapping Hardware

All hardware must be ANSI/NSF 61 listed.

Tapping Sleeves

CIP/DIP/PVC: Tapping sleeve shall be **Mueller H-615**
ACP: Tapping sleeve shall be **Mueller H-619**
CCP: Tapping sleeve shall be **Smith-Blair or JCM 415**

Ford FTSC tapping sleeves may also be used with prior approval from WGW Utility Engineering. All tapping sleeves shall be epoxy coated with 304 stainless steel washers, nuts and bolts.

HDPE: Saddle shall be HDPE 4710, class 200 electrofusion branch saddle (IPS to IPS), NSF 61 listed and meet or exceed applicable ANSI/AWWA requirements manufactured by Georg Fisher (Central) or approved equal. The fittings shall be provided with bottom underclamps or installed using a loading tool as specified by manufacturer's installation procedure.

Tapping Valves

Tapping valves shall be **Mueller A2360 with flange inlets and mechanical joint outlets** and be supplied with 304 stainless steel washers, nuts and bolts.

E. Electrofusion Couplings

Electrofusion couplings shall be Georg Fisher Plastics (Central), Frialen®, Plasson, or approved equal HDPE 4710, IPS DR 11 (4" through 16") and DR 9 (2"), Class 200 or greater, and ANSI/NSF 61 listed. HDPE pipe to HDPE pipe shall be joined by butt or electro fusion.

F. Mechanical Joining Hardware

All hardware must be ANSI/NSF 61 listed.

Mechanical Joint (MJ) HDPE Adapter Kit (HDPE to PVC or DIP)

Mechanical Joint (MJ) adapter kit shall be pressure class 200 or greater, designed for fusion to HDPE pipe and mechanical connection to DIP or PVC pipe (stiffener is required for PVC pipe). Glands, material assembly and bolting shall be in accordance with ANSI A21.11 (AWWA C111); full face rubber gasket shall be included in the kit.

The MJ adapter connection shall provide a fully self-restrained joint and shall not require additional restraint.

Mechanical Couplings

All mechanical couplings (parts) shall be NSF 61 listed and pressure class 200 or greater and in accordance with ANSI/AWWA C153/A21.53:

Mechanical couplings for joining HDPE to ACP shall meet the following minimum requirements:

Sleeve: Ductile Iron ASTM A-536. Ends have smooth inside taper for uniform gasket seating.
Gaskets: Nitrile (Buna N).
Follower Flanges: Ductile Iron ASTM A-536; designed for high strength/weight ratio. Thickness determined by coupling size.
Bolts & Nuts: 304 Stainless.
Finish: asphaltic or fusion bonded epoxy coating in accordance with AWWA C213.

Mechanical couplings shall be Smith-Blair 441 - 442 OMNI Series or 461-462 Quantum Series couplings or approval equal. Stiffener inserts are required in the bores of the HDPE and ACP pipes.

Mechanical coupling for joining HDPE to CIP shall be Smith Blair Maxi-Grip EZ-W restraint coupling designed for joining HDPE and CIP (cast iron pipe). A stiffener insert is required in

the bore of the HDPE pipe.

HDPE to PVC - Mechanical Compression Coupling with restraint – PE shall be restrained by electrofusion flex restraints; PVC pipe restrained using a tapered gripping ring. Stiffener inserts in the pipe bore are required for both HDPE and PVC pipes.

Stiffener

The stiffeners must be stainless steel and sized to encompass the entire bearing length of the restraint devices and shall be engineered to prevent movement causing fitting to slide or rotate.

Joint Restraints

All joint restraints shall be EBAA IRON 2000PV series for PVC pipe and EBAA IRON MEGALUG 1100 series for ductile iron pipe, or approved equal.

HDPE TO Flange Connection

HDPE flange adapter shall be pressure class 200 or greater and used to join HDPE pipe to an existing flange or gate valve.

A backup ring for flange adapter shall be pressure class 200 or greater and stainless.
Bolts & Nuts: 304 stainless.

Gasket: Garlock Blue-Gard 3000 gasket, blue, nitrile rubber, full face gasket designed to be used with potable water, NSF Standard 61 compliant.

Flexible Restraint Devices

Electrofusible HDPE pipe flex restraint device, encased in concrete, shall be attached to HDPE pipe near all transition connections to prevent pull out of HDPE pipe and/or movement of existing pipe. Flex restraint device shall be ISCO Central Plastics/Georg Fisher, or approved equal, designed for installation after a pipe is in place, and be rated at min. 7000 lbs of force per fitting. Resin used to make this fitting shall meet the requirements of ASTM 3350 with a cell classification of 345464C.

The electrofusible HDPE pipe flex restraints shall be installed in accordance with manufacturer's recommendations. Approximate Poisson effect pull force (lb.), calculated per AWWA M55 manual, for selected sizes of ANSI/AWWA C906 pipe operated at full rated pressure plus maximum allowable occasional surge pressure as follows:

Pipe size (in.)	Approximate Pull Force (lb)	Calculated Number of Flex Restraints (each)
6	7,553	2
8	13,428	2
10	20,981	3
12	30,213	5
14	41,124	6
16	53,712	8

The valve tie-back detail Trust Block Table (standard details WD-19 and WD-24) shall be used to size concrete encasement.

G. Service Hardware and Appurtenances

All hardware must be ANSI/NSF 61 listed

Saddles

HDPE 4710 main/HDPE 4710 services: Service Saddle shall be electrofusion IPS, HDPE 4710, Class 200 Central Electrofusion Branch Saddle manufactured by Georg Fisher Plastics or Frialen Electrofusion Branch Saddle manufactured by Friatec Water Inc. The fitting shall be NSF Standard 61 listed and meet or exceed ANSI/AWWA applicable requirements. Pneumatic top-loading tool is required for proper installation.

HDPE 4710 main/copper services: Service Saddle shall be Frialen VA Service Saddle manufactured by Friatec Gas Water Inc. or Central Electrofusion Transition Saddle manufactured by Georg Fisher Plastics, IPS, HDPE 4710, Class 200 with brass 360 Alloy outlet Stainless 304 compression ring. The fitting shall be NSF Standard 61 listed and meet or exceed ANSI/AWWA applicable requirements Pneumatic top-loading tool is required for proper installation. The fittings' outlets are designed for AWWA straight iron pipe thread.

PVC C-900 main/copper services: Service Saddle shall be Class 200 NSF 61 listed Mueller H-13441 (6"), 13442 (8"), 13443 (10"), 13444 (12") with 1", 1 ½" or 2" CC threads or approved Ford equal.

DIP or ACP main/copper services: Services Saddle shall be Class 200 NSF 61 listed Mueller BR2B series.

HDPE/Copper Service Transition

a.) Flare Nut Transition

Poly –Cam Series 914 female **swivel** flare nut, lead free, transition designed for connecting 2" IPS HDPE 4710 potable water services directly to Mueller angle meter valves H-14276 (2") copper flare nut and to 2" Mueller corp. stops H-15000 and H-15025.

The HDPE portion of the transition fitting shall be High Density Polyethylene Pipe (HDPE) PE 4710 SDR 9, IPS size conforming to the latest edition of ANSI/AWWA C906 and have legible marking indicating word Water, type of material HDPE 4710, cell classification 445574C or 445574E, ANSI/AWWA C906, the manufacturer's name or trademark, IPS size, OD, SDR, resin supplier identification, and year of manufacture.

The fittings shall be conforming to NSF Standard 61.

Approved Manufacturers: Poly-Cam, Inc or approved equal

b.) Transition Fitting

This transition fitting shall be 2" IPS x 2" CTS straight and incorporate minimum 60" long straight copper pipe type K meeting ASTM B88 standard for copper tubing for potable water and minimum 18" long High Density Polyethylene Pipe (HDPE) PE 4710 SDR 9 conforming to the latest edition of ANSI/AWWA C906 and ANSI/NSF Standard 61.

The HDPE portion of the transition fitting shall have legible marking indicating word Water, type of material HDPE 4710, cell classification 445574C or 445574E, ANSI/AWWA C906, the manufacturer's name or trademark, IPS size, OD, SDR, resin supplier identification, and year of manufacture.

The transition fitting shall be pull-out resistant (Class 1 rating).

Ball Valve for HDPE service

Ball valve shall be 2" IPS DR 9 HDPE 4710 full port ball valve with minimum pressure rating 200 psig manufactured by Georg Fisher Plastics or approved equal.

Corporation Stops

Corporation Stops for Copper Services shall be Mueller or Ford:

a.) Mueller No. 15025 or approved Ford equivalent with AWWA I.P. thread inlets and copper flare straight connection outlets to use with Frialen VA service saddle.

b.) Mueller No. 15000 or approved Ford equivalent to use with saddles on non-HDPE pipe.

Three Part Unions

Three part unions shall be Mueller H15400 CC threads or approved equal.

Angle Meter Stops

Angle meter stops shall be Mueller H-14255 or H-14276 meter swivel nut and meter flanged respectively.

Meter Boxes

All meter boxes shall be supplied by the Contractor when box replacement is required or a new service is installed. The boxes shall be the following sizes:

1017 box for 5/8" meters
1120 box for 1" meters
1324 box for 1-1/2" meters
1730 box for 2" meters
1416 box for double headed service with two 5/8" meters
2436 box for double headed service with two 1" meters

Boxes shall be supplied with self closing reading lids centered over the meter dials. Box and lid shall have a minimum Tier 5 rating (ANSI/STCE 77 2010) for sidewalk and planting strip applications and a minimum Tier 22 rating for driveway and parking lot applications. Meter boxes shall not be installed in driving lanes of public or private streets. Lids shall have "Water" marked on them.

For installation in areas subject to vehicular traffic meter box shall have H-20 load rating.

Meters

New water meters 5/8"x3/4", 1", 1-1/2" and 2" shall be Badger E-meters, 4" and 6" water meters shall be Badger compound water meters to be obtained from the City of Palo Alto Water Department.

H. Fire Hydrant Assemblies

Fire Hydrant assemblies shall use wet barrel type hydrants meeting AWWA C503 standards. The fire hydrant assemblies shall be constructed using the following materials:

Hydrants

Hydrants shall be Clow/Rich No. 76 in residential, commercial, and heavy industrial areas. Clow/Rich No. 76 hydrant shall be supplied with two (2) 2-1/2" and one (1) 4-1/2" outlets conforming to AWWA C503.

Hydrant Risers

Hydrant Risers shall be AVK Series 2488 Flowguard II Hydrant Check valve conforming to the latest edition of ANSI C110/A21.10 standards and AWWA C503. as shown on the Standard Detail drawing.

Hydrant Bury

Hydrant Bury shall be 6" mechanical joint ductile iron conforming to the latest edition of ANSI C110/A21.10 standards and AWWA C503. as shown on the Standard Detail drawing.

Hydrant Valves Locations

Hydrant valves shall be placed as close as practical to the water main. See specifications for hydrant valves below at Gate Valves (subpart I).

Hydrant Valve Boxes

Hydrant Valve Boxes shall be Christy G5 Traffic Box with G5C non-locking type metal traffic lid marked "Water".

I. Gate Valves (Hydrants and Mains)

a). 12" or smaller

All gate valves shall be 250 psi, ductile iron ASTM A536 body, resilient-seated, tight closure gate valves with non-rising stems in accordance with all applicable requirements of ANSI/AWWA C515 and have IPS HDPE 4710 DR 11 IPS polyethylene pipe ends; must be NSF 61 listed. All valves shall have protective interior/exterior electrostatically applied epoxy-resin coating in accordance with AWWA C550, stainless steel A2-Grade 304 bonnet bolts, and shall open counter clockwise.

Acceptable Manufacturers: American AVK or approved equal

b.) 14" or 16"

Shall be Mueller A2361 series or approved equal, 250 psi, resilient wedge gate valves with iron body and four point wedging mechanism, NRS type complying with AWWA C515, AWWA C111, and ANSI A21.11; NSF 61 listed. Valves shall have a protective epoxy two part thermal setting coating on the interior and on the exterior per AWWA C550. Valves shall have mechanical joint to mechanical joint end (M.J. x MJ) or flange joint ends (FL x FL.). Joints shall be in accordance with ANSI/AWWWA C110/A21.10 or ANSI/AWWWA C111/A21.11 requirements. All bonnet and stuffing box bolts shall be 304 stainless steel. Valves shall open counter clockwise.

J. Air Release and Air/Vacuum Valves

Air Release Valves shall conform to the latest editions of AWWA C512 manufactured by APCO, Crispin Multiplex Manufacturing Co., or approved equal. For 8" through 12" HDPE mains air valves assemblies shall be min. 1" and for 16" HDPE mains air valves assemblies shall be min. 2". All assemblies shall have stainless steel float.

Air/Vacuum Valves shall conform to the latest editions of AWWA C512 manufactured by APCO, Crispin Multiplex Manufacturing Co., or approved equal. Valves shall have stainless steel float with the minimum size of inlet/outlet of:

1" for water mains up to 10"
2" for water mains 12" and larger

Air Release/Vacuum Valves vents shall be placed above flood planes.

K. Linestopping

Line valves shall comply with all requirements for gate valves. If the existing line valve cannot be operated to shut down the water line, a new line valve shall be installed by linestopping. The linestopping shall be performed following written approval by the Senior Project Engineer. The Contractor shall use Hydra-Stopping ^{TM}, or an approved equal method of linestopping.

All linestopping equipment **must be disinfected** prior to use per ANSI/AWWA C651/B301.

In order to minimize potential traffic hazards, all excavation and necessary preparation, prior to line stopping and new line valve installation, shall be done one (1) day in advance prior to the actual plumbing work. Each line valve installation shall include two (2) line stops, one upstream and one downstream of the line valve to be installed, complete with all necessary equipment (i.e., bypass, sawcutters, backhoes, deck plates, traffic control, etc.) and materials (i.e., piping, disinfectant, couplings, concrete, AC, backfill, restraint, etc.), needed to assemble a complete and fully functioning line valve installation.

L. Valve Boxes

All valve boxes shall be Christy G5 Traffic Valve Box with G5C non-locking type metal lid marked “Water”. Solid 10” PVC pipe, Class 200 shall be used as extension as shown on the Utility Standards WGW standard detail.

M. Thrust Blocks

Thrust blocks shall be Class B Portland cement concrete Type II meeting the State of California Standard Specifications Section 90 requirements and sized according to the detail shown on the Utility Standards WGW standard detail WD-19.

N. Mechanical Joint Bolts

Bolts for Mechanical Joint Glands shall be high strength, low alloy steel bolts only, meeting the current provisions of American National Standard ANSI/AWWA C111/A 21.11 for rubber gasket joints for cast iron or ductile iron pipe and fittings. Bolt manufacturers certification of compliance must accompany each shipment. NSS Cor-Ten T-Bolts or approved equal.

O. Spigot Plugs

Spigot plugs shall be Johns Manville UPC0079012 or approved equal.

P. Shell Cutter

Shell cutter shall be:

Mueller Co or approved equal for tapping HDPE 4710 pipe.
Mueller Co, Pipeline Products, or approved equal for C-900 PVC and DIP pipe.

Shell cutters shall be tungsten carbide tipped, designed for an easy fit through valves, and shall have large slots for debris removal. "Drill-bit" type cutters shall not be used.

Q. Tracer Wire and Connections

All tracer wire shall be 10 AWG solid copper wire coated with .45 mils Type HMW - PE blue insulation. The wire shall meet all requirements of the latest version of ASTM D1351 and ASTM B8. Tracer wire shall be UL listed as direct burial wire at temperatures between -40^{o} C and 75^{o} C for circuits not exceeding 600 volts. The surface of the insulation shall be durably marked, at intervals not exceeding 24 inches, with only the following information: maximum working voltage "**600 VOLTS**", wire type, manufacturer's name or trademark, AWG size or circular mil area, UL required markings, and at the Contractor's option "**CAUTION CPA WATER LINE**".

One tracer wire shall be installed with the pipe. All tracer wire connections shall be made with Nicotap #3519J connectors wrapped with aqua seal and electrical tape. All Nicotap fittings must be installed with tooling specified by the manufacturer, the use of pliers or other crimping devices will not be allowed.

Anode boxes with 5 lb bagged Mg anode shall be installed at fire hydrants with tracer wire extending as shown on standard detail; the maximum distance between anodes shall not exceed 500 ft . The wire configuration shall be as follows: North tracer wire – terminal 1, no knot, East tracer wire – terminal 2, with one knot, South tracer wire – terminal 3, with two knots, and West tracer wire – terminal 4, with three knots.

R. Valve Stem Extension

Valve stem extensions shall be fusion coated Mueller 63209 series or approved equal, furnished with an AWWA brass wrench nut; top of AWWA brass wrench nut not to exceed two (2) feet below finished grade. The Mueller 63209 or approved equal shall have a six inch (6") diameter, 1/4-inch thick, fusion-coated black iron guide plate welded six inches (6") below the AWWA brass wrench nut. Stem extensions are to be installed on valves four (4) feet and greater, in depth, as shown on Project Drawings.

S. Bolting For Buried Flanged Joints

Use Type 304 stainless steel, ASTM A193, Grade B8 Hex Head bolts and ASTM A194, Grade 8M Hex Head nuts.

T. Flange Gaskets

Gaskets for flanged joints shall be 1/8-inch thick cloth inserted rubber, one-piece, full-face type, conforming to AWWA C207. For installation requirements in contaminated areas see 2.01-C of this Section.

U. Warning Tape

Warning tape shall be 2 inches wide, blue and carry the inscription: “Caution Buried Water Line Below”, manufactured by Calpico or approved equal. Warning tape shall be installed 12 inches above the top of the new water main (initial backfill zone).

V. Anode Boxes

All anode boxes shall be Christy G5 Traffic Valve Box with G5C non-locking type metal lid marked “Anode Water”.

W. Marker balls shall be blue 3M, Omni, or blue approved equal.

2.02 WORK MATERIALS TO BE FURNISHED BY THE CITY.

The City will provide new water meters for replacement where designated by Engineer. All other materials will be supplied by the Contractor.

2.03 WORK MATERIALS TO BE FURNISHED BY THE CONTRACTOR.

Work materials supplied by the Contractor shall include but not be limited to:

A. All polyethylene pipe and fittings, copper pipe and fittings, fire hydrant assemblies, electrofusion couplings, valves, tapping sleeves and saddles, weak links, tapping valves, corporation and meter stops, unions, anodes, meter boxes, valve and anode boxes, valve extensions, MJ adapters, mechanical and transition fittings, tracer wire, Nicotap connectors, linestopping equipment and hardware, electrical tape, aquaseal, end caps, restraints, marker

balls, and marking tapes.

B. Expendable Concrete Materials. Materials required to install and finish Portland cement concrete, such as form lumber, tie-wire, nails, etc.

C. Concrete. All Portland cement concrete including reinforcing steel, wire mesh, etc.

D. Temporary and Permanent Fencing including traffic barricades required to provide a barrier between vehicular/pedestrian movements and excavations.

E. Trench Backfill Sand. All backfill sand shall be clean imported sand, rock and salt free. Bay sand shall not be accepted.

F. Paving Material. All materials required for temporary and permanent street repairs including base materials.

G. Landscaping Materials. All landscaping materials, plants and surface improvements that are damaged due to this Work.

H. Traffic Control Materials. All materials damaged by Work required to direct vehicular and pedestrian traffic including striping, loop detectors, reflectors, etc.

I. Drilling fluids and bentonite.

J. Non-skid trench plates.

K. Project notification signs.

2.04 MANUFACTURER'S TESTING

A **Health effects evaluation:** All materials in direct contact with potable water including but not limited to pipe and fittings must comply with ANSI/NSF Standard 61.

B. **Long-term hydrostatic strength:** Materials must be tested to establish that their minimum long-term hydrostatic strength is in compliance with the requirements of the applicable AWWA product standard (ANSI/AWWA C903/C906).

C. **Material cell classification:** PE materials must have a cell classification 445574E per ASTM D3350.

2.05 SUBMITTALS AND QUALITY CONTROL

A. The Manufacturer shall submit to CPA a written quality control procedure conforming to requirements of ANSI/AWWA C901 (up to 4") and C906 (4" and larger), which shall be subject to approval by CPA.

B. The Manufacturer shall permit CPA representatives to tour extrusion facilities for the purpose of evaluating manufacturer's capabilities. The tour shall be during extrusion of a CPA order or if prior to order placement during the extrusion of a similar material.

C. The Manufacturer shall certify that the plastic pipe and or fittings supplied meet all the requirements of this Specification. When requested by CPA the Manufacturer shall supply certification for all items ordered, failure to do so shall be cause for order rejection.

2.06 INSPECTION

CPA reserves the right to inspect each order upon delivery and, at the option of CPA, reject any items not meeting this Specification.

PART 3 -- EXECUTION

3.02 WATER POLYETHYLENE PIPE SYSTEM INSTALLATION - MAINS

A. Minimum size of new main

The minimum size of new HDPE water main shall be 8" (I.D. = 6.963), SDR 11.

B. Minimum/Maximum Cover

Water mains shall be installed with a minimum cover, as measured vertically from the top of pipe to the top of pavement:

Pipe Diameter	Minimum Depth of Cover	Maximum Depth of Cover
8"	3'	4.5'
10" -16"	4'	4.5'

C. Underground Clearances

Water Mains, and Sewers and Other Non-potable Fluid-carrying Pipelines

Parallel Construction: The distance between new water mains and sewer lines shall be at least 10 feet horizontally and one foot vertically above. These separation distances shall be measured from the nearest edge of the facilities.

Water mains and non-potable fluid-carrying pipelines shall not be installed in the same trench.

Exceptions to the basic separation standards shall comply with the "Criteria for the Separation of Water Mains and Non-Potable Pipelines" and will be reviewed by the City on a case by case basis. (See Utility Standard Detail #WGW-08 and "Guidance Memo No. 2003-02: Guidance Criteria For The Separation Of Water Mains and Non-Potable Pipelines," dated October 16, 2003 from the California Department of Health Services)

Other Facilities

Unless otherwise specified a minimum of 12 inches vertically and 48 inches horizontally shall be maintained between the pipe surface and other utility lines or adjacent foreign structures surfaces.

In the event that it is not possible to maintain required vertical clearance from other structures, the Contractor shall case the water main in steel pipe or concrete at the discretion of the City's representative.

If horizontal separation is between 1' to 4', review and approval by WGW Engineering Department is required. Horizontal separation less than 1' is prohibited.

D. Location

1. Water mains shall be located seven (7) feet off the lip of gutter/edge of pavement on the north and east side of streets, unless otherwise specified on the Project Drawings.

2. Water services shall be installed perpendicular from the water main in the shortest straight line to the water meter. Water meters and services shall be installed 5' minimum from trees, edge of driveway, and the sanitary sewer house lateral.

3. Water meters two inches and smaller in size shall be installed in the public right-of-way. The meter location and installation shall conform to the standard details.

4. Water meters larger than two inches in size shall be installed on the customer's property, adjacent to the customer's property line. The meter location and installation shall conform to the standard details.

E. Maximum Velocity of Flow for Water Main

The maximum design flow velocity in any water main shall not exceed 7 feet per second, based on the maximum calculated loads.

F. Water Pipe Bedding

Trench shall be free of debris, sharp rocks, etc. before adding the sand bed for the new water main. Sand bed shall have a minimum thickness of 4" below and 12" above the water main.

G. Location of Valves

Valves in water mains shall, where possible, be located on property line extensions unless shown otherwise on the Drawings. Each valve's position shall be GPS surveyed and data submitted in the required format to the City along with the set of record drawings of Work performed. On record drawings, valves shall be tied to two existing permanent physical features in the field. The horizontal distances tied to the valve shall be less than 100 feet. .

In order to minimize customer shutdowns and construction time, line stopping for the installation of line valves, shall be implemented as shown on the Project Drawings or as directed by the Engineer.

Where no permanent fixtures are available in the right-of-way, the valves shall be located by a 4"x 4" x 6' redwood post, offset 5 feet from the mains, painted white with the words "WATER VALVE" painted in 3 inch black block letters on all FOUR sides of post.

H. Valve Boxes and Valve Pits

A valve box provided by the Contractor with a cast iron lid marked water and metal lip ring shall be installed over each valve as shown on the Plan. The riser from the valve box to the top of the installed valve shall be constructed of solid 10" PVC pipe and shall be sized to fit the valve box installed.

Tracer wire shall be extended up from the main along the O.D. of each valve riser into the valve box. A three foot (3') coil of the wire will remain inside the valve box on each end of the tracer wire as shown on the Drawings.

I. Main Filling

All main filling shall be done in the presence of the Engineer and field operations personnel. Suitable corporation stops shall be installed on the main by the Contractor, so as to remove trapped air from the main. Payment for main filling shall be included in price paid per linear foot of water main installation and no separate payments will be made.

J. Marker Balls shall be placed above all fittings, taps, changes in main alignments and other locations as determined by the Engineer.

K. Maximum Pull Force

A commercially available weak link approved by the Engineer shall be used, in accordance with manufacturer's recommendations, between the puller and the pipe. The maximum pull force for PE 4710 HDPE shall be **less than:**

Pipe Diameter (Inch)	Maximum Pulling Force (lb)
8	27,000
10	42,000
12	59,000
14	71,200
16	93,000

3.03 WATER SERVICES

All new services, except in the area of know contamination shall be HDPE 4710, installed as shown on the Construction drawings and described in Specifications. In the area of known contamination existing copper service shall be replaced with copper, as directed on the Construction drawings. All connections are to be electrofusion type HDPE portion of a new service and flare type HDPE /Cu transition to angle meter stop. Flare type connections shall be used on all reconnected copper services.

The minimum distance between service taps shall be 24 inches. New services shall be installed perpendicular to the main. All new services shall be shown accurately on the "as-built" drawings and tied to existing property lines.

Tracer wire shall be installed along with all new HDPE services.

Transfer or reconnection of a water service from the existing main to a new main may cause an interruption in the customer's service. The contractor must notify the customer via door hanger notices, 24 hours in advance of the service interruption with the approximate time (8 am -12 pm or 1 pm - 5 pm) and duration of the service interruption. At that time of service interruption, the customer will be notified by ringing the door bell or knocking. The customer's main water valve will be closed if it can be located. After the service has been transferred/reconnected the customer's main water valve will be opened, and customer's service pipe flushed through a hose bib to remove air, sand, chlorine, shaving material, etc.

A. Minimum size of new service

The minimum size of a new and replacement water service shall be 2” IPS HDPE 4710 pipe. For installation requirements in contaminated areas see 2.01-C of this Section.

B. Depth

Water services shall be installed with a minimum cover of 24”, as measured vertically from the top of pipe to the top of pavement. The maximum depth of installation shall not exceed 30”.

C. Maximum Velocity of flow

The maximum design flow velocity in any residential or commercial water service shall not exceed 10 feet per second, based on the maximum calculated loads.

3.04 HYDRANT ASSEMBLIES AND FIRE SERVICES

Hydrant Assemblies shall be installed and field tested according to the requirements of AWWA M17, ANSI/AWWA C503 and as shown on the Drawings.

Prior to reconnection, all existing fire services shall be potholed by the Contractor to avoid possible conflicts. Existing fire service pipe shall be joined with new HDPE pipe, connected to a new HDPE water main, by MJ adapter as shown on WGW Utility Standard Detail. Contractor may be required to furnish shop drawings of how re-connection will be constructed and shall inform the nearest City Fire Station, City Communications Center, and Customer regarding the fire service work. The Contractor will be required to make all necessary schedule arrangements to accommodate the customer's needs.

PART 4 -- TESTING

4.01 Testing and Inspection

The Engineer or Inspector shall have access to the Work at all times whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection. If the Specifications, the Engineer's instructions, law, ordinances, or any other public authority require any work to be specially tested or approved, the Contractor shall give the Engineer 24 hours notice of its readiness for inspection, and if the inspection is by an authority other than the Engineer, the Contractor shall make special arrangements for the outside authority to make its inspection. Inspections by the Engineer will be promptly made.

Work covered up without approval or consent of the Engineer, shall, if required by the Engineer, be uncovered for examination and properly restored at the Contractor's expense if the Work is not in conformance with the Drawings and Specifications.

Authorized Inspectors will be considered to be the representatives of the City limited to the duties and powers entrusted to them. It will be the Inspectors' duty to inspect materials and workmanship of those portions of the Work to which they are assigned, either individually or collectively, under the instructions of the Engineer and to report any and all deviations from the Drawings, Specifications and other Contract provisions which may come to their notice.

An Inspector will order the Work entrusted to his/her supervision stopped if in his opinion such action becomes necessary. The Engineer will be notified and will determine if the Work is proceeding in due fulfillment of all Contract requirements. All pipe and accessories shall be laid, jointed and tested under pressure for defects and leakage in a manner specified, in the presence of and as approved by the Engineer.

A. Connection to Existing Main

The Contractor shall make connections to existing mains where indicated on the Drawings. All necessary preparation (not limiting to traffic control and excavation) for system connections shall be done one (1) day prior to actual materials installation**. The new water mains are to be kept isolated from the City system until they are flushed and bacteriologically tested and accepted**. **New system isolation by a closed valve will not be permitted**. The Engineer will review the Contractor's method and sequence of connecting to existing mains to minimize contamination danger. (Connections to existing valves prior to obtaining satisfactory leakage and pressure tests of the new facilities will not be allowed.)

The City assumes no responsibility for the water tightness of existing valves. If necessary, the Contractor must work with City of Palo Alto to accomplish water tightness of existing valves. All costs and expenses for obtaining water tightness shall be included in the bid price for various bid items and no special compensation shall be allowed.

Service interruption on existing mains impacted by the shutdown shall be coordinated with the Engineer who will specify time and duration of the interruption. The Contractor shall notify all affected users in writing at least 48 hours in advance of service interruption. The Contractor shall notify the City's Water-Gas-Wastewater Operations Division (496-6967) at least **5-days** in advance to schedule valve closings for service interruptions. **Manipulation of existing valves will only be done by or under the direction of City Water Division**

personnel.

After the new water system has been flushed, bacteriologically accepted, pressure and leak tested, and placed into service, all valves in the system shall be maintained in an "on" position except as directed by the Engineer.

B. Hydrostatic Pressure and Leak Testing

Installed main shall be adequately anchored with a covering of at least 6" of initial backfill, if installed by an open trench method. The joints and fittings, particularly flange connections shall be left uncovered for visual leak inspection.

Leak tests of HDPE water system shall be conducted in accordance with ASTM F2164. The pipeline should be slowly filled with potable water and all trapped air bled off. The main should undergo a hydrostatic pressure test using pressure at the lowest elevation in the system at 150 psi. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, the pressure shall remain steady within 5% (7.5 psi) of a target 150 psi test pressure for one hour.

The total test time should not exceed 8 hours. If the pipeline has to be retested – the pipe must be depressurized and allowed to "relax" for at least 8 hours before the next testing sequence.

In fused polyethylene water piping system no leakage shall be present. If leakage is observed at a fusion joint, complete rupture may be imminent. The Contractor shall move all personnel away from the joint and depressurize the main. Leaks, failure or defective construction shall be promptly repaired by the Contractor at the Contractor's sole expense.

Payment for pressure and leakage testing shall be considered included in the price paid per linear foot for water main installation.

C. Disinfection and Bacteriological Testing

Newly installed potable water pipelines require disinfection in accordance with ANSI/AWWA C651/B301. The disinfection should take place after the initial flushing and after the completion of the pressure testing.

Injection of liquid chlorine solution shall be used to disinfect HDPE water mains. The disinfecting solution should not contain more than 12 percent of active chlorine. Prolonged exposure to highly concentrated disinfection chemicals may damage the inside surface of HDPE pipe and is to be avoided.

Air is to be exhausted from each high point, dead end, branch run and hydrant run. The chlorinated water shall be removed prior to samples being collected for bacteriological testing.

Before bacteriological testing samples are taken, each hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one part per million. The Contractor shall measure residual chlorine concentrations by using a color comparator test that is witnessed and approved by the Inspector.

After the chlorine concentration is less than 1 ppm, samples shall be gathered and tests conducted according to the provisions of AWWA C651-92, at the expense of the Contractor, by a laboratory approved by the Engineer. Samples shall be taken at representative points as required to thoroughly test the installed main.

The Contractor will be required to perform two consecutive 24-hour apart Coliform tests. Testing laboratory used by the Contractor shall be State Certified and provide QA/QC report.

The new facilities shall remain isolated and out of service until satisfactory test results have been obtained that meet the requirements of the California Department of Public Health (CDPH) and the Engineer has accepted the results as indicative of the bacteriological condition of the new water main. If unsatisfactory or doubtful results are obtained from the initial sampling, the chlorination process shall be repeated until acceptable test results are obtained. The bacteriological test takes at least 48 hours for results to be conclusive.

Individual new water services will be flushed thru the angle meter stop after connection to the new water main.

Payment for disinfecting water mains shall be considered included in the price paid per linear foot for water main installation.

Disposal of chlorinated water shall comply with all federal, state, and local regulatory requirements. Disposal directly to the storm drain system without removal of chlorine is strictly prohibited. No discharge into the storm drain system shall be allowed during rain. Upon termination of the flushing, any standing water in the gutter shall be removed by sweeping it to the nearest storm drain catch basin. Flushing of chlorinated water directly into the sanitary sewer system will only be allowed with the written approval of the City.

New water mains **must be tied-in** into water distribution system within 24 hours following the Engineer's acceptance of the bacteriological tests' results or the Contractor will be required to repeat flushing, disinfection and bacteriological testing procedures at the Contractor's expense.

The new pipe, connections, and fittings must be kept clean and swabbed with a 5% solution of hypochlorite before installation.

D. Washing/Flushing Vehicles

All vehicles used for street washing or flushing must be equipped with meters and have air gap separation connection to hydrants and filling tanks.

PART 5 – DESIGN AND REGULATORY STANDARDS

A. Load

The design load shall be the total present (and additional future) water demand as presented on the Utilities Application - Load Sheet.

B. Calculating Service Size

The service size calculation must be based on the use of the Hazen-Williams Formula to calculate the head loss due to the pipe friction.

C. Available Pressure

The service designer must consult the Fire Hydrant Flow Data available at Fire Station 5 located at 600 Arastradero Rd. (Phone 650-329-2187), and the Pressure Contour Map for an estimate of static pressure at the water supply main. The water pressures in the distribution system vary with the elevations of the area served. During average demand conditions, pressures range from 30 to 125 pounds per square inch, psi, with an average of 50 psi which is sufficient for normal water delivery. However, the City does not guarantee any water main pressure, during peak hour and/or emergency conditions, certain areas of the City are subject to inadequate pressures. The water pressure on Foothill properties, west of highway 280, may be as high as 200 psi.

D. Blowoffs and air release valves

1. Water mains shall not be designed as dead end mains. Easements shall be provided to cross-tie water mains in cul-de-sacs and as required by the City.

2. Blowoffs shall be provided at all low points and as required by the City. Temporary blowoffs shall be provided as necessary to pressure test and chlorinate the water mains.

3. Vacuum and air release valves shall be installed at all summits in the water main and as directed by the City.

E. Valves

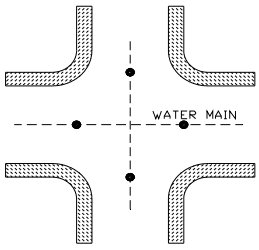
1. All line valves 12" or smaller shall be 250 psi, ductile iron ASTM A536 body, resilient-seated, tight closure gate valves with non-rising stems in accordance with all applicable requirements of ANSI/AWWA C515 and have IPS HDPE 4710 DR 11 IPS polyethylene pipe ends; must be NSF 61 listed. All valves shall have protective interior/exterior electrostatically applied epoxy-resin coating in accordance with AWWA C550, stainless steel A2-Grade 304 bonnet bolts, and shall open counter clockwise.

   For installation requirements in contaminated areas see 2.01 –C of this section.

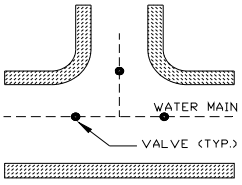
2. 14" and 16" valves shall be Mueller A2361 series, 250 psi, resilient wedge gate valves with iron body and four point wedging mechanism, NRS type complying with AWWA C515, AWWA C111, and ANSI A21.11; NSF 61 listed. Valves shall have a protective epoxy two part thermal setting coating on the interior and on the exterior per AWWA C550. Valves shall have mechanical joint to mechanical joint end (M.J. x MJ) or flange joint ends (FL x FL.). Joints shall be in accordance with ANSI/AWWWA C110/A21.10 or ANSI/AWWWA C111/A21.11 requirements. All bonnet and stuffing box bolts shall be 304 stainless steel. Valves shall open counter clockwise

3. A 2" HDPE bypass with 2" full port ball valve (NSF 61 listed) shall be installed around each 14" and 16" valve to facilitate operation of the valve (standard detail WD-20).

4. Four water valves shall be installed at each water main intersection or cross and three valves shall be installed at each water main tee at the property line extensions, see Figure 1.



Install four valves At each water main Intersection



Install three valves At each water main tee

Figure 1.

F. Meter Bypasses

Some customers, such as hospitals, schools, beauty shops, and factories with processes requiring uninterrupted water service shall have bypasses installed around the meter so that

tests at regular intervals and repairs can be carried out without inconvenience to either the customer or the utility.

G. Elevation of the Customer's System

Customers on hillsides or in high-rise buildings will be affected by the difference in elevation between the utility's water main and customer's outlet. If the customer is at an elevation less than that of the water main, then he can anticipate a higher pressure than that in the main, and conversely, the homeowner at a higher elevation than the main will encounter lower water pressure.

Multistory buildings will often be too high to use the available main pressure, and pumping will be necessary. It is the responsibility of the customer's engineer to design the system from the meter outlet to determine the pressure that will be available to meet their demand.

H. Pressure Reducing Valves

Pressure reducing valves (PRVs) are used in mountainous and hilly areas to control the downstream pressure and protect the property owner's plumbing from excessive pressure when his building is located in the lower elevations of the pressure zone. These are installed by the customer at the meter or at a suitable location in the customer's plumbing system to permit reduced pressure to the house fixtures. PRV's must be installed to leave maximum pressure at outside hydrants. It is customer's responsibility to install and maintain PRVs.

I. New Developments

When the City deems it necessary, the Developer will be asked to create a water model to show that the existing water distribution system will not be impacted by the new development. The applicant's engineer shall prepare and submit a complete report for the new subdivision water distribution system. The report shall consist of an engineering study including a computer hydraulic water model. The study report shall analyze the existing City of Palo Alto water system and the new development by the use a hydraulics model. The recommendations for the new development water system improvements shall include a cost estimate and suggested design criteria.

J. Irrigation Meters

Water service for all new and rehabilitated industrial, commercial, and institutional landscaping and new and rehabilitated multi family common areas requiring a permit or review by the City shall be provided by a separate irrigation meter. This meter shall be designed as an irrigation account and no other utilities will be billed on such accounts. The customer shall pay for the additional service according to rate schedule W-5.

K. Fire Hydrants

Fire hydrants shall be located no more than 500 feet apart in residential areas and no more than 300 feet apart in the downtown areas. Locations and usage shall comply with City of Palo Alto Rule and Regulation 21.

L. Cross Connection Control

Cross Connection Control shall be installed per the City of Palo Alto **SPECIAL WATER UTILITY REGULATION 21-E** entitled "Water System Protection", the revised California Administrative Code (Title 17, Sections 7583 through 7605 inclusive protecting the public water supply against actual or potential cross-connections), and standard drawings WD-17 through WD-18D. For further questions contact the Utilities Cross Connection Inspector at 650-496-6972.

1. Type of Protection Required

The type of protection provided to prevent backflow into the public water supply will be commensurate with the degree of hazard that exists on the consumer's premises as determined by the Cross-Connection Control Officer.

Reference: California Administrative Code, Title 17, Section 7604

Where the water service may not be interrupted during normal working hours, two parallel backflow preventer assemblies shall be installed.

2. Testing and Maintenance of Backflow Preventers

The Cross-Connection Control Officer will ensure that adequate maintenance and periodic testing is provided. Backflow preventers will be tested by a certified tester. Backflow preventers will be tested at least annually or more frequently if determined to be necessary by the Cross-Connection Control Officer. When a backflow preventer is found to be defective, it shall be repaired or replaced within 30 calendar days. Backflow preventers will be tested immediately after installation, relocation, or repair prior to being placed into service. The Cross-Connection Control Officer will notify the water user when testing is needed. Reports of testing and maintenance will be maintained by the City of Palo Alto for a minimum of three years. These regulations are to be reasonably interpreted. It is the intent of these regulations to recognize that there are varying degrees of hazard and to apply the principle that the degree of protection should be commensurate with the degree of hazard. It is recognized that the control of cross-connections requires cooperation between the City of Palo Alto, the water consumer, and the California Department of Public Health. The City of Palo Alto has the primary responsibility to prevent water from unapproved sources, or any other substance from entering the public water supply system. The California Department of Public Health has the overall responsibility for preventing water from unapproved sources from entering either the potable water system within consumer's premises or the public water supply.

Reference: California Administrative Code, Title 17, Section 7605

3. Parallel Reduced Pressure Principle Assemblies

Parallel reduced pressure principle assemblies shall be installed for all locations where the water can not be interrupted during normal working hours.

List of approved Backflow Preventers:

Only backflow assemblies approved for the State of California by USC Foundation for Cross-Connection Control and Hydraulic Research may be used.

5.01 Water Service Abandonment Procedure

1. Excavate the existing water service at the main.

2. Service with a corporation stop and service saddle: turn off the corporation stop and Check for leaks. Cut the copper or HDPE tubing with a tubing cutter and bend both cut ends over approximately 1" from cut end (copper service) or electrofuse HDPE electro fusion end cap (HDPE service).

3. Service with a corporation stop with no service saddle: notify all effected water Customers of the service interruption. Coordinate water shutdown with affected customers and C.P.A. Utilities. Remove the corporation stop and install a Mueller or Ford repair clamp. Any leaks, failures, or defective repairs shall be promptly repaired by the contractor.

4. Remove the water meter and salvage to the City of Palo Alto corporation yard water meter repair shop.

5. Remove the abandoned water meter vault and backfill and compact hole to City standards with top soil or clay dirt.

6. Backfill, compact and pave hole at the main per trench backfill standard detail Std. WD-01.

7. Abandonment of all existing water services shall be witnessed by Palo Alto's Utilities Inspector. Schedule WGW utilities inspections at 650/566-4504 five working days before start of abandonment.

5.02 ACP Pipe and Hazardous Material Disposal

Asbestos containing pipe will not be accepted by the City landfill and must be properly disposed of per State and Federal regulations. Contractor and subcontractors, if any, shall be in full compliance with any and all laws, orders, citations, rules, regulations, standings and statutes in effect with respect to handling, storage and removal of Hazardous Material. Contractor accepts sole responsibility for insuring the adequacy of any required use of all safety practices, procedures and equipment.

END OF SECTION

NATURAL GAS DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

Work Includes installation of 8", 6", 4" and 2" natural gas mains, 1" and 2" natural gas services, tracer wire, polyethylene valves and boxes, polyethylene fittings, excess flow valves, anode boxes, modification of existing natural gas house plumbing to accommodate relocation of gas meters, and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section 02200 Excavation, Backfill and Restoration

1.03 QUALIFICATION OF NATURAL GAS DISTRIBUTION SYSTEM CONTRACTOR

The Contractor performing work on the City of Palo Alto natural gas distribution system shall have a drug testing program in place per **PIPELINE SAFETY REGULATIONS Part 199 "Drug Testing Pipeline Safety" and Part 40 "Procedures for Transporting Workplace Drug Testing Programs**."

PART 2 -- MATERIALS

2.01 NATURAL GAS DISTRIBUTION SYSTEM MATERIALS

A. POLYETHYLENE PIPE

GENERAL

All polyethylene pipe supplied under this Section shall conform with the latest edition of ASTM D-2513, polyethylene fittings supplied under this Specification shall conform with the latest edition of ASTM D-2513 and ASTM D-3261 (Standard Specification for Thermoplastic Gas Pressure Systems) listed in Section I Appendix B of the latest edition of the Office of Pipeline Safety, Part 192, Title 49, Code of Federal Regulations and with the specifications stated herein.

1. All pipe shall be uniformly yellow in color medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.

3. Pipe dimensions and tolerances:

   The outside diameter and wall thickness shall be within the limits specified in Table 1.

Table 1: Dimensional Standards for Polyethylene Pipe and Tubing

Nominal Pipe/ Tubing Size	Average Outside Diameter (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	Wall Thickness Tolerance (inches)	Out of Roundness Tolerance (inches)	Standard Dimension Ratio (unitless)
1" CTS	1.125	± 0.005	0.099	+ 0.008 - 0.000	-	11.5
2" IPS	2.375	± 0.006	0.216	+ 0.026 - 0.000	± 0.012	11.0

Nominal Pipe/ Tubing Size	Average Outside Diameter (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	Wall Thickness Tolerance (inches	Out of Roundness Tolerance (inches)	Standard Dimension Ratio (unitless)
4" IPS	4.500	± 0.009	0.333	+ 0.047 - 0.000	± 0.015	13.5
6" IPS	6.625	± 0.011	0.491	+ 0.059 - 0.000	± 0.035	13.5
8" IPS	8.625	± 0.013	0.639	+ 0.077 - 0.000	± 0.040	13.5

Approved Manufacturers: CP CHEM Performance Pipe, CSR Poly Pipe Industries, or approved equal.

B. PE Fittings

1. All fittings shall be uniformly yellow in color. medium density PE 2406 polyethylene molded from one of the following: Performance Pipe Company Marlex HHM TR-418 Resin; or Ineos Fortiflex® K38-20-160 Resin.

2. Dimensions and tolerances:

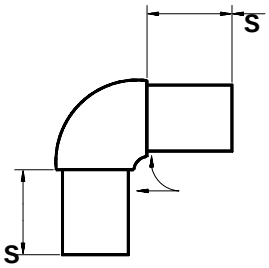
   Butt Fusion Fittings shall conform to the dimensions given in Table 2.

Table 2: Dimensional Standards for Polyethylene Butt Fusion Fittings

Nominal Fitting Size	Ave Outside Dia at Point of Fusion (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	SDR (unitless)	Minimum Stub Length* (inches)
2" IPS	2.375	± 0.010	0.216	11.0	2.0
4" IPS	4.500	± 0.015	0.333	13.5	3.0
6" IPS	6.625	± 0.018	0.491	13.5	3.5
8" IPS	8.625	± 0.025	0.639	13.5	3.5

* as defined in Figure 1 (only applicable to tees, 45° and 90° ells).

Figure 1: Definition of Stub Length for Butt Fusion Fittings



STUB LENGTH-S

PORTIONS O.D. CONTROLLED TO MATCH PIPE O.D.

3. **Approved Manufacturers:** CP CHEM Performance Pipe, CSR Poly Pipe Industries, or approved equal.

D. Polyethylene Gas Valves

Polyethylene gas valves shall be manufactured by Flowserve Corp. (Nordstrom Valves), Friatec Gas Water, Inc., Kerotest Manufacturing Corp, or Broen, Inc. (Ballomax). The gas valves shall be manufactured within 6 months of date of sale to the City and in compliance with the requirements of ANSI/AMSE B16.40 “Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems”, ASTM 1996 Section 8 “Plastics”, Volume 08.04 “Plastic Pipe and Building Products” D-2513, and DOT Part 192.145 “Valves”.

The valves shall be assembled to operate smoothly and provide gas tight seal. Each valve’s stem shall be equipped with the weather seal(s) protecting inner parts from ground water and foreign debris intrusion. All polyethylene valves shall be supplied with the Butt End outlets.

The polyethylene portion of the valve shall be one piece molded medium density PE-2406 polyethylene manufactured from Performance Pipe Company Marlex TR-418 Resin, Rigidex PC 2040Y, or FINATHENE 3802Y.

PE valves shall conform to the dimensions given in Table 3.

Table 3: Dimensional Standards for Polyethylene Valves

VALVE SIZE	SDR	MIN. PORT DIA. *	MIN. STUB LENGTH *
2"	11	1.80"	2.00"
4"	13.5	3.60"	3.00"
6"	13.5	4.80"	3.50"
8"	13.5	6.30"	3.50"

* as defined in Figure 2

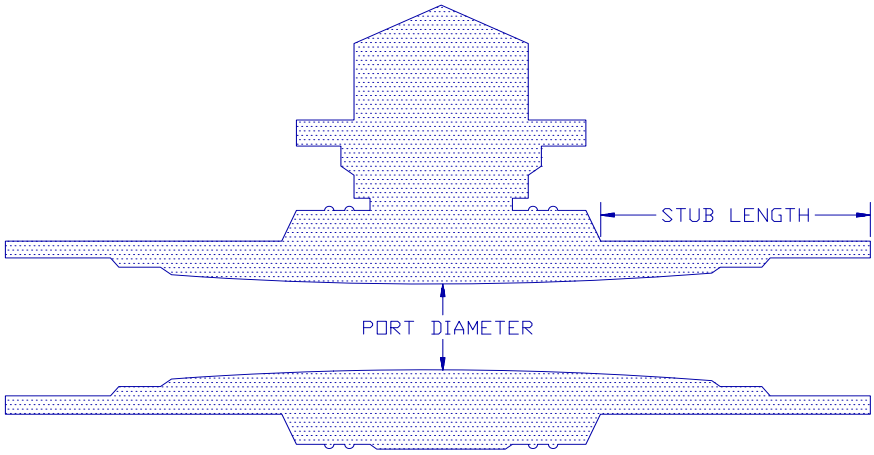


Figure 2: Definition of Dimensions for Polyethylene Valves

For purging at designated locations shall be used Flowserve Corp. (Nordstrom Valves) with integral polyethylene purge connections. These valves shall comply with all specifications for polyethylene gas valves of this section.

E. Gas Service Riser Anodeless

All risers must meet or exceed the latest editions of the following standards or requirements:

- DOT Code of Federal Regulations, Title 49, Part 192
- ASTM D2513 for polyethylene pipe, tubing, and fitting
- Pipe threads ANSI B1.20.1
- Cathodic disbondment testing per ASTM G8
- 100% factory leak tested

A. Prebent Risers:

1. **Anodeless 1" CTS X ¾" MPT PREBENT** - The ¾" casing pipe shall be fabricated from ASTM A53 schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 60 inches long, 1.625" OD x 0.072" wall thickness ASTM A513 mechanical tubing with ¾" MPT nipple outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 10-inch minimum radius resulting in a min. 16" horizontal by 30" vertical configuration.

   A 10 inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.5.

The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

2. **Anodeless 1" CTS X 1-1/4" MPT PREBENT** - The 1-1/4" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.625" O.D. x 0.072 wall thickness ASTM A513 mechanical tubing with 1-1/4" MPT nipple outlet, neoprene bushing crimped in place gasket moisture seal. Additionally, the casing pipe shall be bent to a 12-inch minimum radius resulting in a 30" horizontal by 30" vertical configuration.

   A 10-inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density ASTM D2513 PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin; SDR 11.5.

   The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

3. **Anodeless 2" MPT X 2" IPS PREBENT** - The 2" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 2-3/8" MPT outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 24-inch minimum radius resulting in a 36" horizontal by 36" vertical configuration.

   A 10-inch long, 2" IPS PE pigtail shall extend from the steel pipe casing. The 2" IPS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.0.

   The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

4. **Anodeless 4" MPT X 4" IPS PREBENT** - The 4" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 4.5" MPT outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 36-inch minimum radius resulting in a 30" horizontal by 42" vertical configuration.

   A 12-inch long, 4" IPS PE pigtail shall extend from the steel pipe casing. The 4" IPS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.0.

The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

B. Straight Risers:

1. **1" CTS X ¾" MPT STRAIGHT** - Anodeless Service Risers shall be straight with an overall length of 70 inches. The ¾" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.625" OD x 0.072" wall thickness ASTM A513 mechanical tubing with ¾" MPT nipple and crimp gasket moisture seal.

   A 10 inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.5.

   The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

Approved Manufacturers: R.W. Lyall & Company, Inc. (www.rwlyall.com), Georg Fischer (Central Plastics Company www.centralplastics.com), Continental Industries, Inc (www.conind.com), Perfection Corporation (www.perfectioncorp.com).

F. Valve Boxes

All valve boxes for 2" through 8" valves shall be Christy G5 Traffic Valve Box with G5C non-locking type metal traffic type lid marked "GAS".

Corrugated 10" pipe shall be used as extension for 6" and 8" valves. Valve supports shall be supplied for 2" valve sizes only and be manufactured by C. P. Test Services Inc., model FPKPV2.3 or approved equal.

G. Tracer Wire

All tracer wire shall be 10 AWG solid copper wire coated with .45 mils Type HMW - PE yellow insulation. The wire shall meet all requirements of the latest version of ASTM D1351 and ASTM B8. Tracer wire shall be UL listed as direct burial wire at temperatures between -40° C and 75° C for circuits not exceeding 600 volts. The surface of the insulation shall be durably marked, at intervals not exceeding 24 inches, with only the following information: maximum working voltage "**600 VOLTS**", wire type, manufacturer's name or trademark, AWG size or circular mil area, UL required markings, and at the Contractor's option "**CAUTION CPA GAS LINE**".

H. Meter Valve

Meter valves shall meet all applicable parts of D.O.T./CFR TITLE 49 PART 192 and ASME/ANSI B16.33. All meter valves shall be insulated 3/4", 1-1/4", or 2" Mueller H-11179 or equal with a 3/4", 1-1/4", or 2" steel plug.

I. Anode Boxes

Anode box shall be Christy G5 Traffic Box with G5C non–locking type metal traffic lid marked "ANODE".

J. Steel Pipe - Gas Carrier

Steel pipe shall be schedule 40 grade B A53 seamless steel pipe with a 30 mil extruded polyethylene coatwrap.

K. Steel Pipe - Fittings

All welded fittings shall be schedule 40 and comply with ASTM A-234 WPB (materials) and ANSI B36.10 (dimensions).

All threaded fittings shall be IPT, BLK., conforming to ASTM A-197.

L. Casing

Steel Casing - shall be steel pipe, schedule 40, grade A106.

Polyethylene Casing - shall be high density HDPE 3408 polyethylene pipe (SDR 9.3) with cell classification of 345464C, D or E per ASTM D3350.

M. Casing Insulators

Commercial available casing insulators with a minimum of 4 plastic runners, each runner a minimum of 1/4" high, shall be installed at 5 feet maximum intervals on the steel gas main prior to insertion. Insulators shall be sized to center the gas main in the casing.

N. Cable Protectors

When inserting the pipe into the casing, the Contractor shall use a suitable cable protector on the casing end to protect the pipe and or pipe coating from damage. Cable protectors shall be left in place after pipe insertion is completed.

O. Casing End Seals

End seals shall be Link Seal™ or approved equal capable of forming a watertight seal at the ends of the casing.

P. Excess Flow Valves (EFV)

GENERAL: Polyethylene natural gas excess flow valves (EFV) shall be manufactured by either UMAC Inc., Perfection Co., or Dresser. The excess flow valves shall be manufactured within 6 months of date of sale to the City and be in compliance with CFR Title 49 DOT Part

192.381 and MSS SP-115: Excess Flow Valves. All EFVs shall be tested in accordance with ASTM F 1802-97: Standard Test Method for Performance Testing of Excess Flow Valves.

The design of excess flow valves shall incorporate a bypass to allow the valve to automatically reset and resume normal operation after repairs are made to the severed gas line. Each valve shall be fixed or anchored to the interior of the fitting to preclude movement of the valve.

Each valve shall have an affixed tag, identifying the EFV's capacity range and flow direction, and be individually packaged and supplied with the operating instructions. An additional stainless steel tag or washer shall be included in the package indicating the size and flow capacity of the valve, which will be attached to the gas riser.

MATERIAL: The polyethylene portion of EFV shall be one piece molded medium density PE-2406 polyethylene manufactured from Performance Pipe Company Marlex TR-418 Resin or Solvay Fortiflex® K38-20-160 Resin.

APPROVED MODELS (shall be designed for electro fusion applications):

- ***UMAC***

  Model 41, 1" CTS Series 700
  Model 41, 1" CTS Series 1800
  Model 41, 1" CTS Series 2600
  Model 41, 2" IPS Series 5500
  Model 41, 2" IPS Series 10,000

- ***Perfection (Powell Flow Limiter)***

  1" CTS Powell 800 dwg 51523
  1" CTS Powell 1800 dwg 51258T

- **Dresser**

  Polyethylene Sticks:

  Style 480, 1" CTS (Low Capacity)
  Style 480, 1" CTS (Medium Capacity)

Table 4: EFV Trip and Load Information

EFV Models	Inlet Pressure (PSIG)	Pressure Drop at Typical Load (PSIG)	Minimum Trip Point (SCFH)	Service Length Protected (FT)
Model 41, 1" CTS, Series 700	10	0.6	700	2105
Powell 800, 1" CTS, dwg 51523	10	0.35	800	1600
Dresser Style 480, 1" CTS, Low Capacity	10	0.4	624	2172
Powell 1800, 1" CTS, dwg 51258T	10	1.1	1600	261
Dresser Style 480, 1" CTS, Medium Capacity	10	0.45	1073	710
Model 41, 1" CTS, Series 1800	10	0.44	2000	258
Model 41, 1" CTS, Series 2600	10	0.9	2600	127
Model 41, 2" IPS, Series 5500	10	1.3	5500	1332
Model 41, 2" IPS, Series 10,000	10	0.51	10,000	

PRESSURE DROP: An average pressure drop across EFV at an inlet pressure of 10 psig shall not exceed: for 1" CTS - 0.6 psig @ 425 scfh, 0.8 psig @ 1250 scfh, 0.9 psig @ 1400 scfh, and 1.3 psig @ 5500 scfh.

DIMENSIONS: 1" EFV shall be 1" CTS SDR 11.5 with 0.099" min. wall thickness with a minimum length of 10". 2" EFV shall be 2" IPS SDR 11 with 0.216" min. wall and a minimum length of 10". Valves shall be supplied with plain pipe ends.

Q. Marker balls shall be 3M yellow, Omni yellow or approved equal.

R. **Meter Boxes**

Curb meter installation in sidewalk or planting strip will be allowed only when there is no above ground location on property (the building occupies the entire property or underground parking garage prohibits above ground installation) All meter boxes shall be supplied and installed by the Contractor when box replacement is required or a new service is installed. Boxes shall be supplied with self closing reading lids. Box and lid shall have a minimum Tier 5 rating (per ANSI/STCE 77 2010) for sidewalk and planting strip applications. Meter boxes shall not be installed in driving lanes of public or private streets. Lids shall have "GAS" marked on them.

For installation in areas subject to vehicular traffic, meter box and lid shall have H-20 load rating.

2.02 WORK MATERIALS TO BE FURNISHED BY THE CITY.

The City will provide gas meters.

2.03 WORK MATERIALS TO BE FURNISHED BY THE CONTRACTOR.

Work materials supplied by the Contractor shall include but not be limited to:

1. All polyethylene pipe, electro fusion tapping tees, excess flow valves, valves, valve boxes, valve extensions, valve supports, anode boxes, 2" through 8" PVC end caps, tracer wire, Nicotap # 3519J single type, electrical tape, risers, insulated meter valves, end plugs, electro fusion couplings, aquaseal, molded PE fittings, marker balls, casing insulators, casing end seals and weld rod, meter and regulator vaults.

2. Expendable Concrete Materials. Materials required to install and finish Portland cement concrete, such as form lumber, tie-wire, nails, etc.

3. Concrete. All Portland cement concrete including reinforcing steel, wire mesh, etc.

4. Temporary and Permanent Fencing including traffic barricades required to provide a barrier between vehicular/pedestrian movements and excavations.

5. Trench Backfill Sand. All backfill sand shall be clean imported sand, rock and salt free. Bay sand shall not be accepted.

6. Paving Material. All materials required for temporary and permanent street repairs including base materials.

7. Landscaping Materials. All landscaping materials, plants and surface improvements that are damaged due to this Work.

8. Traffic Control Materials. All materials damaged by Work required to direct vehicular and pedestrian traffic including striping, loop detectors, reflectors, etc.

9. Drilling fluids and bentonite.

2.04 MANUFACTURER'S TESTING

A Minimum Burst Pressure Tests, conducted in accordance with the latest edition of ASTM D1599 (Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings), shall be performed by the manufacturer to determine the short term rupture strength of the pipe and fittings furnished. The minimum short term burst pressure shall be that required to develop a minimum hoop stress value of 2520 psi. This test shall be performed on each lot of pipe ordered. A lot shall mean all material covered by a single item on a CPA order. Fittings shall be tested at the frequency specified in the latest edition of ASTM D2513, Annex A2., Section A2.3, Fittings Tests. Manufacturer shall provide test data for each lot of pipe as requested by the CPA.

B. Sustained Pressure Tests shall be performed to ensure that the pipe and fittings supplied have passed the sustained pressure test outlined in the latest edition of ASTM D1598 (Standard Test Method for Time-To-Failure of Plastic Pipe Under Constant Internal Pressure). The minimum sustained pressure shall be that required to produce a minimum hoop stress value of 1320 psi. Testing frequency shall meet or exceed that called for in the latest edition of ASTM D2513, Annex A2. Manufacturer shall provide test data for each lot of pipe or fittings as requested by the CPA.

2.05 SUBMITTALS AND QUALITY CONTROL

A. The Manufacturer shall submit to CPA a written quality control procedure conforming to the latest edition of ASTM D2513, Annex A2., which shall be subject to approval by CPA.

B. The Manufacturer shall permit CPA representatives to tour extrusion facilities for the purpose of evaluating manufacturer's capabilities. The tour shall be during extrusion of a CPA order or if prior to order placement during the extrusion of a similar material.

C. The Manufacturer shall certify that the plastic pipe and or fittings supplied meet all the requirements of this Specification. When requested by CPA the Manufacturer shall supply certification for all items ordered, failure to do so shall be cause for order rejection.

2.06 INSPECTION

CPA reserves the right to inspect each order upon delivery and, at the option of CPA, reject any items not meeting this Specification.

PART 3 -- EXECUTION

3.02 POLYETHYLENE PIPE INSTALLATION - MAINS

A. Minimum Cover

Gas mains shall be installed with a minimum cover of 30", as measured vertically from the top of pipe to the top of pavement.

B. Underground Clearance

Unless otherwise specified a minimum of 12 inches vertically and 24 inches horizontally shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. In the event that it is not possible to maintain required vertical clearance from other structures, the Contractor shall case the gas main in steel pipe or concrete at the discretion of the City's representative.

C. Gas Pipe Bedding

Trench shall be free of debris, sharp rocks, etc. before adding the sand bed for the new gas main. Sand bed shall have a minimum thickness of 4" below and 12” above the gas main.

I. Tracer Wire Connections

One tracer wire shall be installed with the pipe. All tracer wire connections shall be made with Nicotap lateral splice sleeve wrapped with aqua seal and electrical tape. All Nicotap fittings must be installed with tooling specified by the manufacturer, the use of pliers or other crimping devices will not be allowed. Tracer wires from the four pipelines feeding into an intersection will be terminated at an anode box located by the north valve. Tracer wire shall have knots tied in the wire as follows: north wire - no knot attached to terminal 1 of the anode box; east wire - one knot attached to terminal 2; south wire - two knots attached to terminal 3; west wire - three knots attached to terminal 4. Each wire shall extend a minimum five feet

above grade. The Drawings detail installation requirements. Tracer wires from steel gas mains inserted into casings shall be extended to the closest “westerly” anode box with four knots tied.

J. Valves

Valves shall be installed at the marked locations. Valve supports are required for 2" valves only. Valves shall be installed with the operating nut on top, facing vertically up. The City will not accept valves that are cocked or oriented in any direction except up.

K. Valve Boxes

All valve boxes for 2” through 8” valves shall be Christy G5 Traffic Valve Box with G5C non-locking type metal traffic type lid marked “GAS”.

Corrugated 10" pipe shall be used as extension for 6" and 8" valves. The Drawings detail installation requirements.

L. Anode Boxes

Anode boxes shall be installed at locations shown on plans or as directed by the project inspector. Anode boxes shall be installed in the same manner as valve boxes.

M. Pressure Test

The Contractor will conduct air pressure tests at 100 psig on all main lines and services for a minimum time of 24 hours. The City will provide a pressure chart recorder to document all air tests. The pressure shall not decrease during the test period. Tests shall be performed on each block of main installed after service installation is completed.

O. Boring

All underground utilities shall be located and potholed prior to the start of boring. One tracer wire shall be attached to all pipe prior to insertion in the borehole. All pipe ends shall be sealed with a butt fusion end cap or similar fitting prior to pulling into a borehole.

P. Sealing Installed Piping

Contractor shall seal open piping with butt fusion end caps at the end of each workday. No open pipe ends will be allowed at the end of the day.

Q. Marker Balls

Marker Balls shall be placed above all fittings, tapping tees, change in main alignments and other locations as determined by the Engineer.

3.03 GAS MAIN INSERTION

When inserting a Polyethylene pipe in an existing (to be abandoned) main the Contractor shall follow the following procedures to minimize gas service disruption:

1. Install all new 1” PE services.

2. Perform all required house plumbing modifications.
3. Pressure test the entire length of pipe to be inserted before insertion for a minimum period of 24 hours at 100 psig with air.

3.04 GAS HOUSE LINES

All materials and installation methods must comply with the latest City adopted version of UPC.

3.05 INSTALLATION - SERVICES

A. Tapping Tee Installation

1. Contractor shall install tapping tees at the locations marked by the City. Bell holes shall be excavated, if installing the gas mains by boring methods, at each tapping tee installation site to provide an adequate work area for installation and inspection of tapping tees. The tapping tees shall be installed in accordance with Appendix E " Polyethylene Pipe Fusion Training Procedures and Certification", by the person(s) qualified by the City to install tapping tees. Tapping tee fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. **TAPPING TEES SHALL ONLY BE INSTALLED ON THE TOP OF THE GAS MAIN.**

2. The main shall be tapped after the tapping tee outlet coupling has cooled for the time period specified in Appendix A and the service line has been soaped and pressure tested. The manufacturer supplied tapping wrench or fitting shall be the only tool used for turning the tapping tee cutter to avoid tapping the backside of the main or loss of the cutter into the main, allen wrenches shall not be used.

3. Tapping tee cutter shall be moved back to the top of the tee tower prior to seal cap installation.

B. Service Pipe Installation with Excess Flow Valves

1. All services must be installed with boring type devices, approved by the Engineer, except in cases where ground conditions or existing underground utility congestion precludes it. Open cut trenching of services must be approved by the Engineer.

2. Excess flow valves shall be installed on all service lines, where commercially available, 12” from the outlet of the tapping tee connected by electrofusion couplings. Care shall be taken to insure that the excess flow valve is installed with the arrow pointing towards the riser (away from the tapping tee).

3. A 1" cap shall be attached in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" by a qualified person(s) in the presence of or with the prior approval of the City's Inspector, to the end of the 1" service pipe and a tracer wire attached to the service pipe prior to inserting the pipe into the bore hole. Services shall be one continuous polyethylene pipe with no fusion joints.

4. A qualified person shall make all connections between the excess flow valve and the service line by electro fusion couplings in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" in the presence of or with the prior

approval of the City's Inspector.

5. A qualified person shall connect by electrofusion the service line to the service riser in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" in the presence of or with the prior approval of the City's Inspector.

6. The Contractor shall install a meter valve, by-pass assembly (if indicated on a construction drawing), and end plug on each service riser. Stop cock shall be installed with operating shut off nut facing away from structure and having regulator at its left side as per Utility Standards for WGW Drawing # STD. GD-02 and 03.

7. MARKING GAS SERVICE LINE. The contractor shall be required to mark the gas service line on the sidewalk. The marking shall be triangular shape engraved on the sidewalk; the base of the triangle shall be parallel to the curb and its vertex shall be located on the gas service line and pointing toward the house along the alignment of the gas service piping. The marking must be placed at the time of service installation by attaching a line locator device to the tracer wire to insure that the marking is located above the pipe location.

8. House line: All materials and installation methods must comply with the latest City adopted version of UPC.

C. Minimum Cover

Gas services shall be installed with 24" minimum cover, as measured vertically from top of pipe to top of pavement or below existing grade.

D. Maximum Cover

Gas services shall not be installed any deeper than 30" below existing grade unless directed by Engineer.

E. Service Leak Testing

Prior to tapping the main, the contractor will conduct air pressure tests at 100 psig on service lines for a minimum time of 15 minutes. The pressure shall not decrease during the test period. Air pressure shall be held until after soap testing. Soap test the service connection by brushing a liquid soap and water solution around the tapping tee base at the main, both ends of the outlet coupling, the outlet connection of the excess flow valve, and the pipe to riser connection in the customer’s yard, and at the meter valve inlet and outlet. If any leaks appear, the City’s Inspector will direct repair procedures.

F. Surface Restoration

Once the City’s Inspector noted the location of the service pipe in the customer’s property, the Contractor shall restore the customer’s surface improvements to the preconstruction condition.

3.06 STEEL PIPE INSTALLATION

A. Welding

All steel gas carrier pipe shall be butt welded per Part 192 Subpart E by a welder qualified under Part 192 Subsection 192.227 and certified by the City.

B. Wrapping of Welds

Primer (Royston Roybond 747) and 30 mil minimum thickness wrapping tape shall be applied over welded joints and any other bare metal surface of the pipe. Complete wrap shall be two thicknesses of cold wrap tape covering the metal in all places (50% overlap of the cold wrap tape) and overlapping the plant coat wrap by a minimum of 2 inches. Manufacturer's primer shall not be applied to polyethylene pipe.

3.07 SYSTEM PRESSURE TEST

The Contractor will conduct an air pressure test at 100 psig on all lines, including services and mains, for a minimum time of 24 hours. Test will only be performed on Monday-Thursday. The City will provide a pressure chart recorder to document the system air test. The pressure shall not decrease during the test period.

All customer piping shall be inspected and approved by the building inspection division before gas service is instituted. Gas meters will be installed within three working days after the building inspection division passes the building gas piping and releases a set tag for the gas meters to the Utilities Department.

3.08 POLYETHYLENE PIPE FUSION QUALIFICATION REQUIREMENTS

A. General Conditions

The Contractor shall have qualified persons to perform the polyethylene pipe joining as per Appendix E of these standards and **PIPELINE SAFETY REGULATIONS PART 192 Subpart F.**

B. Qualification Testing

The City will test the person(s) intending to fuse polyethylene pipe for the purpose of Qualifying that person(s) to fuse on City piping. Said person(s) will be deemed the Qualified Fuser(s) and shall be the only person(s) performing fusions on the job site. Qualification testing is required for all Contractor employees that will be performing polyethylene pipe fusions. The Contractor will perform the qualification testing using his own equipment and materials. The Contractor will schedule fusion testing two weeks prior to the start of Work. Notify WGW Construction Supervisor, (650) 496-6960, for scheduling.

3.09 DESIGN STANDARDS

Polyethylene service piping is currently the only material installed in the C.P.A. gas system (medium density PE - 2406).

A. LOCATION

1. Gas mains shall be located two (2) feet off the lip of gutter on the north and east side of streets, unless otherwise specified on the Project Drawings. Gas mains shall be twenty-four (24) inches minimum from any parallel utility line or as determined by the

City. Gas mains and services shall have a minimum one (1) foot vertical clear space from any crossing utility lines or other underground facilities.

2. Gas services shall come perpendicular from the gas main in the shortest straight line to the gas meter.

3. Above ground gas meters shall be installed on private property adjacent to the building. Curb meters' installation shall only be allowed with the approval of the Engineer. The meter location and installation shall be as specified in the project documents.

   No meter or regulator shall be installed inside of a building, garage, carport, crawlspace, or in any other enclosed area with walls on more than two sides or under a roof structure. The Owner is responsible for installing meter by-pass, concrete meter pad, concrete walkway for meter access, and bollards when required by the City.

B. DEPTH OF PIPE

Minimum depths are to be provided to the finished street surfaces, unless otherwise specified on the Drawings, are as follows:

1. Gas mains shall be installed with a minimum cover of thirty (30) inches, as measured vertically from the top of pipe to the top of pavement.

2. The depth of new gas services shall be a minimum of twenty-four (24) inches unless the gas service serves more than one gas meter; then the minimum depth shall be thirty (30) inches.

3. Unless otherwise specified a minimum of 12 inches shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. In the event that it is not possible to maintain 12 inches clearance from other structures, the Contractor shall case the gas main in steel pipe or concrete at the discretion of the City's representative.

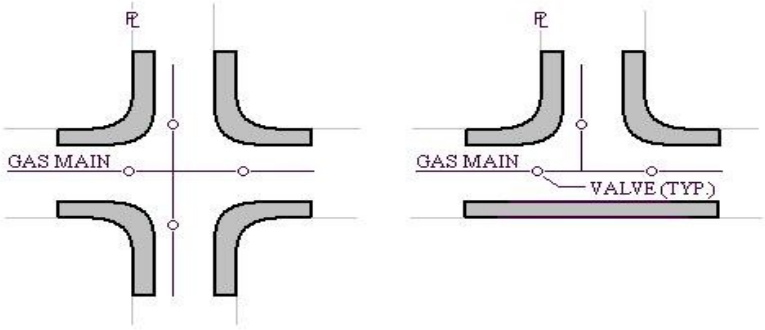
C. MINIMUM SIZE OF NEW MAINS AND SERVICES

1. The minimum new gas main size is 2" (I.D.= 1.917"), SDR 11.0.

2. The minimum service size for new construction is 1" (I.D.= 0.919"), SDR 11.5.

D. VALVES

Four valves shall be installed at each intersection and three valves shall be installed at each tee (at the property line extensions as shown on Figure 3) or as shown on the construction drawings or directed/approved by the Engineer.



Install four valves at each gas main intersection

Install three valves at each gas main tee

Figure 3

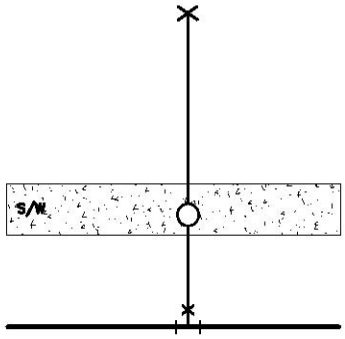


Figure 4

Valves will be required on all gas services 2" and larger (as shown on Figure 4). Placement of valve shall be in the sidewalk or in unimproved areas at locations approved by the Engineer.

E. LOAD

The maximum connected load shall be used for design purposes, e.g., the total shown on the submitted load sheet plus any anticipated future load when available. Coincidence or diversity factors shall not be used when designing gas services.

F. CALCULATING SERVICE SIZE

The sizing of gas services shall be based on the High Pressure Mueller Equation (applicable for 1 psi and greater) where the length of the service is doubled to account for fittings and a factor of safety.

Note: the absolute pressure (psia) must be used when performing calculations with the Modified High Pressure Mueller Equation. The standard barometric pressure correction is 14.7 psia.

G. AVAILABLE PRESSURE

1. The standard C.P.A. delivery pressure is 7" w.c. (Water Column), equivalent to 0.217 psig. Non-standard delivery pressures above 7" w.c. will be limited to 1, 2, 3 and 5 psig. Approval from the Engineering Manager is required for any delivery pressures greater than 7" w.c.

2. When designing gas services the C.P.A. design pressure at the main is 3.5 psig.

3. Pressure losses across the meter and regulator shall be found from the manufacturer's specifications, for residential services use 0.5 psig pressure loss across the meter and regulator.

PART 4 --NATURAL GAS HOUSE PLUMBING

Part 4 is only for City gas main replacement projects (CIP work) where the gas meter needs to be relocated as part of the CIP. Any other gas house plumbing (any piping downstream of the gas meter) is solely the responsibility of the property owner.

4.01 DESCRIPTION

The work to be performed shall consist of furnishing all tools, equipment, materials, supplies, manufactured articles, transportation and services (including fuel, power, and essential communication), labor, and other operations necessary for the modification of existing natural gas house plumbing to accommodate relocation of gas meters including: obtaining required permits, installation of new house gas pipes, new shut off valves and flexes, subsequent pressure testing of the entire house gas plumbing system, and passing required inspections - for houses located in Palo Alto for the City of Palo Alto. The work shall be complete and performed in strict accordance with the Contract Specifications, and in compliance with all applicable codes and standards. All work, materials, and services not expressly shown or called for in the Contract Documents, which may be necessary for the complete and proper construction of the Work in good faith, shall be performed, furnished, and installed by the Contractor as though originally so specified or shown, at no increase in cost to the City.

4.02 QUALIFICATIONS OF WORKMEN

Journeyman Plumbers shall be licensed plumbers completely familiar with the design and application of work described.

4.03 MANUFACTURER'S RECOMMENDATIONS.

All equipment, materials, devices, etc., shall be installed in a manner meeting the manufacturer's recommendations for the particular item. Prior to the start of work, the Contractor shall obtain and deliver copies to the Engineer of all installation manuals, brochures, and procedures that the manufacturer issues for the items supplied. The Contractor shall be held responsible for all installations contrary to the manufacturer's recommendations, unless otherwise approved by the Engineer. If any item or piece of equipment or material is found to be installed not in accordance with the manufacturer's recommendations, or as otherwise directed by the Engineer, the Contractor shall make all necessary changes and revisions to achieve such compliance at the Contractor's expense.

4.04 EXISTING GAS PLUMBING

The modification of the existing gas plumbing shall be performed by the contractor only after receiving written approval from the Engineer. With the Engineer's authorization the Contractor shall perform all repairs and modifications required for code compliance of existing customer owned natural gas plumbing.

The Contractor shall remove and dispose of all abandoned gas plumbing materials.

The Contractor shall not modify the existing gas plumbing until the WGW inspector verifies the new stubout location.

4.05 TESTING OF CUSTOMER OWNED GAS PIPING

Contractor shall pay for all testing and retesting required to show compliance with the Contract Specifications, Codes, Regulations, and all other applicable laws.

A. SYSTEM PRESSURE TEST

The Contractor will conduct air pressure test in accordance with the latest adopted version of the UPC and as required by the City Building Inspector. The pressure shall not decrease during the test.

Other inspections and tests required by the City Building Inspector, codes, ordinances, or other legally constituted authority shall be the responsibility of and shall be paid for by the Contractor.

Testing of the existing gas house plumbing shall be performed prior to connecting the new supply line.

B. TESTING:

Testing will be in accordance with the City of Palo Alto’s Building Department requirements.

C. CONTRACTOR'S CONVENIENCE TESTING:

Inspection and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor and all related costs borne by the Contractor.

D. SCHEDULE FOR TESTING:

1. Testing shall be scheduled with the Building Department in advance.

2. At least 48 hours notice shall be provided to the Engineer, when testing is required.

3. Testing involving City personnel shall not be scheduled on Fridays.

4.06 COOPERATION WITH THE BUILDING DEPARTMENT:

Building Inspectors shall have access to the Work at all times and all locations where the Work is in progress. Contractor shall provide such access to enable the Building Department to perform its functions properly.

A. Revising schedule: When changes of construction schedule are necessary during construction, Contractor shall coordinate all such changes with the Building Department as required.

B. Adherence to Schedule: When the Building Department is ready to inspect, but is prevented due to incompleteness of the Work, all extra charges for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the City.

4.07 COORDINATION WITH CUSTOMERS

The Contractor is responsible for coordinating access to private property with the homeowners**.**

The Contractor shall notify the property owner/ resident at least 14 days in advance of performing work. Prior to starting work at a specific location the Contractor shall schedule the work with the homeowner or resident, as the customer's presence during the work is required.

The Contractor shall relight all pilot lights the same day (before 5:00 P.M.) after the City installs the new gas meter and regulator.

No residence shall be shall be left out of service overnight. Each residence shall be reconnected and all pilot lights re-lit before 5:00 P.M. each day.

4.08 RESTORATION

The contractor shall restore all existing improvements and landscaping at each location to the pre-construction condition as soon as practical after completing the work at each house location, but in no case later than 24 hours after Work is complete. The Contractor shall include restoration in the appropriate bid items; no separate payment will be made for restoration.

END OF SECTION

WASTEWATER DESIGN STANDARDS

1.01 DESIGN WASTEWATER FLOW

General:

A capacity study report shall be submitted by the Project Engineer when plans are submitted for preliminary review. The report shall provide the following information for the study area:

A. Pipe information for each new sewer reach, including:

Pipe diameter
Slope
Invert elevations
Length
Roughness coefficient for Manning's equation
Design capacity
Full pipe capacity
Design flow
Percentage of full pipe capacity utilized[1]
Pump station operation parameters (if applicable)

B. Land use information for conditions prior to commencement of project, immediately after completion of project, and at build-out, including:

Number of residential units
Square footage for Commercial/Industrial users
Square footage for "High Tech" Industries[2]
Sewered acreage

C. Map showing:

Location of new sewer reaches and pump stations
Proposed connection point(s) to existing City sewers
Location of residential/commercial/industrial users

[1] Calculated by dividing the design flow by the full pipe capacity and multiplying by 100.

[2] "High tech" industries are defined as those with unusually high water requirements

Design:

Sewers shall be designed for a design flow 20 years from the current year. The design flow is composed of up to three components: peak base wastewater flow (PBWF), groundwater infiltration (GWI), and rainfall-dependent infiltration/inflow (RDI/I). The design flow shall be based on the greater of the following two formulas:

DF = (PBWF X .75) + GWI + RDI/I

or

DF = PBWF + GWI

Whichever is greater

Exception: If the wastewater flow is pumped, design flows downstream of the pump station shall be based on the maximum capacity of the pump(s).

1.01.01 Peak Base Wastewater Flow (PBWF)

Average base wastewater flow (ABWF) is the average daily dry weather flow contributed from residential, commercial, industrial, and "high tech" users. ABWF is calculated by applying the unit flow rates shown in Table 1-1 and then multiplying those rates by the number of units for the appropriate category. If supporting data indicates the need, a higher unit flow rate should be applied for commercial/ industrial users. The ABWF values must be multiplied by a peaking factor to account for the variations that occur hour-to-hour and day-to-day.

A peaking factor is determined by the equation:

$$Peaking\ Factor = 3.15 \times ABWF^{-0.104}$$

where ABWF is in million gallons per day (mgd). The peaking factor has a maximum of 4.0 and a minimum of 1.0.

$$PBWF = ABWF \times Peaking\ Factor$$

1.01.02 Groundwater Infiltration (GWI)

Groundwater infiltration is groundwater that enters the collection system from defects in the pipes, pipe joints, and sewer structures. The amount of GWI entering the collection system depends on the structural condition of the system, the depth of the pipes, and the elevation of the groundwater table relative to the elevation of the sewer pipes. GWI tends to decrease during the dry summer and fall months and gradually increases as the wet-weather season progresses.GWI is calculated by applying the GWI unit flow rate that corresponds to the project's basin to the sewered area. GWI unit flow rates are shown in Table 1-1.

1.01.03 Rainfall-Dependent I/I (RDI/I)

Rainfall-Dependent I/I is storm water that enters the collection system in direct response to the intensity and duration of individual rainfall events. In addition to being dependent on rainfall events, RDI/I is sensitive to soil moisture, increasing throughout the wet weather season as the soil moisture increases. A 20-year storm event shall be used to determine estimated RDI/I for new sewers.

RDI/I is calculated by applying the RDI/I unit flow rate that corresponds to the project's basin to the sewered area. RDI/I unit flow rates are shown in Table 1-1.

Table 1-1 Unit Flow Rates for ABWF, GWI, and RDI/I*

A. Average Base Wastewater Flow (ABWF)

Land Use Category	Land Use Designation	Unit (gpd/unit)	Unit Flow Rate (gpd)
Residential			
Single Family	SF	Dwelling Unit	220
Multi-Family	MF	Dwelling Unit	160
Transit-Oriented	CC	Dwelling Unit	160
Commercial	CS, CN, CH	Building Sq. Ft.	0.15
Research/Office Park	RO	Building Sq. Ft.	0.10
Light Industrial	LI	Building Sq. Ft.	0.10
Major Institutional	MISP	Building Sq. Ft.	0.15
School	S	Student	15

B. Groundwater Infiltration (GWI) = 500 gpd/acre

C. Rainfall-Dependent I/I (RDI/I) = 1,900 gpd/acre

* All rates are based on the 2004 Wastewater Collection system Master Plan.

1.02 PIPE CAPACITY

The theoretical capacity of new pipes shall be calculated using Manning's equation. The "n" value (Manning's roughness coefficient) shall be equal to 0.014 for pipes less than 48 inches in diameter and 0.013 for pipes greater than or equal to 48 inches in diameter.

Manning's Equation

$$Q\ (cfs) = 1.49 / n * A * R_h^{2/3} * S^{½}$$

Q = Flow (cfs)
n = Manning's roughness coefficient
A = Area in flow (ft2)
R_h = Hydraulic Radius (ft)
S = Slope (ft/ft)

1.03 PIPE SIZE, SLOPE, DEPTH, AND ALIGNMENT

1.03.01 Size

Pipes less than or equal to 10 inches in diameter shall be sized to handle peak flows at 75% of full pipe capacity. Pipes greater than 10 inches in diameter shall be sized to handle peak flows at 90% of full pipe capacity.

No gravity sewer mains shall be less than 8 inches in diameter and no sewer laterals less than 4 inches in diameter.

As a rule, when a smaller sewer joins a large one, the top of both pipes (crowns) should be at the same elevation.

1.03.02 Slope

All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following are the minimum slopes that should be provided:

Sewer Size	Minimum Slope (Feet Per 100 Feet)
8 inch	0.34
10 inch	0.25
12 inch	0.19
15 inch	0.14
18 inch	0.11
21 inch	0.09
24 inch	0.08
27 inch	0.07
30 inch	0.06
36 inch	0.04

Where velocities greater than fifteen (15) feet per second are attained, special provision shall be made to protect against displacement by erosion, shock, and hydraulic jumps at changes in velocity. Sewers on 20 percent slopes or greater shall be anchored securely with concrete anchors, spaced as follows:

a. Not over 36 feet on center for grades of 20 to 35 percent;

b. Not over 24 feet on center for grades of 35 to 50 percent;

c. Not over 16 feet on center for grades of 50 percent and over.

1.03.03 Depth

In general, sewers should be below pressure utilities and be sufficiently deep to receive sewage from basements.

Crown (top inside surface of the pipe) of any inlet pipe shall not be lower than the elevation of the outlet main crown in the manhole, unless otherwise approved by the Engineer.

1.03.04 Alignment

The horizontal and vertical alignment of sewers shall be maintained by the use of laser survey equipment. Unless otherwise approved by the Project Engineer, all sewers shall be constructed straight and at uniform grade between manholes.

1.04 MANHOLES

Manholes shall be installed: at the end of each lines; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet. Greater spacing may be permitted in large sewers greater than 30 inches in diameter.

1.04.01 Drop Manholes

A drop pipe should be provided for a sewer entering a manhole at an elevation of 30 inches or more above the top of the manhole outlet pipe. Where the difference in elevation between the incoming sewer and the top of the outlet pipe is less than 30 inches, the invert should be channeled to prevent solids deposition.

Drop manholes should be constructed with an outside drop connection. Inside drop connections, allowed only in special cases approved by the Engineer, shall be secured to the interior wall of the manholes and provide access for cleaning.

Due to the unequal earth pressures that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete.

The minimum diameter of manholes shall be 48 inches. A minimum access diameter of 24 inches shall be provided.

The flow channel through a manhole should be made to conform in shape and slope to that of the sewers.

Manholes shall be of the pre-cast concrete type with a poured-in-place base.

Non-HDPE pipes entering a manhole shall be provided with a flexible joint within 12 inches of the edge of the concrete base.

1.05 SEWERS CROSSING STREAMS

Sanitary sewer construction by streams shall have a Santa Clara Valley Water District permit prior to starting work. Sewers crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line and shall be installed in a steel casing. If open cut excavation method is used, casing shall be encased in concrete. In general the following cover requirements must be met:

a. One foot of cover is required where the sewer is located in rock;

b. Three feet of cover is required in other material. In major streams, more than three feet of cover may be required, and

c. In paved stream channels, the top of the sewer line should be placed a minimum of one foot below the bottom of the channel pavement.

Less cover will be approved only if the proposed sewer crossing will not interfere with the future improvements to the stream channel. Reasons for requesting less cover should be given in the Bid.

Sewers located along streams shall be located outside of the stream bed sufficiently far away to provide for future possible stream widening and to prevent pollution by siltation during construction.

1.05.01 Alignment

Sewers crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.

1.05.02 Materials

Sewers entering or crossing streams shall be constructed of Class 52 Ductile Iron Pipe with

concrete encasement. Sewers shall be constructed so they will remain watertight and free from changes in alignment or grade. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials which will not cause siltation.

1.05.03 Siltation and Erosion

Construction methods that will minimize siltation and erosion shall be employed. The design engineer shall include in the Project Specifications the methods(s) to be employed in the construction of sewers in or near streams to provide adequate control of siltation and erosion. Project Specifications shall require that cleanup, grading, seeding, and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven days.

1.06 AERIAL CROSSINGS

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement.

Expansion jointing shall be provided between above-ground and below-ground sewers.

For aerial stream crossings the impact of flood waters and debris shall be considered.

1.07 PROTECTION OF WATER SUPPLIES

1.07.01 Water Supply Interconnections

There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.

1.07.02 Relations to Water Works Structures

In general, sewers shall meet the requirements of the California Department of Public Health Services "Criteria for the Separation of Water Mains and Sanitary Sewers" - Basic Separation Standards.

a. Parallel Construction: The horizontal distance between pressure water mains and sewer lines shall be at least 10 feet.

b. Perpendicular Construction (Crossing): Pressure water mains shall be at least one foot above sanitary sewer lines where these lines must cross.

These separation distances shall be measured from the nearest edges of the facilities.

Exceptions to the basic separation standards shall comply with the "Criteria for the Separation of Water Mains and Sanitary Sewers" and will be reviewed by the City on a case by case basis. (See Utility Standard Detail #WGW-08)

Water mains and sewer lines must not be installed in the same trench.

*** **END OF SECTION** ***

SANITARY SEWER LATERAL

1.01 SCOPE

This section covers installation of sewer laterals. Laterals shall be as specified herein and installed at the locations shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

A. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.

B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with the standards specified herein. The date the pipe was manufactured shall be included in the Certification.

1.03 MATERIALS

Sanitary sewer lateral materials shall meet the requirements of this section and in the following sections:

Section 2735	Polyethylene Sewer Pipe
Section 2300	Polyethylene Pipe Installation for Water, Gas and Wastewater

Generally, the sewer lateral materials are as follows:

HDPE Pipe	HDPE, SDR 17, 345434C, D, or E as described in ASTM D3350. The HDPE pipe shall have a white or light gray interior
Couplings	Rubber, neoprene, or elastomeric PVC non-shear, rigid, shielded couplings with stainless steel screws, nuts, and housings. Fernco Inc. "PROFLEX", Mission Rubber Products “Flex Seal”, or approved equal. Note: All connections shall be made with butt fusion, electrofusion or socket fusion. Couplings will only be allowed with prior approval of Senior Project Engineer for special circumstances.
T Cone Plugs	Expandable pipe plug with no metal parts. D.O. Smith 14070 or equal.
Cleanout Box	Christy V1 drain box with F8C cast iron lid, or approved equal.
Locator Ball	Sewer marker ball shall be a green extended range ball good for up to 5 feet of cover. The passive electronic marker provides a unique electronic signature (121.6 kHz for sanitary sewer), when it is activated by a marker locator. Locator ball shall be 3M EMS 4” 1404-XR, Utility Insight Inc. “Omni Markers” or approved equal.
Elastomeric Sealant	High performance, one part, polyurethane sealant. Vulkem 921 or approved equal.

Any pipe, fittings, or appurtenances that do not conform to the above specifications shall be rejected and shall be removed immediately from the work site by the Contractor.

1.04 JOINING AND INSTALLATION

A. The Contractor is responsible for verifying an existing lateral's horizontal and vertical alignment.

B. Laterals shall be installed perpendicular to the main, unless otherwise approved by the Engineer. When a lateral's horizontal alignment is not perpendicular to the main of the customer served, the Contractor shall realign the lateral.

C. If the existing lateral meets the minimum horizontal and vertical alignment standards, the Contractor shall have the option of pipebursting the lateral. Pipebursting requirements are specified in Section 2735 Polyethylene Sewer Pipe. The Contractor shall pothole to confirm that the process will not affect nearby utilities.

D. Laterals on concrete or existing VCP mainline pipes shall be HDPE.

E. Pipe lateral material shall be the same from the connection to the City owned cleanout to the main.

F. Pipe and fittings shall be handled, joined, and installed in accordance with the printed instructions and recommendations of the pipe manufacturer. Unless otherwise specified, lay all pipe straight between changes in alignment and at uniform grade between changes in grade. Pipe bedding shall provide uniform and continuous support of the pipe barrel.

G. Locator ball shall be placed at the lateral cleanout as shown on the Drawings. The depth of cover shall be 2 feet minimum and not exceed 5 feet. The locator ball shall be affixed to the top of the lateral or lateral riser with duct tape.

1.05 LATERAL CONNECTIONS

1.05.01 Lateral Connections to Mains

Lateral Connections to sanitary sewer mains shall comply with the latest Utility Standards for Water Gas and Wastewater.

Exceptions:

a. "Tap-tite" (a patented sewer fitting), or approved equal, is acceptable upon Engineer's approval.

b. Special fittings for connection to sewer liners will be reviewed on a case by case basis.

1.05.02 Lateral Connections to Manholes

Manholes shall be core drilled to accept new laterals. Hammering of a hole(s) is unacceptable.

Lateral crowns (top inside surface of the pipe) shall not be lower than the elevation of the outlet main crown in the manhole, unless otherwise approved by the Engineer.

An appropriate manhole water stop gasket shall be used on all plastic pipe entering manholes.

Channel bottoms shall be worked to provide a smooth flowing transition from the new laterals to

the outlet channel. See Section 2738 for drop piping requirement.

Pipe penetrations shall be sealed with a non-shrink grout.

1.05.03 Cleanouts

A sanitary sewer cleanout shall be provided in the planting strip, back of curb or in the case where the sidewalk and curb are integral, back of sidewalk.

A T Cone Plug shall be used to plug the cleanout. T-Cone Plugs shall not be over tightened. Plugs shall be tightened just enough to hold the plug in place and prevent inflow into the pipe.

1.05.04 Inspection

All lateral connections shall be inspected and approved by the Utilities Inspector. Call one week in advance of the work to arrange for inspection services.

1.06 REMODEL AND NEW FACILITIES

The following requirements apply to any new construction, addition, remodel, expansion, or repair to a structure in Palo Alto that requires a Building Permit with a Plumbing sub-permit:

The Customer will be responsible for replacing non-plastic wastewater laterals when building a new structure or constructing additions/remodels that have a value greater than $100,000. Reconnection to the City wastewater lateral will only be allowed on plastic pipe laterals (ABS, PVC or HDPE). All other material pipe services must be replaced, per the WGW Utility Standards, from the main up to and including the cleanout at the property line at the fees listed in the rate schedule.

The customer will be responsible for installing a clean check sewer backwater preventer valve at each location that the sewer line exits the building within two feet of the building see detail WWD-01.

1.07 SEWER LATERAL ABANDONMENT PROCEDURE

A. Excavate the existing lateral at the main.

   1. If the wye is in good condition (at the discretion of the CPA Utilities Inspector) or if the main has been U-Linered, plug the wye or tee with a mechanical plug or stopper. If the U-Linered tap or saddle is in bad condition (at the discretion of the CPA Utilities Inspector), replace the tap or saddle and plug with a mechanical plug or stopper.
   2. If the wye is in bad condition (at the discretion of the CPA Utilities Inspector) or if it is a tapped or saddled connection, remove and replace that section of main in kind.

B. Remove cleanout and fill lateral with clean sand, cement slurry, or other flowable compacting fill. Plug the open lateral ends with 12” of concrete.

C. Backfill and compact hole at the main per Utilities Standard Details. Restore surface paving or landscape as necessary per Utilities Standard Details.

D. Abandonment of all existing sewer laterals shall be witnessed by CPA Utilities Inspector. Call (650) 566-4501 three days in advance of the work to schedule for inspection.

1.08 TESTING

A. The pipe shall be tested with low pressure air in accordance with ASTM F1216. Wyes shall be plugged during test. Tests shall be made in the presence of the Contractor and the Engineer.

B. If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s) or relay the pipe, as necessary. The pipe shall then be retested until a satisfactory result is obtained.

C. Despite any previous testing or CCTV inspection, any pipe defects developed before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

***** END OF SECTION *****

POLYETHYLENE SEWER PIPE

1.01 GENERAL

1.01.01 Scope

This section covers the installation of new high density polyethylene sewer pipe (HDPE) by directional boring, trenching, sliplining an existing sewer or by pipe bursting. Pipe shall be as specified herein and shall be installed at the locations, and using the methods, indicated on the Drawings.

1.01.02 General Bid Requirements (for CIP Projects containing Pipe Bursting)

1.01.02.01 Qualifications of Bidders

All pipe-bursting work shall be performed by an experienced contractor or subcontractor who meets the following qualification:

1. The contractor or subcontractor shall have completed at least three projects in the last 5 years, involving pipe-bursting installation of a combined total of 20,000 feet or more of 8 to 22 inches (O.D. of new pipe) pipes in diameter.

2. The contractor or subcontractor shall have completed projects involving pipe-bursting installation of a combined total of 5,000 feet or more of 24 inches (O.D. of new pipe) or larger pipes in diameter. (Note: This requirement is only applicable for project scope involving 24" or larger pipes.)

3. The project on-site superintendent and/or on-site foreman shall each have at least 10,000 feet and three years experience involving pipe-bursting installation on 8 inches (O.D. of new pipe) or larger pipes. The on-site superintendent and/or on-site foreman shall not be removed or replaced from the project without written permission from the City. The replacement person shall also meet the required qualification.

The following data shall be submitted, using the City-provided form #2735-1 (use multiple sheets if necessary), with the bid:

Contractor/Subcontractor Pipe-Bursting Experience

- Name of Contractor and/or Subcontractor.
- Name of project and year of construction.
- Project location and project dollar amount.
- Owner, owner contact, and phone number.
- Total footage and size of pipe-bursting experience as described above for 8 to 22 inches (O.D. of new pipe) pipes.
- Total footage and size of pipe-bursting experience as described above for 24 inches (O.D. of new pipe) or larger pipes. (Note: This requirement is only applicable for project scope involving 24" or larger pipes.)

The following data shall be submitted, using the City-provided form #2735-2 (use multiple sheets if necessary), with the bid:

On-site Superintendent and/or Foreman Pipe-Bursting Experience

- Full name

- Years of pipe-bursting experience
- Name, location, year, owner, owner contact information of the referenced project(s)
- Total footage of pipe-bursting experience on 8 inches or larger pipes

1.01.02.02 Patents
The Contractor shall assume all costs arising from the use of any patented materials, equipment, devices, or processes used on or incorporated in the work, and agrees to indemnify and save harmless the City of Palo Alto and its employees, and their duly authorized representatives, from all suits at law, or actions of every nature for, or on account of the use of any patented materials, equipment, devices, or processes.

The City's purchasing manager in conjunction with the City's project manager shall determine whether the Contractor that is otherwise the lowest responsive bidder, meets the experience and qualification criteria and shall notify the Contractor in writing of a determination that it does not meet the criteria. The Contractor may dispute this determination by delivering written notice to the city's purchasing manager within 5 business days of receipt of the City's notice of disqualification. The determination shall be final if the Contractor does not submit a notice requesting a hearing within this time period. The notice shall request a hearing and set forth the grounds on which the Contractor disputes the City's determination. Upon receipt of the Contractor's notice an informal hearing shall be scheduled with the City Manager or designee at which the Contractor will be given the opportunity to present information and the reasons for disputing the determination that it does not meet the qualification and experience criteria . The decision of the City Manager or designee shall be final.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

A. Manufacturers literature on the materials and equipment identified below.

B. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM D3350 and ASTM F714-85. Certification shall be signed by an authorized agent of the manufacturer. A report of test results shall be furnished if requested by the Engineer. The date the pipe was manufactured shall be included in the Certification.

C. Fusion Certifications by City of Palo Alto – provide names and copies of cards issued to all operators.

D. Access pit locations.

1.03 MATERIALS AND EQUIPMENT

Sanitary sewer materials shall meet the requirements of this section and in the following section:

Section 2734	Sanitary Sewer Lateral
Section 2300	Polyethylene Pipe Installation for Water, Gas and Wastewater

1.03.01 Materials

Service Saddles	Electrofusion saddle Per Utility Standard Details.

1.03.01.01 Pipe Bursting Materials

Pipe and Fittings	SDR-17 Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE345464C, D, or E (inner wall shall be white or light in color) per ASTM D3350 in IPS sizes. Performance Pipe "DriscoPlex 4100" or approved equal.

The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material pipe.

Pipe and Fittings shall be homogeneous throughout and free of:

(1) Serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth.

(2) Cracks

(3) Kinking (generally due to excessive or abrupt bending)

(4) Flattening

(5) Holes

(6) Blisters

(7) Other injurious defects

Pipe and fittings shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected.

1.03.01.02 Pipe Markings

Pipe shall be marked at 3-foot intervals or less with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, including the year of issue, the letters "PE" followed by the cell classification number of the raw material compound used, the nominal pipe size in inches, the dimensional ratio, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture. Pipe shall be color identified by stripes, a color shell, or solid color. The pipes shall be properly stored and handled in accordance with the manufacturer's recommendations and shall be less than two (2) years old at the time of installation.

Fittings shall be marked with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, and the manufacturer's code identifying the resin manufacturer, lot number, lot number, and date of manufacture.

The average outside diameter and wall thickness of pipe and fittings shall conform to Table 1 when measured in accordance with ASTM D2122.

TABLE 1		
Nominal Size (inches)	**Nominal OD (inches)**	**Minimum Wall Thickness SDR17 (inches)**
3	3.5	0.206
4	4.5	0.265
5	5.563 5.375	0.327 0.316
6	6.625	0.390
7	7.125	0.419
8	8.625	0.507
10	10.75	0.632
12	12.75	0.750
13	13.375 13.386	0.787
14	14.00	0.824
16	16.00	0.941
18	18.00	1.059
20	20.00	1.176
22	22.00 21.50	1.294
24	24.00	1.412
27	27.00	-----
28	28.00	1.647
30	30.00	1.765
32	32.00	1.882
34	34.00	2.000
36	36.00	2.118
42	42.00	-----

1.03.02 Electrofusion Couplings

Electrofusion couplings shall be manufactured by Central, Frialen by Friatec, or approved equal.

1.03.03 Equipment

Butt Fusion Machine	McElroy Manufacturing, Inc. or approved equal.
Electrofusion Machine	Central, Friatec, or approved equal.
External and Internal Bead Removers	McElroy Manufacturing, Inc. or approved equal.
Pulling or Pushing Head	Driscopipe, Plexco or approved equal.

1.04 JOINING AND INSTALLATION

1.04.01 Pipe Bursting

1.04.01.01 Access Pits.

Access pit locations shall be chosen and recommended by the Contractor with the intent of minimizing excavation and traffic disruption. Recommended locations shall be at service connections, manhole construction, or at points where spot repairs need to be performed. The Contractor shall submit the number, location, and size of pits to Engineer for review prior to start of the work.

The access pits shall be excavated to allow adequate width for access of workers, sheeting and shoring installation, and to provide clearance necessary to avoid damage to the liner during insertion. Care shall be taken to protect existing utilities.

The minimum length of each access pit as measured at the bottom of trench shall be determined by the formula, Length = (12 x Outside Diameter of the liner in feet) + (2.5 x Depth of the trench in feet).

1.04.01.02 Joining

Pipes shall be joined to one another and to plastic fittings by thermal butt-fusion or saddle fusion in accordance with ASTM D2657 or by automatic electrofusion. Operators of fusion equipment must pass qualification testing by the City of Palo Alto Gas Division of the Utilities Department prior to performing any fusion work. Time and temperature of fusion shall be per the manufacturer's recommendation. Weld on flanges may be used to join pipes in access pits if prior approved by the Engineer. Joints shall be stronger than the pipe itself, be properly aligned, and contain no gaps or voids. Bead projections on the outside and inside of the pipe shall be removed. No rubber couplings are allowed on mainlines, unless approved by the Engineer.

1.04.01.03 Insertion of the new pipe

The pipe shall be supported on rollers throughout its entire length during insertion. Dragging of the pipe along the ground during insertion will not be permitted.

1.04.01.04 Pipe Bursting

All sharp edges shall be removed from the exposed pipe opening. The Contractor shall also expose the main at every lateral connection to a depth equal to 1 x the outside diameter of the main under the invert of the existing main to allow free movement of the bursting head.

The maximum pulling length shall be limited to one reach (from manhole to manhole) at a time.

The pipe bursting tool shall make a tunnel along the path formerly occupied by the old sewer and shall install the new pipe by either pulling, pushing, or a combination of both. The pipe-bursting tool shall be of the type and size recommended by the tool manufacturer for the size of pipe being burst and for the ambient ground conditions. For pipe diameters greater than 16” use lubricating fluids, bentonite or polymer slurry, injected behind the bursting head to minimize pipe friction.

When the tool is pulled along the existing pipe, the pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall then install the new pipe by pulling it into place.

The new sewer pipe shall be installed in a straight horizontal and vertical line with the invert of the new sewer pipe matching the invert of the existing sewer at the exit of the upstream manhole and the entrance into the downstream manhole regardless of the size and alignment of the existing pipe.

The Contractor shall allow the new HDPE pipe to return to its original length and shape in the unstressed state and then trim the excess pipe in the manholes. The liner pipe manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation after pulling operations are completed. Time allowed for stress and strain relief shall not be less than 24 hours.

Three working days prior to pipe bursting mains or laterals, the Contractor shall pothole, at a minimum, all utility mains crossing the pipe bursting alignment where the invert of the pipe being burst is 6 feet deep or less. Pothole crossing ACP water mains and primary electric lines where the pipe invert is 8-1/2 feet deep or less.

Potholed utility mains shall be fully exposed during pipe bursting to create a 6 inch (minimum) void space all around crossing main. Void space shall extend 1 foot on each side of pipe bursting (2 feet on either side for ACP water mains). The contractor is responsible for all costs resulting from damage to utilities during pipe bursting operations.

The upsizing method shall not cause excessive disruption to the above ground terrain or improvements except for at the launching and receiving pits.

1.04.01.05 Service Connections

After the pipe has been pulled into place, the Contractor shall reconnect all active service connections to the new liner.

Liners that are pulled into place shall be sufficiently relaxed prior to installation of the service saddles. The relaxation period shall be determined by the Engineer, but in no case shall the period be less than one hour.

All services shall be reconnected within 24 hours after the liner has been pulled in place.

Electrofusion saddles shall be installed per Utility Standard Details for service connections.

1.05 TESTING

1.05.01 Air pressure setup shall be in accordance with ASTM F1417, Constant Pressure Method. The pipe shall be tested with low pressure air at 10 psi for 10 minutes with **NO** pressure loss. Wyes shall be plugged during test. Tests shall be made in the presence of the Contractor and the Engineer.

1.05.02 If the pipe fails the air test, the Contractor shall locate the source(s) of the leak and repair the defect(s). The pipe shall then be retested.

1.05.03 TV Inspection: After passing the air test, lateral shall be CCTV per Section 2739, Cleaning and Video Inspection of Sewer Pipe.

1.05.04 Any pipe defects identified before the end of the 1-year guarantee period shall be expeditiously repaired by the Contractor at no expense to the City.

1.06 SIGNS

A sign which reads, "CAUTION-PE PIPE-DO NOT ROD", shall be placed inside the manhole(s) where the polyethylene main is installed. These signs shall be installed at 12 inches below the grade ring on the manhole walls. Signs shall be made of polyethylene, cellulose acetate butyrate, or an approved equal and anchored to the manhole walls with stainless steel anchor bolts.

1.07 CLEANING AND VIDEO INSPECTION

1.07.01 Initial Cleaning and Video Inspection

The existing sewer shall be cleaned and video inspected in accordance with Project Specifications. The Contractor shall verify location of active lateral connections at this time.

1.07.02 Final Cleaning and Video Inspection

After installation, pipe and structures shall be cleaned and video inspected in accordance with Project Specifications and the current Standards for Water Gas and Wastewater. For sliplining construction, the final proofing shall be performed no later than 30 minutes after the liner pipe has been final cleaned and video inspected. The Contractor shall repair all defects at no additional cost to the City.

***** END OF SECTION *****

CURED-IN-PLACE PIPE (CIPP)

1.01 GENERAL

1.01.01 Scope

This section covers the installation of cured-in-place pipe (CIPP) rehabilitation of existing sewer pipe. The cured pipe shall be as specified herein and installed at only the locations approved by the engineer and shown on the Drawings.

1.01.02 General Bid Requirements

A. The curing and installation methods of the liner shall be described and included with the Bid. The Contractor shall demonstrate that the method is applicable and that his/her experience in using the method is proven.

B. The Contractor, or his/her CIPP Sub-contractor, shall be properly licensed and trained to a cured-in-place pipelining process having of a combined total of 20,000 lineal feet of successful installation in the United States within the last 2 years, in pipelines ranging from 8 to 48 inches. Documentation of the licensing and details of two years minimum training of the on-site superintendent and foreman of the Contractor, or his/her CIPP Sub-contractor, performing the actual installation, shall be submitted, using the City-provided forms #2736-1 and 2736-2 (use multiple sheets if necessary), with the Bid.

The City's purchasing manager in conjunction with the City's project manager shall determine whether the Contractor that is otherwise the lowest responsive bidder, meets the experience and qualification criteria and shall notify the Contractor in writing of a determination that it does not meet the criteria. The Contractor may dispute this determination by delivering written notice to the city's purchasing manager within 5 business days of receipt of the City's notice of disqualification. The determination shall be final if the Contractor does not submit a notice requesting a hearing within this time period. The notice shall request a hearing and set forth the grounds on which the Contractor disputes the City's determination. Upon receipt of the Contractor's notice an informal hearing shall be scheduled with the City Manager or designee at which the Contractor will be given the opportunity to present information and the reasons for disputing the determination that it does not meet the qualification and experience criteria . The decision of the City Manager or designee shall be final.

1.01.03 Process Description

Installation of the Cured-In-Place Pipe shall be accomplished by the use of an inversion process or a winched-in application. The reconstruction of the existing line shall be accomplished by installing a flexible tube which is first impregnated with a thermosetting resin. The tube is either inverted into the pipeline by using hydrostatic head (water pressure), compressed air pressure or some other approved inversion method, or pulled into the pipeline from manhole to manhole using mechanical equipment (winch). After full insertion, the tube is cured by circulating hot water or introducing controlled air or steam throughout the length of the tube to cure it into a hard, impermeable pipe. This "pipe" shall extend the full length of the original sewer, and shall provide a structurally sound, jointless, tight-fitting, watertight pipe within a pipe.

1.01.04 References

The following documents form a part of these specifications to the extent stated herein and shall be the latest edition thereof.

American Society for Testing and Materials (ASTM):

ASTM D 256	Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials
ASTM D 543	Resistance of Plastics to Chemical Reagents
ASTM D 638	Tensile Properties of Plastics
ASTM D 732	Standard Test Method for Shear Strength of Plastics by Punch Tool
ASTM D 790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 2990	Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM D 3567	Standard Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
ASTM D 5813	Cured-in-Place Thermosetting Resin Sewer Pipe
ASTM F 1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube (1991 Revision)
ASTM F 1743	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe
ASTM F 2019	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Glass reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)

National Association of Sewer Service Companies (NASSCO): Recommended Specifications for Sewer Collection System Rehabilitation.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following information:

A. Engineering calculations for the design of the liner thickness. The design calculations shall be checked and approved by a Registered Professional Civil Engineer in the State of California. Liner design calculations shall be supported by field analysis, technical assumptions, and section 1.03.03, Liner Design Criteria, of this specification. Final approval of the design calculations shall be given by the Engineer.

B. Certification from the installer that all lining materials and resins furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM F 1216,latest edition, "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube".

C. Manufacturer's recommendations for the installation of the CIPP including resin application, curing process details (including temperature control), storage procedures, service connection methods,

trimming and finishing, and quality control measures to be used for cured-in-place pipe lining of main-lines and services.

D. Certification from the manufacturer(s) that the installer is licensed to perform the work.

E. Certification from the manufacturer(s) that the resin material complies with the required application, meets the intended service condition, and that the resin will meet the physical requirements set forth in this specification. Information from the resin manufacturer shall include specifications, characteristics and properties of the resin, methods of application, curing temperatures, and duration of temperature (step cooking temperatures/hours at each and final stages).

F. Independent test laboratory results of field samples taken at locations specified by the Engineer. Prior to construction, the Contractor shall provide the contact information for the third party independent testing laboratory for approval.

G. The beginning and end of the pipe lining shall be cut flush at the inlet and outlet points in the manhole. The ends shall be sealed to the rehabilitated pipeline. The sealing material shall be compatible with the pipe liner and shall provide a watertight seal.

H. Air test service connection for water tightness after the main has been installed. Chemical grout non air tight service connections.

1.03 MATERIALS

All materials and procedures used in the cured-in-place pipe Rehabilitation process shall be equal to or exceed the manufacturer's standards.

1.03.01 Tube

The liner tube shall be fabricated to meet performance requirements as specified in section 1.03.04, Finished and Cured Liner Properties, of this specification.

Fiber Felt Tube System: The felt tube shall be a thermoplastic polyester or acrylic tube consisting of one or more layers of flexible needled felt or an equivalent woven and/or non-woven material capable of carrying resin, and with sufficient needling and crosslapping and strength to withstand the installation pressures and curing temperatures. The felt tube to be furnished shall be compatible with the resin and catalyst systems to be utilized.

The tube shall be free of tears, holes, cuts, foreign materials and other defects and will be subject to inspection by the City.

The finished lining shall consist of an inner plastic coating and an outer polyester felt layer (or layers) impregnated with a thermosetting resin and fabricated to fit tight against the existing pipe wall. An allowance shall be made for circumferential stretching during inversion.

Contractor shall determine the minimum tube length necessary to effectively span the designated run between manholes, unless otherwise specified. Contractor shall field verify the lengths in the field prior to impregnation of the tube with resin, to insure that the tube will have sufficient length to extend the entire length of run.

1.03.02 Resin/Catalyst

The resin used shall be compatible with the rehabilitation process used, and designed for a wastewater environment. The resin shall be able to cure in the presence or absence of water, and the initiation temperature for cure shall be as recommended by the resin manufacturer and approved by the Engineer. The resin shall have sufficient thixotropic properties to obtain non-draining characteristics when impregnated into the fiber fabric.

Unless otherwise specified or approved by the Engineer, the resin shall be a polyester system for typical residential sewage and shall be able to meet the service conditions specified for the tube system. For commercial, industrial, or other areas with a potential for sewage that affects polyester, epoxy or vinyl ester resin shall be required as determined by the City.

The Engineer shall also be informed in advance, for verification and inspection of the resin material at the "wet out" of the tube. The inspection shall be at the discretion of the Engineer, which shall not relieve the Contractor of his responsibilities. The wet-out procedure shall utilize the resin and catalyst in sufficient quantities to ensure complete impregnation of the liner and provide the properties specified in Section 1.03.04, Finished and Cured Liner Properties.

The catalyst system shall be compatible with the resin and other materials to be utilized in the rehabilitation process. Quantity and type of catalyst shall be selected based on the curing conditions and recommendations of the resin manufacturer.

1.03.03 Liner Design Criteria

The Cured-In-Place Pipe thickness shall be calculated and designed upon the following physical conditions of the existing host pipe and per ASTM F1216, Appendix X.1:

A. All pipes shall be considered fully deteriorated.

B. All pipes shall be subjected to a soil load of 120 lbs./cu. ft., with applicable live load, and water table two (2) feet below the top of the ground.

C. Pipes in good condition shall have a minimum of 2% ovality in the circumference. A higher value of ovality shall be used if the pipe is deteriorated.

D. Factor of safety (N) of 2.0 shall be used for calculations.

Conditions A and/or B above may change after the initial TV report, if approved by the Engineer. The Engineer shall have the right to modify/change the required liner thickness, depending upon field conditions evident from the video tape(s) and/or tested product values.

1.03.04 Finished and Cured Liner Properties

The finished cured-in-place pipe liner shall be white or light gray, fit tightly and neatly against the existing pipe walls. The liner shall be fabricated from materials which, when cured, will be suitable for continuous service in sewerage environments containing hydrogen sulfide, carbon monoxide, carbon dioxide, methane, dilute (10%) sulfuric acid at an average wastewater temperature of 80°F, dilute (10%) phosphoric acid, petroleum hydrocarbons, gasoline, vegetable oil, tap water (pH 6.5 - 9), up to 1 hour per day exposure to 5 percent sodium hydroxide up to a pH of 11, moisture saturation, and external exposure to soil bacteria and chemical attack which may be due to materials in the surrounding ground or sewage within. 0% shrinkage allowed.

The cured-in-place pipe system shall conform to and comply with the requirements above, and meet or exceed the minimum standard physical properties as follows:

STRUCTURAL/MECHANICAL PROPERTY	ASTM TEST METHOD	ASTM MINIMUM SHORT TERM VALUE	ASTM MINIMUM LONG TERM VALUE
TENSILE STRENGTH (@ Yield)	D-638	4,000 psi.	
TENSILE MODULUS	D-638	250,000 psi.	125,000 psi
FLEXURAL STRENGTH	D-790	5,000 psi.	
FLEXURAL MODULUS	D-790	300,000 psi.	150,000 psi
SHEAR STRENGTH	D-732	5,500 psi.	
IMPACT STRENGTH	D-256	1.9 in.-lb.	

The initial stiffness factor shall conform to the following table:

Nominal ID of Original Pipe (Inches)	Stiffness Factor (EI)[1] (in^3-lbf/in^2)	Maximum Allowable Depth of Groundwater Above Invert.[2] (Feet)
6	328	238
8	328	96
10	328	48
12	328	27
12	1109	96
15	1109	48
18	1109	27

[1.] Stiffness factor shall be determined in accordance with ASTM D2412.
[2.] Safety factor not included.

1.04 INSTALLATION

The Contractor's operations to furnish and install the lining shall be in strict conformance with the component materials and manufacturer's recommendations.

The host pipeline shall be cleaned and televised in accordance with Section 2739. The outside diameter of the tube being inserted shall be properly sized to allow for expansion so that the CIPP liner can fit tightly against the host pipe.

The tube shall be installed through the existing manholes, in accordance with the manufacturer's recommendations and procedures. The finished pipe on mainline reaches shall be continuous over the entire length between manholes. A sealing material compatible with the liner shall be installed at the entrance to each manhole between the tube and the existing pipe to provide a watertight seal.

The Contractor shall submit to the Engineer a detailed plan of construction including the installation procedures, equipment set-up, and the locations of the proposed access points for approval. The Contractor shall have an approved plan of construction prior to commencing any construction.

During the curing process, the Contractor shall keep logs, charts and/or graphs of the liner temperatures at the upstream and downstream manholes to insure that proper temperatures and cure times have been achieved. These documents may be required by the Engineer at any time during and after the curing process.

Immediately after curing of the tube and after testing, within the same working day, the Contractor shall reinstate all existing active service connections, without excavation, by means of an approved remote control cutting device from within the sewer. An initial relief hole shall first be cut on all services, followed by finish cutting to the approximate original size and shape. The service connection shall be brushed to remove rough edges, strings or other pipe defects that would prevent solids from flowing freely. The Contractor shall have a back-up remote control cutting device on site in case of malfunction.

Any evidence of infiltration between the service connection and the existing pipe shall be corrected by the Contractor. The method of correction shall be submitted and approved by the Engineer.

1.05 TESTING

After curing of the tube and before any service connections are reinstated, the Contractor shall perform the following hydrostatic exfiltration test on the tube to determine if it is watertight.

1.05.01 Hydrostatic Exfiltration Test

The leakage testing shall be in conformance with ASTM F1216. The test shall be conducted for a minimum of one hour.

1.05.02 Pipe Samples Testing

The Contractor shall prepare a minimum of one CIPP sample for testing per inversion in accordance with ASTM F1216 and ASTM F1743. Sample(s) shall conform to the following two methods:

1) For host pipe diameters 18” and smaller, the sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

2) For host pipes larger than 18" in diameter, the sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the down tube.

The samples for each of these cases should be large enough to provide a minimum of three specimens. The samples shall be tested by a certified independent third party testing laboratory. The lab shall provide the Engineer for approval with certified test results. The following test procedure shall be performed after the sample is cured and removed:

1) Short-Term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural stress shall be measured for gravity and pressure pipe applications in accordance with ASTM D790 and should meet the short term flexural modulus and flexural strength values used in the thickness designs of the CIPP previously submitted.

2) Wall thickness at any point shall not be less than 87.5% of the design thickness.

1.06 CLEANING AND VIDEO INSPECTION

1.06.01 Initial Cleaning and Video Inspection

The existing sewer shall be cleaned and video inspected in accordance with Project Specifications. The Contractor shall verify location of active lateral connections at this time.

1.06.02 Final Cleaning and Video Inspection

After CIPP lining is complete and the services have been reinstated, the liner pipe shall be cleaned and video inspected in accordance with the Project Specifications. The Contractor shall repair all defects at no additional cost to the City.

1.07 WARRANTY AND QUALITY ASSURANCE

1.07.01 The Contractor shall provide to the City a warranty to be in force and effect for a period of two (2) years from the date of acceptance by the City. The warranty shall cause the Contractor to repair or remove and replace the liner should failure result from faulty materials or installation.

1.07.02 Correction of failed liner or liner deemed unacceptable, as a result of the post video inspection and/or test reports for structural values, thickness, chemical resistance, etc., shall always be the responsibility of the Contractor, at no extra cost to the City. Method of correction/repair shall be approved by the City with prior field demonstration, if required. It shall be understood that minimum criteria of the specification shall not be lowered to compromise with lower than the required test values, unless approved in writing.

1.07.03 The finished liner shall be continuous over the entire length of run between two manholes and shall be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The finished liner shall meet or exceed the requirements of Section 1.03.04, Finished and Cured Liner Properties.

1.07.04 Wrinkles in the finished liner pipe which exceed 5% of the pipe diameter are unacceptable. Contractor shall remove either the liner or the wrinkled segments which exceed 5% of the pipe diameter. Additionally, any wrinkles that traverse the invert and impede flow shall be

removed. Repair of the removed sections shall be proposed by the Contractor and approved by the Engineer.

1.07.05 The Contractor shall carry out the operations in strict accordance with all applicable OSHA regulations. Particular attention is called to those safety requirements involving work on an elevated platform and entry into a confined space.

***** END OF SECTION *****

PRECAST CONCRETE MANHOLES

1.01 SCOPE

This section covers the installation of new sanitary sewer manholes. Manholes shall be as specified herein and installed at the locations shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit for approval by the Engineer the following:

A. Manufacturer's literature on the materials identified below. Literature shall include recommended installation procedures.

B. Certification by the manufacturer that all precast sections furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM C 478 or ASTM C 361.

C. Mix design of the concrete used for the manhole base.

1.03 MATERIALS

Precast Sections	ASTM C 478. Hanson Concrete Products, Inc., or approved equal. FOR GREATER THAN 72-INCHES ID: ASTM C 361, Class D-25. Flush Bell design, centrifugally spun or wet cast. Ameron, Concrete Pipe & Products or approved equal.The cover shall
Precast Manhole Base	ASTM C 478. Hanson Concrete Products, Inc., or approved equal.
Sealant	Ram-Nek K.T. Snyder Company, Inc., or approved equal.
Steps	ASTM C 478-80 Polypropylene Safety Steps.
Frame and Cover	PAMREX 24” manhole frame and cover with locking kit as manufactured by CertainTeed or approved equal. See standard detail WWD-12 for casting imprint
Concrete	Section 90 Class 2 Concrete. CalTrans Standard Specification.
Mortar	Section 65-1.06A, CalTrans Standard Specification. Mortar shall be non-shrink as manufactured by Sika or approved equal.
Water Stops	Molded plastic or rubber waterstops by Mission Rubber, Newby Rubber or approved equal.

1.03.01 Drop Manholes

Drop manholes shall be installed whenever a pipe entering a manhole has an invert elevation 30 inches or more above the top of the outlet pipe in the manhole.

1.04 INSTALLATION

Manhole bases shall be poured in a dry trench, using Class 2 concrete. Concrete will be sampled at the Engineer's discretion. Upon Engineer's approval, pre-cast manhole bases may be used on straight runs and terminal manholes only. No field medication of pre-cast manhole bases shall be allowed.

During the pouring of the manhole base, precautions shall be taken to ensure that the sewer pipes entering and leaving the manhole do not move from the installed alignment and grade. Plugs shall be placed in open pipes to prevent concrete from entering the lines. In case of straight-through lines, the pipe may be laid through the manhole excavation with the base being poured around the pipe. The upper half of the pipe shall then be cut out to form the channel. Water stops shall be used on all plastic pipe entering the manhole to prevent groundwater from leaking through the manhole wall. Water stop shall be molded plastic or molded rubber.

Care shall be taken in setting the bottom manhole section at the appropriate time during the cure of the concrete to ensure penetration (see Standard Drawings) and to allow for two inches of minimum clearance between the bottom of the manhole section and the top of the highest pipe. Manholes shall be plumb.

The channels shall be shaped in flowing curves as indicated on the drawings to ensure good hydraulic characteristics for the flow of wastewater. A smooth, clean, hand rubbed finish shall be given to the surfaces of the manhole base and to any joint mortar work. Transitions between different sizes of pipes shall be smooth and regular. Cracks, joints, holes, etc., shall be sealed with Sika or approved equal non-shrink grout or sealing compounds to ensure watertight manholes.

No more than twelve (12) vertical inches of grade rings shall be used to adjust the level of the manhole frame (12 inches maximum between the top of the tapered manhole section and the bottom of the manhole frame). Manhole steps shall be located on the downstream side of the manhole. For manholes less than 5 feet in depth, concentric cones shall be used and manhole steps shall be omitted.

Backfill shall be placed uniformly around the outside of the manhole so as to not create differential forces and the possibility of dislodging the manhole sections.

Where a manhole is constructed on an existing straight-through sewer, the top portion of the sewer pipe shall not be removed until the manhole has been completed and tested.

1.05 TESTING

The Contractor shall conduct an exfiltration test or vacuum test on each manhole constructed. The test shall be conducted by the Contractor in the presence of the Engineer.

Exfiltration tests shall consist of plugging incoming and outgoing sewer lines and filling the manhole with water up to the rim. After initial absorption (15 minutes), if the water loss exceeds one inch in depth in five minutes, the manhole shall have failed the test. Each manhole which fails the test shall be carefully inspected to determine the problem and then resealed and retested until the water loss is less than one inch in five minutes.

Vacuum tests shall consist of drawing a vacuum on a sealed manhole and measuring the time for the vacuum to drop to a predetermined level. The actual test procedure shall be provided by the manufacturer of the test equipment and approved by the Engineer. Each manhole which fails the test shall be carefully inspected to determine the problem and then resealed and retested until the manhole passes.

***** END OF SECTION *****

CLEANING AND VIDEO INSPECTION OF SEWER PIPE

1.01 SCOPE

This section covers the cleaning and video inspection of sewer pipelines and video processing software and equipment. The word "clean" in this section is defined as the removal of all accumulations including sludge, dirt, sand, rocks, grease, roots, and other solid or semisolid material in the pipe or manhole and on the pipe or manhole inside wall, down to the parent material.

1.02 SUBMITTALS

1.12.1 Contractor shall submit NASSCO PACP and/or LACP certificates, as applicable, for the video operator coding the video.

1.12.2 Each of the Contractor's crews, upon completion of their first 1000 LF, shall submit one copy of the DVD for review and acceptance prior to continuing work.

1.12.3 One copy DVD discs, and download color video and audio information to the City's server of all sewer reaches inspected shall be submitted to the City. Work will not be considered complete until these items have been received and approved by the Engineer.

1.03 EXPERIENCE

Camera Technician Experience: Each camera technician shall have a minimum of 5 years experience with at least 100,000 LF in projects televising sanitary sewer lines and commenting on observed defects. Each camera technician shall be NASSCO PACP and/or LACP certified.

1.04 MATERIALS

Video Processing System – The video processing system shall be the software system, Pic Ax 2.1,as used by the City or a compatible database format system with ICOMMM that can use the existing generic connector to convert to a Pic Ax 2.1 format. Files shall be exported in PACP database format. Verify compatibility with RedZone Robotics (925) 824-3200.

Video Codeset – Video codeset shall be PACP 4.2, 4.4, or 6.0 formatted data.

1.04 CLEANING AND VIDEO INSPECTION

1.04.01 Cleaning

Pipelines and structures shall be cleaned using any combination of cleaning methods based on the cleaning necessary and pipe type. Acceptance of the sewer line cleaning shall be made upon the successful completion of the video inspection and shall be to the satisfaction of the Engineer. If video inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the sewer main at no additional cost to the City.

1.04.01.01 Cleaning Methods include but are not limited too the following:

1. High Velocity Jet Cleaner. The equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of six hundred (600) feet of high pressure hose with a selection of two or more high velocity nozzles. Nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all designated line sizes. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines and pumps, and hydraulically driven hose reel. All controls shall be located so that the equipment can be operated above ground. Equipment shall include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream.
2. Rodding Machines.- Use heads and cutters as necessary to remove roots, grease and other debris. The attachments shall be suitable for the pipe type that is being cleaned.
3. Bucket Machines
4. Chemicals – Chemicals made for sanitary sewer use and acceptable to the City's Water Quality Control Plant may be used to remove grease and kill roots.

1.04.01.02 Root Removal - Roots shall be removed in the designated sections where root intrusion is a problem. Roots shall not be a reason for reverse set-ups. Special attention should be used during the cleaning operation to ensure complete removal of roots from the joints for 33"-diameter and smaller pipes and to ensure 90-95% removal of roots from the joints for 36"-diameter and larger pipes. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.

1.04.01.03 Cleaning Debris - The material resulting from the cleaning operation shall be removed at the downstream manhole of the reaches being cleaned, through the use of a filtering device. The material collected at the downstream manholes shall become the property of the Contractor. It shall be removed from the site by the Contractor in a closed container and disposed of in a legal manner. It shall not be dumped into streets, ditches, catch basins, or storm sewers. Flushing of the material from manhole reach to manhole reach is unacceptable.

1.04.02 Material Dewatering and Disposal

Contractor shall screen all the debris collected prior to analysis and disposal. Contractor shall haul and properly dispose of material at a class 3 landfill.

1.04.03 Video Inspection

Depth of flow shall not exceed twenty percent (20%) of the inside pipe diameter as measured in the manhole when performing video inspection. In the event the depth of flow of the reach being televised exceeds twenty percent (20%) of the inside pipe diameter, the Contractor shall provide the necessary flow control or reschedule the inspection for a time when such flow is reduced to permit proceeding with the work. If nighttime work is necessary, the Contractor shall obtain a "Noise Exception Permit" from the CPA Police Department.

Video equipment shall include a multi-angle television camera capable of spanning 360-degrees circumference and 270-degrees on horizontal axis to televise sewer lines 6-inch diameter or larger;

the purpose of the rotating head camera is to view all service connections, upstream and downstream manhole structures, and to locate all defects, as well as questionable problem areas; focal distance shall be adjustable through a range of one (1) inch to infinity. The television camera shall be color format and specifically designed and constructed for operation in connection with sewer inspection, and for operation in sewers under 100% humidity conditions. Lighting and camera quality shall produce a clear, in-focus picture of the entire periphery of the pipe for a minimum distance of six feet. Other required equipment are television monitor, cables, power sources, lights, and other equipment necessary to do the work.

The video shall start outside the manhole and end inside the end structure capturing video of both structures prior to setting the start footage and after the footage is stopped. The camera shall be moved through the pipeline in either direction at a uniform rate, stopping when necessary to ensure proper documentation of the sewer's condition. In no case shall the television camera be pulled or propelled at a speed greater than thirty (30) feet per minute. The camera height shall be adjusted such that the camera lens is always centered in the pipe being inspected. The equipment shall have an accurate footage counter, which shall display on the monitor the exact distance of the camera from the centerline of the starting manhole. Unless otherwise approved by the Engineer, footage measurements shall begin at the centerline of the upstream manhole.

The video inspection shall follow PACP and/or LACP formatting that includes the documentation that describes the inspection location and other parameters associated with the inspection. Data of significance includes, but is not limited to, the locations of service connections, types of upstream and downstream manhole structures, and any pipe defects. Footage shall be imbedded in the video (Pic Ax) or burned on the video in addition to other footage indicators or recorded events. If the recordings are of such poor quality that the Engineer is unable to evaluate the condition of the sewer, locate sewer service connections, or verify cleaning, the Contractor shall re-televise the sanitary sewer and provide a new recording of good quality at no cost to the City. No payment will be made for recordings that do not meet the requirements of these specifications.

***** END OF SECTION *****

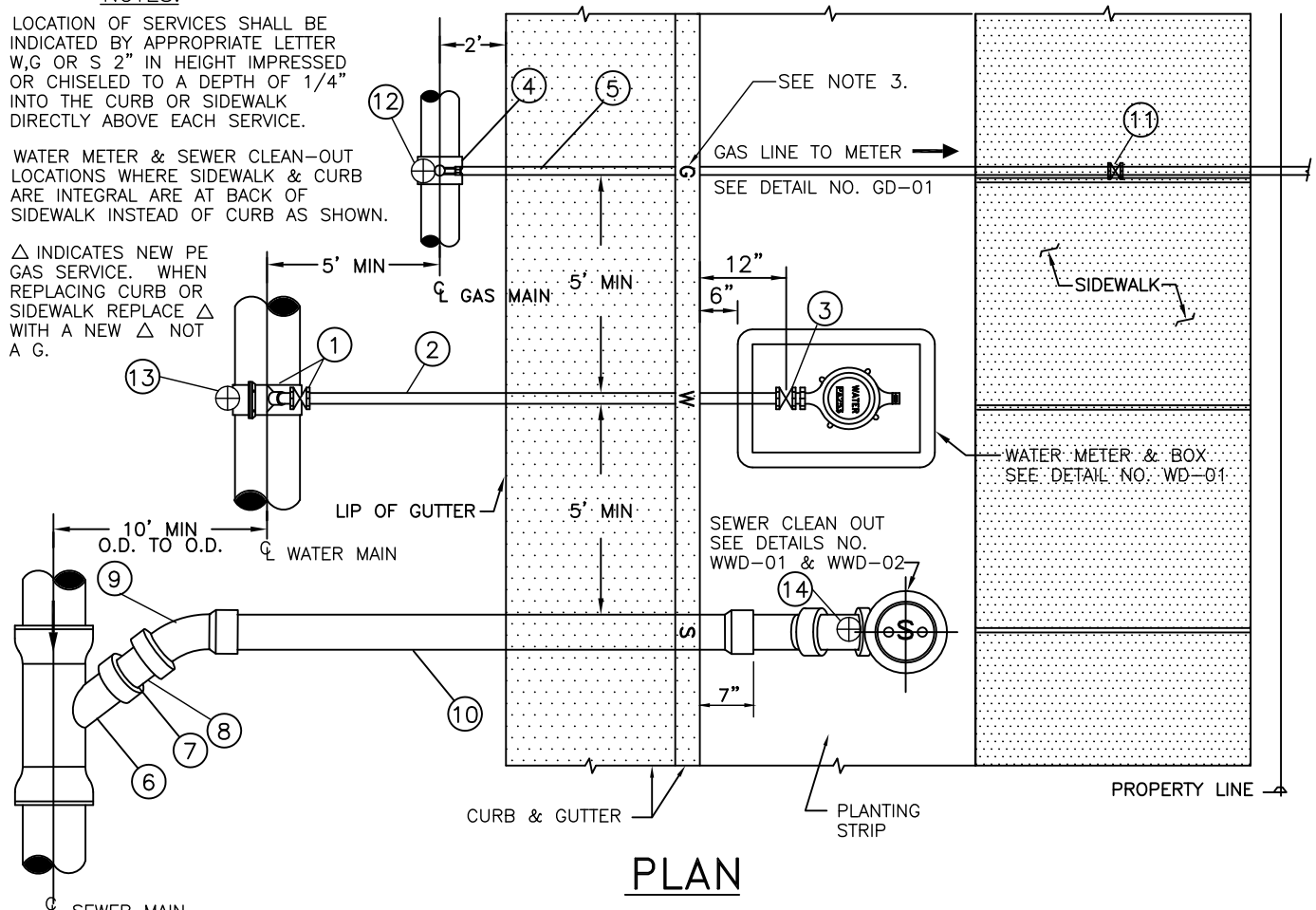
APPENDIX A.

General WGW Utility Standard Details

STANDARD DETAIL DESCRIPTION	STANDARD DETAIL NO.
Water, Gas, and Sewer Main and Service location	WGW-01
Trench Backfill	WGW-02
Trench Backfill for Shallow Water Mains	WGW-03
Pipe Bedding	WGW-04
Commercial Bollard Standard Detail	WGW-05
Residential Bollard Standard Detail	WGW-06
Gas and Water Valve Conc. Collar and Rebar at E. Conc. Street	WGW-07
Water – Sewer Separation Criteria	WGW-08

NOTES:

1. LOCATION OF SERVICES SHALL BE INDICATED BY APPROPRIATE LETTER W,G OR S 2" IN HEIGHT IMPRESSED OR CHISELED TO A DEPTH OF 1/4" INTO THE CURB OR SIDEWALK DIRECTLY ABOVE EACH SERVICE.
2. WATER METER & SEWER CLEAN-OUT LOCATIONS WHERE SIDEWALK & CURB ARE INTEGRAL ARE AT BACK OF SIDEWALK INSTEAD OF CURB AS SHOWN.
3. △ INDICATES NEW PE GAS SERVICE. WHEN REPLACING CURB OR SIDEWALK REPLACE △ WITH A NEW △ NOT A G.



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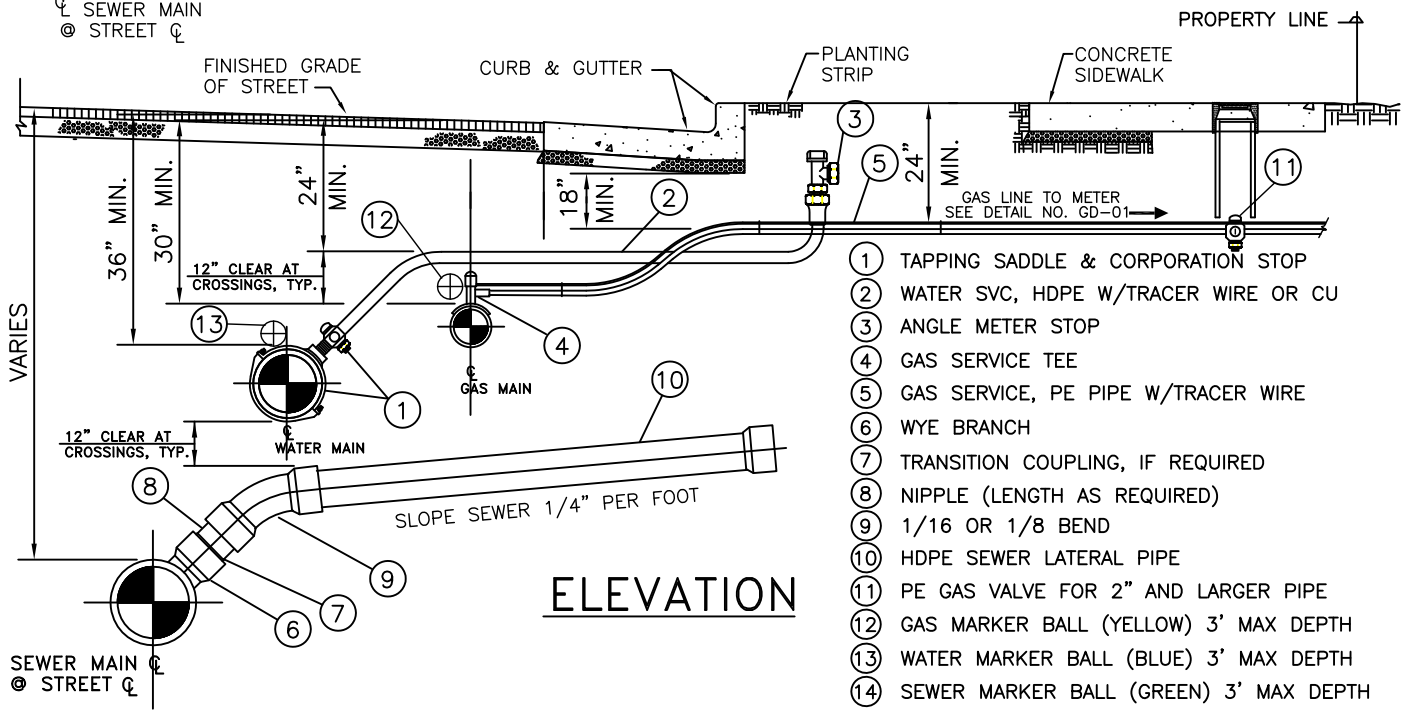


ELEVATION

1. TAPPING SADDLE & CORPORATION STOP
2. WATER SVC, HDPE W/TRACER WIRE OR CU
3. ANGLE METER STOP
4. GAS SERVICE TEE
5. GAS SERVICE, PE PIPE W/TRACER WIRE
6. WYE BRANCH
7. TRANSITION COUPLING, IF REQUIRED
8. NIPPLE (LENGTH AS REQUIRED)
9. 1/16 OR 1/8 BEND
10. HDPE SEWER LATERAL PIPE
11. PE GAS VALVE FOR 2" AND LARGER PIPE
12. GAS MARKER BALL (YELLOW) 3' MAX DEPTH
13. WATER MARKER BALL (BLUE) 3' MAX DEPTH
14. SEWER MARKER BALL (GREEN) 3' MAX DEPTH

	BY	DATE
DRAWN	J.J.	9/92
CHECKED	R.E.	10/10
REVIEWED	RE	11/10

WATER, GAS & WASTEWATER MAIN LOCATIONS AND SERVICE CONNECTIONS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

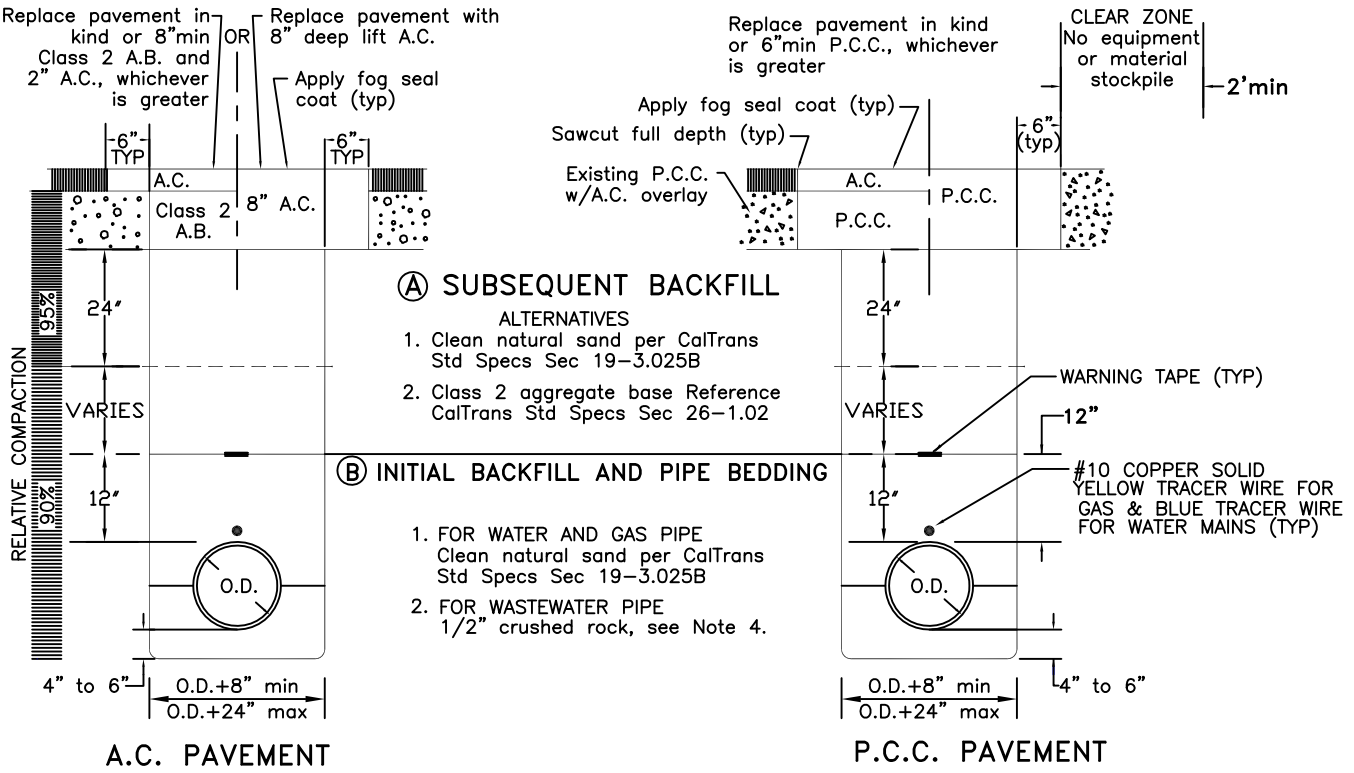
Edward Wu 52944
EDWARD WU R.E. NO.
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

SCALE:
NONE

DWG. NO.
STD. WGW-01

APPENDIX A

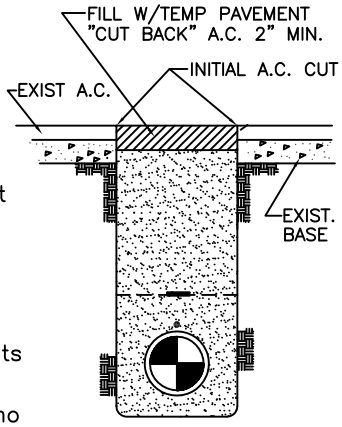


A.C. PAVEMENT

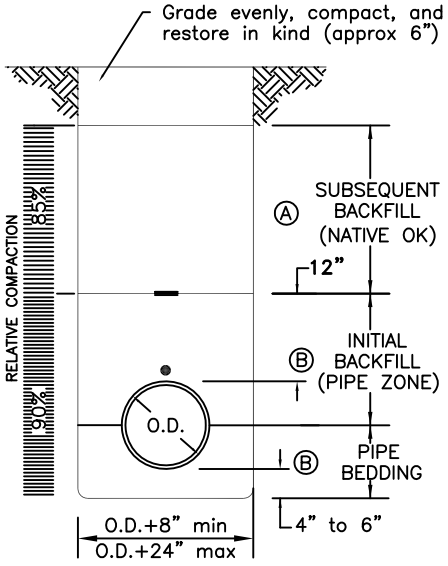
P.C.C. PAVEMENT

JETTING NOTES

1. **IMPROVED AREAS**
   a. INITIAL BACKFILL – jetting of sand OK
   b. SUBSEQUENT BACKFILL – jetting of sand subject to approval of City Engineer, except for top 2 ft, which must be mechanically compacted
2. **UNIMPROVED AREAS:** jetting of sand OK
3. **WHEN JETTING IS PERMITTED:**
   a. Excess water shall be collected at low points and removed by pumping
   b. Sand to be jetted shall be placed in lifts no thicker than 4 ft
   c. Jetting shall be performed at intervals along the trench not to exceed 6 ft



TEMPORARY RESTORATION



UNIMPROVED AREA

NOTES:

1. FINAL TRENCH RESTORATION SHALL BE COMPLETED WITHIN 10 WORKING DAYS FROM THE LAST DAY PIPE HAS BEEN INSTALLED ON ANY PARTICULAR CONTINUOUS SECTION.
2. IF TRENCH IS LOCATED 3 FEET OR LESS FROM EDGE OF PAVEMENT, SURFACE COURSE PAVEMENT SHALL BE REMOVED AND REPLACED FROM TRENCH TO EDGE OF PAVEMENT.
3. TRENCH WIDTH TO BE INCREASED WHEN SHORING IS USED.
4. IF WATER IS PRESENT, WRAP GEOTEXTILE FABRIC, MIRIFI 600X OR EQUAL. OVERLAP 12" ON TOP OF PIPE AND 24". AT ENDS. IF DIRECTED BY CITY, CONSTRUCT DAM TO PREVENT WATER FLOWING ALONG THE TRENCH.

	BY	DATE
DRAWN	E.L.	5/92
CHECKED	R.E.	3/98
REVIEWED	RE	1/10

TRENCH BACKFILL STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

52944 R.E. NO.

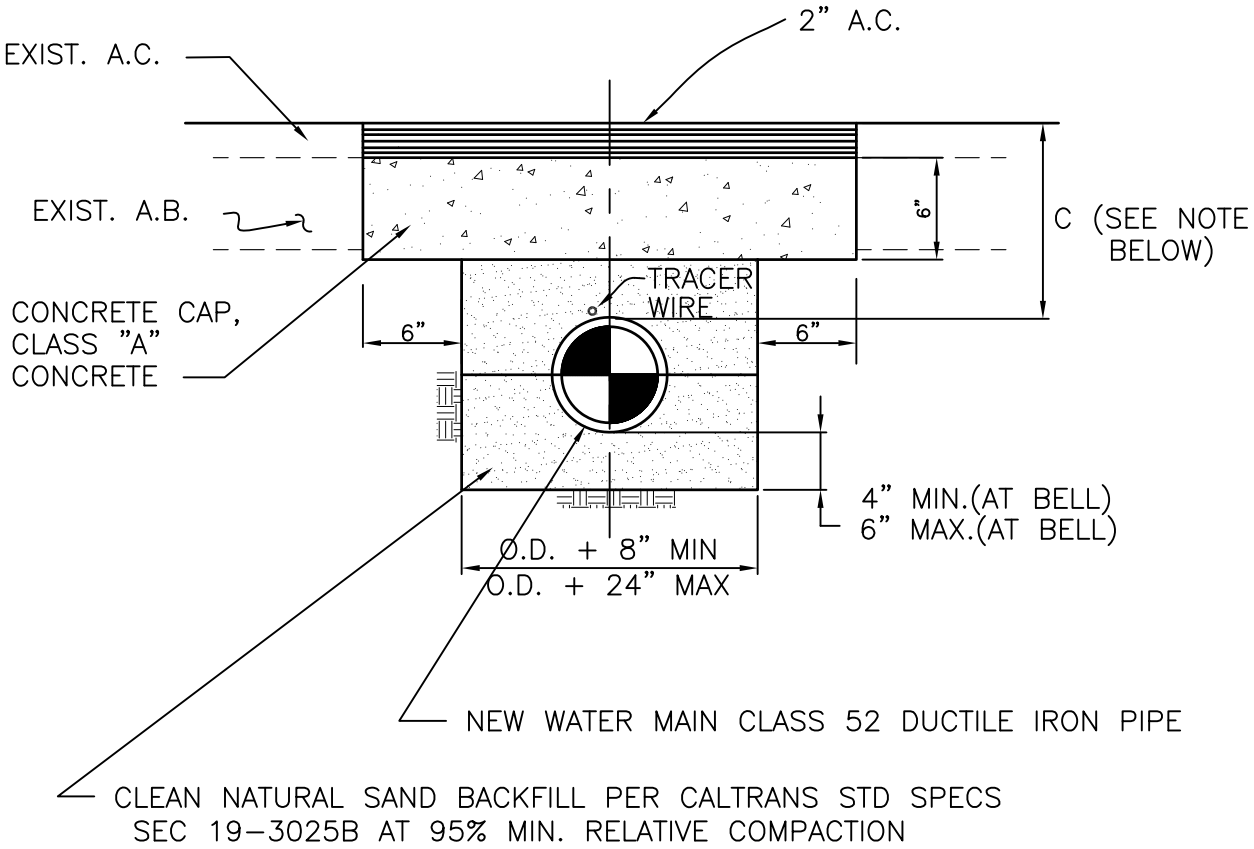
EDWARD WU
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WGW-02

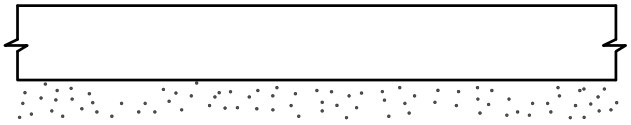
APPENDIX A



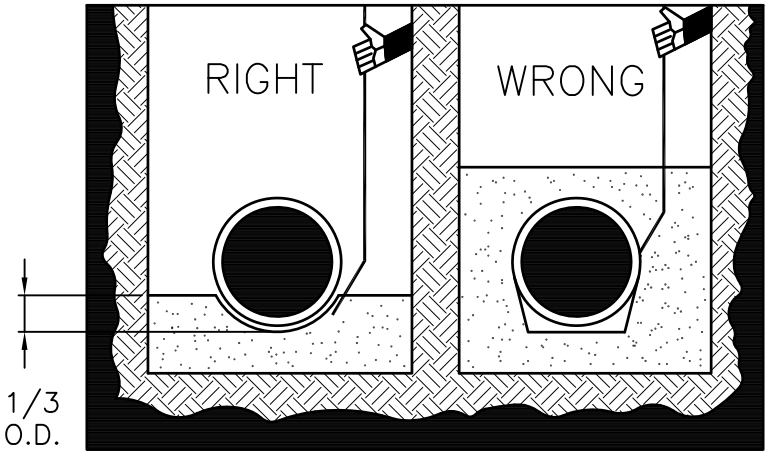
NOTE:

THIS DETAIL APPLIES WHERE DIMENSION "C" IS LESS THAN 3 FEET.

BY	DATE	TRENCH BACKFILL FOR SHALLOW WATER MAINS STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN EL	5/92		Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WGW-03
CHECKED CB	5/92			
REVIEWED RE	10/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX A

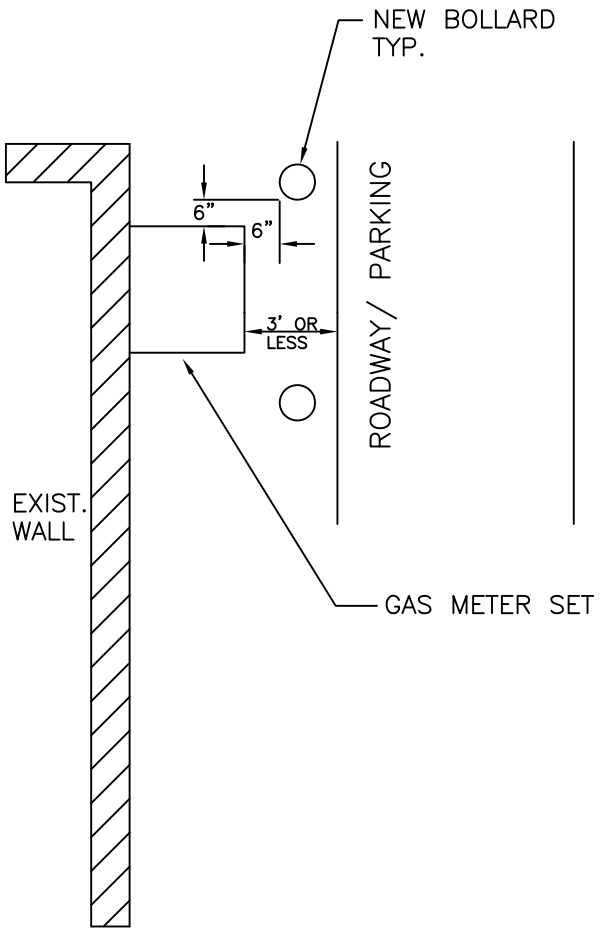


PROVIDE UNIFORM AND CONTINUOUS SUPPORT OF PIPE FOR ALL CLASSES OF BEDDING.



PLACE BACKFILL TO SPRINGLINE AND SHOVEL SLICE TO FORM DENSE COMPACTED HAUNCH SUPPORT TO 1/3 THE OUTSIDE DIAMETER OF THE PIPE.

	BY	DATE			
DRAWN	RF	5/92	PIPE BEDDING STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	EW	6/92		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WGW–04
REVIEWED	RC	6/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX A



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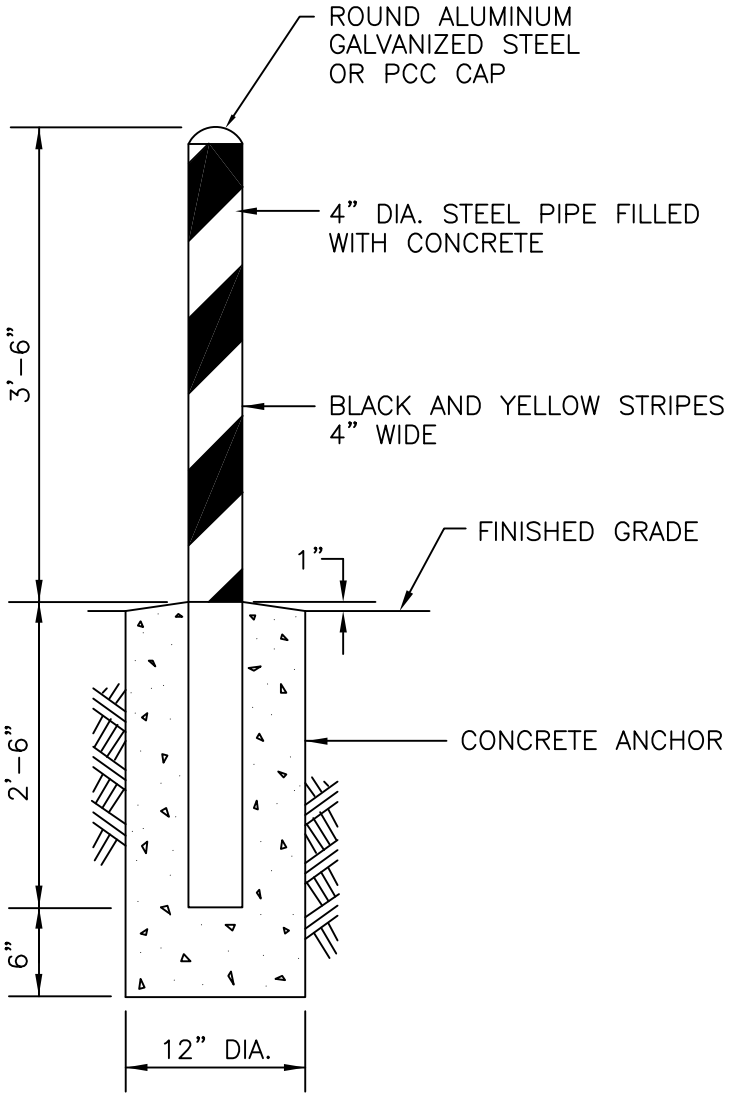
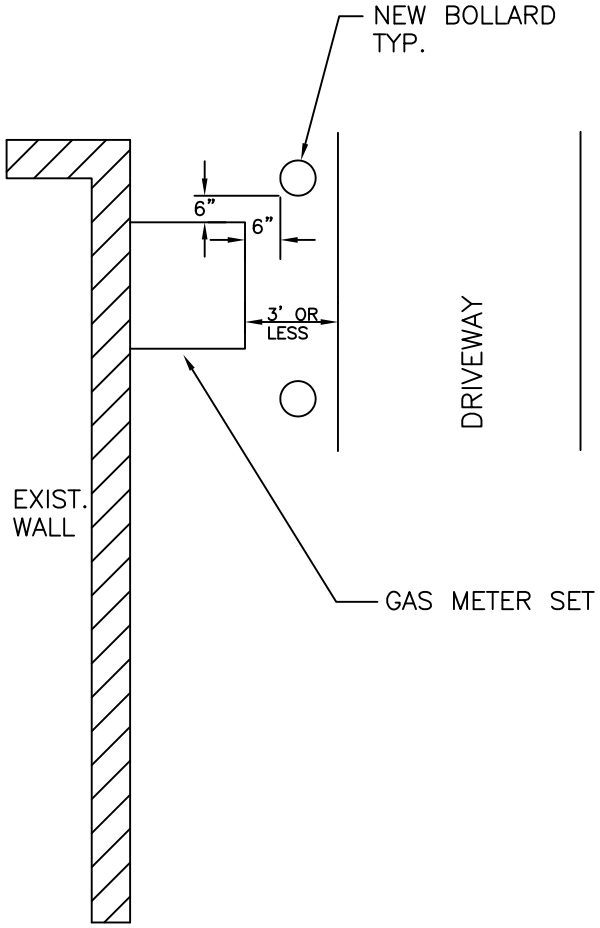


PROFILE

ANY GAS METER OR BACKFLOW DEVICE WITHIN THREE (3) FEET OF POTENTIAL VEHICULAR ACCESS SHALL BE PROTECTED BY EITHER COMMERCIAL OR RESIDENTIAL BOLLARDS DEPENDING ON APPLICATION.

	BY	DATE			
DRAWN	J.J.	8/92	COMMERCIAL BOLLARD STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	J.J.	9/92		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WGW-05
REVIEWED	RE	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX A



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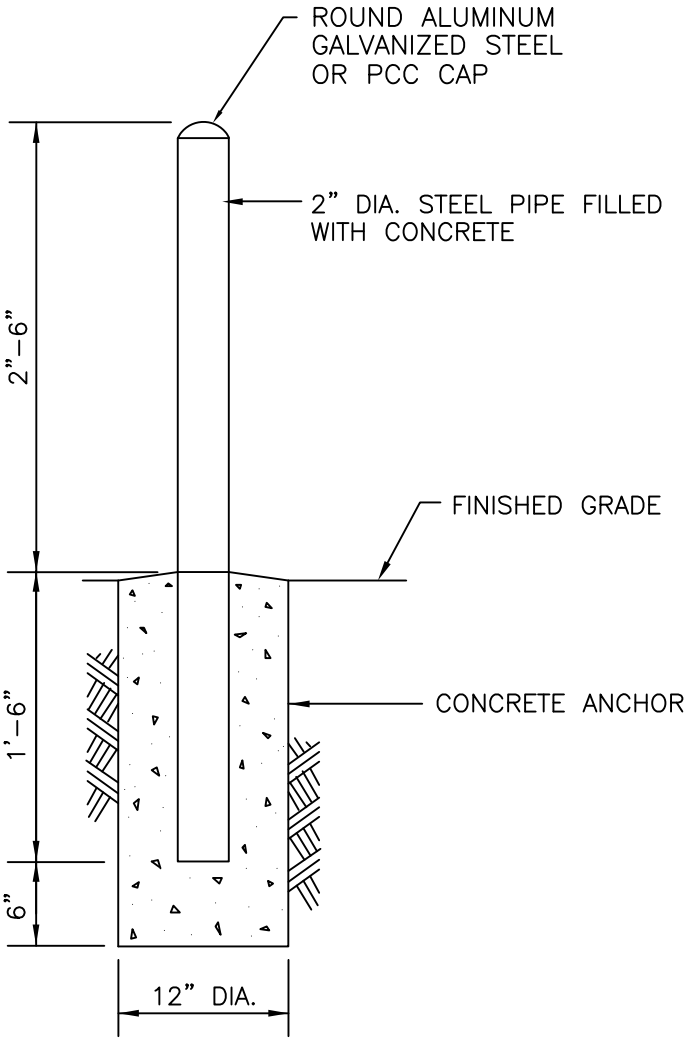


PROFILE

ANY GAS METER OR BACKFLOW DEVICE WITHIN THREE (3) FEET OF POTENTIAL VEHICULAR ACCESS SHALL BE PROTECTED BY EITHER COMMERCIAL OR RESIDENTIAL BOLLARDS DEPENDING ON APPLICATION.

	BY	DATE
DRAWN	R.E.	3/98
CHECKED	R.E.	3/98
REVIEWED	R.E.	12/09

RESIDENTIAL BOLLARD STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

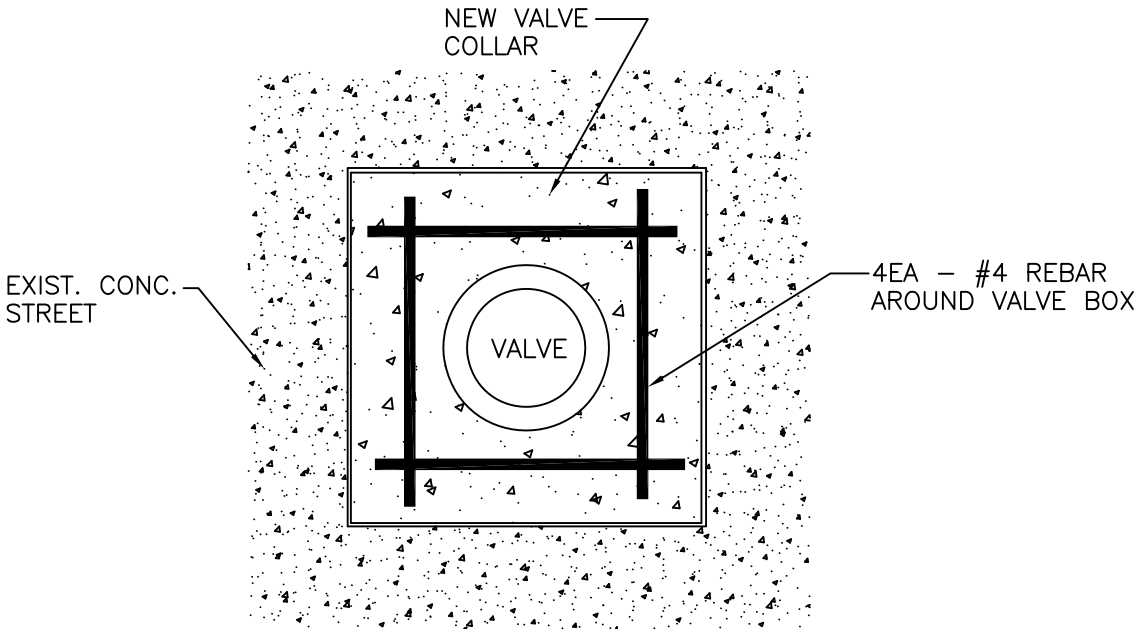
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

SCALE:
NONE

DWG. NO.
STD. WGW-06

APPENDIX A



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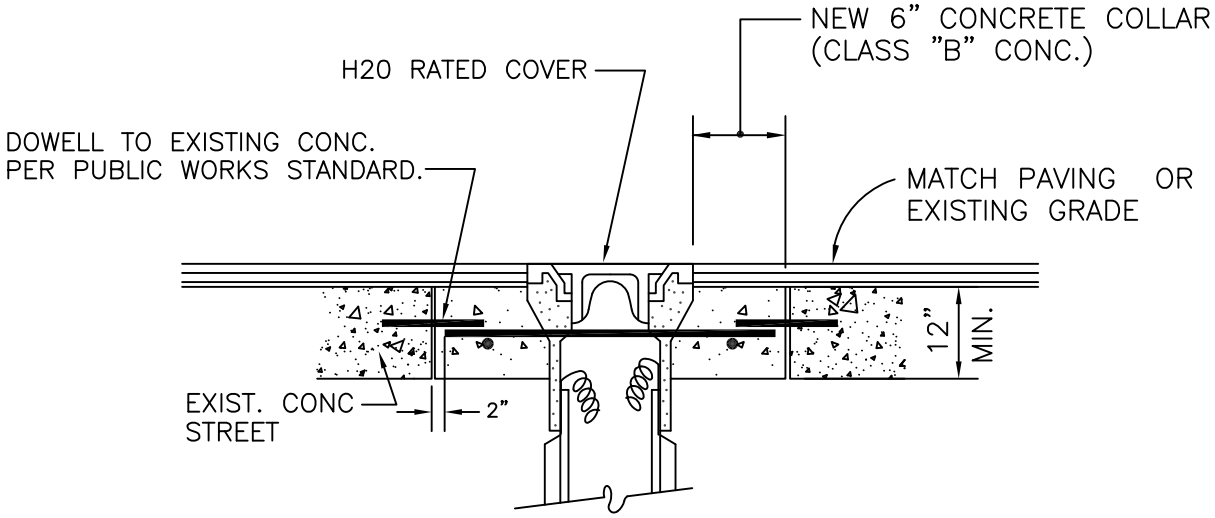
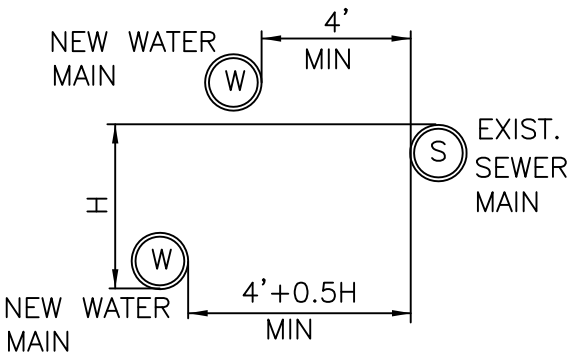
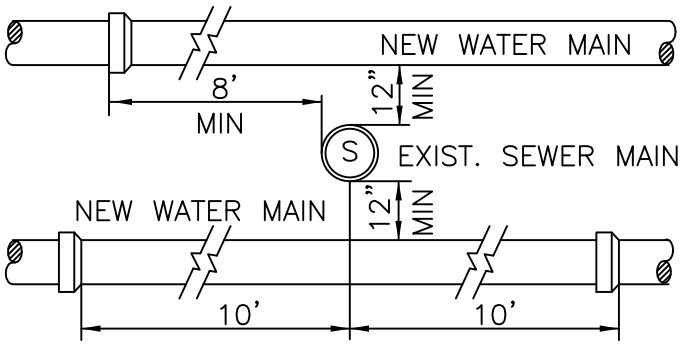


PROFILE

	BY	DATE			
DRAWN	R.E.	12/04	GAS AND WATER VALVE CONC. COLLAR AND STEEL REBAR AT EXISTING CONC. STREET	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	R.E.	12/04		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WGW–07
REVIEWED	R.E.	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX A

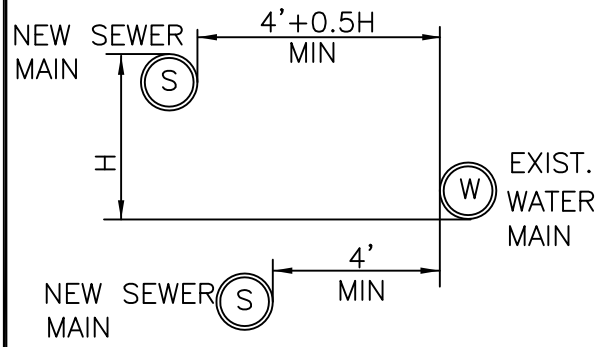


PARALLEL

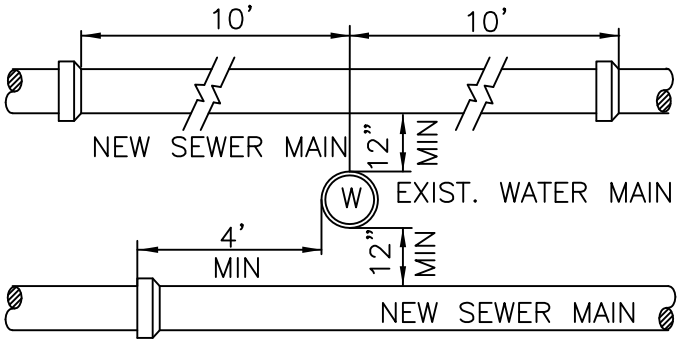


CROSSING

NEW WATER MAIN



PARALLEL



CROSSING

NEW SEWER MAIN

NOTES:

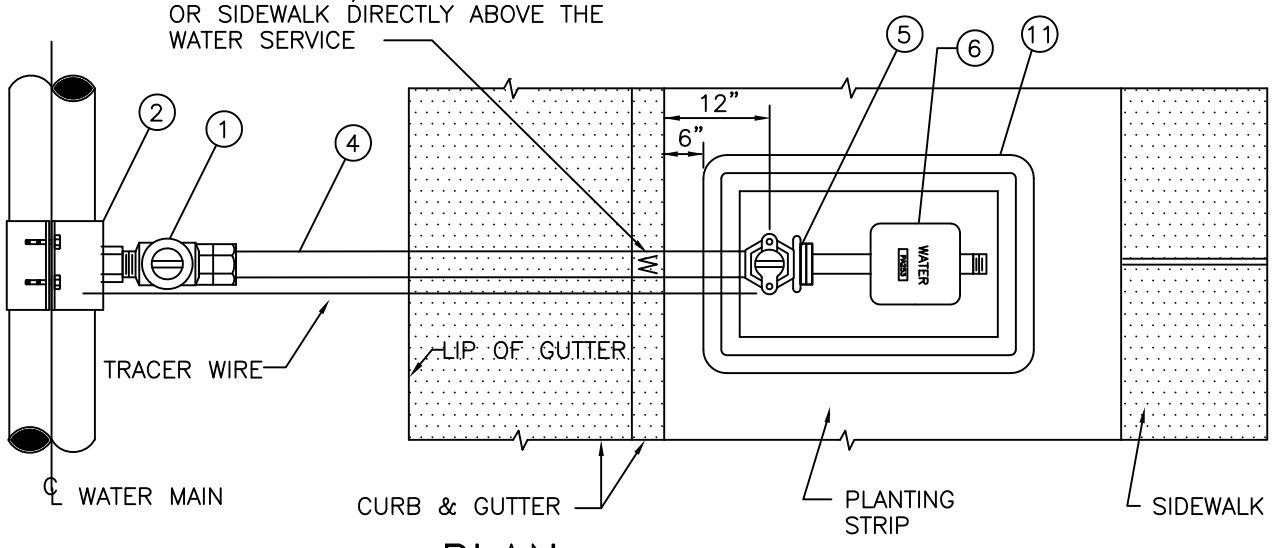
1. NEW WATER MAIN SHALL BE 4710 HDPE PER SECTION 2660.
2. NEW SEWER MAIN SHALL BE HDPE PER SECTION 2735.
3. AT WATER & SEWER MAINS CROSSINGS, A CONTINUOUS SECTION OF PIPE SHALL BE CENTERED OVER THE PIPE BEING CROSSED (NO JOINTS AT CROSSING).
4. SEPARATION DISTANCES COMPLIES WITH SECTION 64630(E)(2) CALIFORNIA ADMINISTRATIVE CODE, TITLE 22.
5. CROSSING ALIGNMENT: IF VERTICAL SEPARATION IS BETWEEN 4" TO 12", REVIEW AND APPROVAL IS REQUIRED BY THE WGW ENGINEERING DEPARTMENT. VERTICAL SEPERATION LESS THAN 4" IS PROHIBITED.
6. PARALLEL ALIGNMENT: IF HORIZONTAL SEPARATION IS BETWEEN 1' TO 4', (OR CALCULATED MIN. 4'+0.5H, AS APPLICABLE), REVIEW AND APPROVAL IS REQUIRED BY THE WGW ENGINEERING DEPARTMENT. HORIZONTAL SEPERATION LESS THAN 1' IS PROHIBITED.

BY	DATE	WATER – SEWER SEPARATION CRITERIA STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN B.C.	12/04		Edward Wu 52944 R.E. NO.	DWG. NO. STD. WGW–08
CHECKED RA/EW	12/04		EDWARD WU WGW ENGINEERING MANAGER	
REVIEWED R.E.	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX A

APPENDIX B.

Water Standard Details

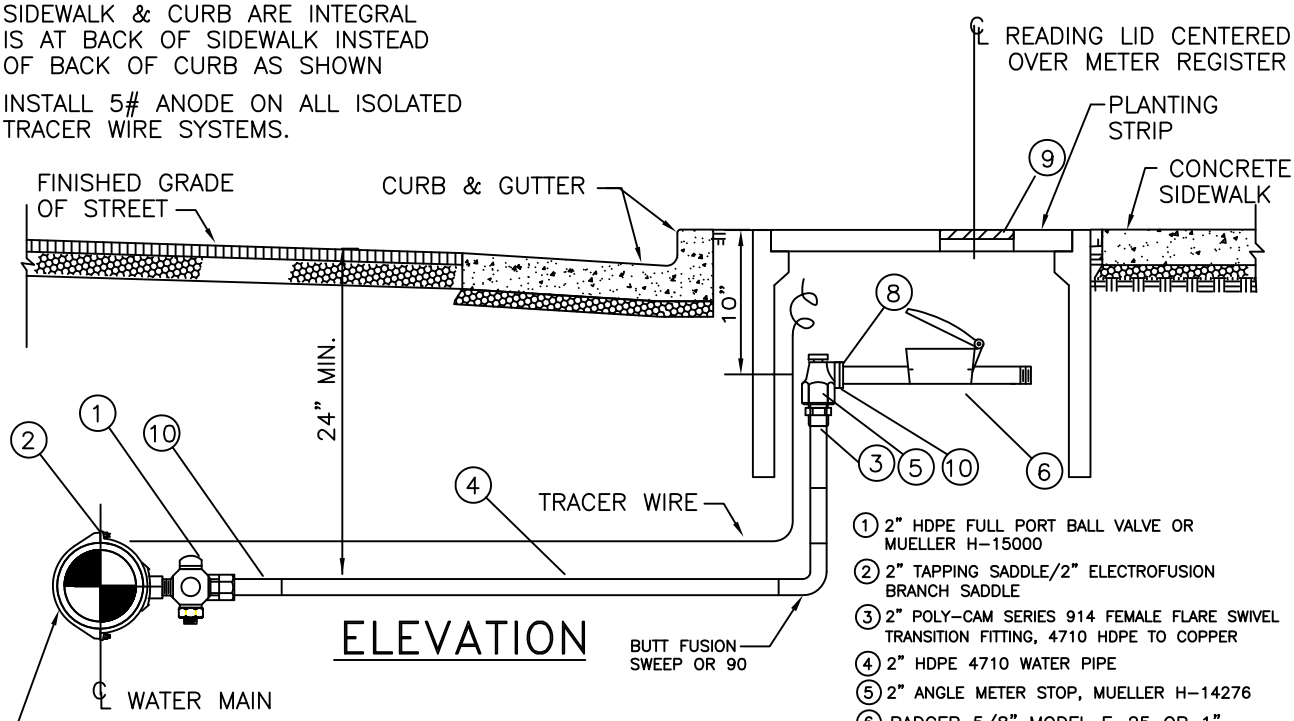
STANDARD DETAIL DESCRIPTION	STANDARD DETAIL NO.
2” HDPE Water Service With 1” or 5/8” Meter	WD-01A
1” Copper Water Service With 1” or 5/8” Meter (for contaminated soil areas only)	WD-01B
2” HDPE Water Service With 1-1/2" or 2" Meter	WD-02A
2” Copper Water Service With 1-1/2" or 2" Meter (for contaminated soil areas only)	WD-02B
4" thru 8" HDPE Pipe Domestic and /Fire Service Connection	WD-03A
2" HDPE Pipe Dedicated Fire Service Connection	WD-03B
4" Or 6” Water Meter Set with 2" By-Pass	WD-05
2" HDPE Water Service with Two 5/8" or 1” Meters	WD-06
2" Water Service Manifold with Two or More Meters	WD-07
2" HDPE Water Service Tap Fire Service	WD-08
Combination Fire and 4" Water Service Connection	WD-10
Combination Fire and 4" Water Service Connection with Two or More Meters	WD-11
1730 Meter Box With Multiple 1” or 5/8” Water Meters	WD-12A
2448 or 2460 Meter Box with Multiple 1” or 5/8” Water Meters	WD-12B
Reduced Pressure Principle Assembly - RPPA	WD-17A
Parallel Reduced Pressure Principle Assemblies	WD-17B
Reduced Pressure Detector Assembly - RPDA for Automatic Fire Sprinkler	WD-18A
Reduced Pressure Detector Assembly - RPDA Inside Installation	WD-18B
Double Check Assembly - DCA Vault Installation	WD-18C
Double Check Assembly - DCA - Vertical Installation	WD-18D
Residential Double Check Assembly - DCA Vault Installation	WD-18E
Thrust Block Table	WD-19
Gate Valve Assembly	WD-20
Fire Hydrant Assembly	WD-21
Fire Hydrant Abandonment	WD-22
Vertical Bends – HDPE Pipe Connection To Non-HDPE Pipe	WD-23
Valve Tie-Back During Construction	WD-24
Valve Stem Extensions	WD-25
1” Water Service Line Replacement and Reconnection	WD-26
Cut and Cap Existing Main	WD-27
Fire Hydrant Blow-Off	WD-28
Air Release Valve	WD-29
New Gate Valve on Existing Water Main	WD-30



PLAN

NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.



ELEVATION

TAPPING SADDLE SHALL BE DOUBLE BRONZE STRAPPED MUELLER H-16100 SERIES FOR ALL MAINS EXCEPT PVC & PE MAINS. FOR PVC USE MUELLER H-13000 SERIES. FOR PE USE 2" ELECTROFUSION BRANCH SADDLE.

METER	LAY LENGTH
5/8"	7-1/2"
1"	10-3/4"

1. 2" HDPE FULL PORT BALL VALVE OR MUELLER H-15000
2. 2" TAPPING SADDLE/2" ELECTROFUSION BRANCH SADDLE
3. 2" POLY-CAM SERIES 914 FEMALE FLARE SWIVEL TRANSITION FITTING, 4710 HDPE TO COPPER
4. 2" HDPE 4710 WATER PIPE
5. 2" ANGLE METER STOP, MUELLER H-14276
6. BADGER 5/8" MODEL E-25 OR 1" MODEL E-55 ULTRASONIC METER
8. 1" X 2" BUSHING FOR 1" MTR 3/4" X 2" BUSHING FOR 5/8" MTR
9. METER BOX W/ READING LID 1017 BOX FOR 5/8" METER & 1120 BOX FOR 1" METER. METER BOX & LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET
10. FORD CF31-77 2" FL X 2" FIP TRANSITION

	BY	DATE
DRAWN	R.E.	8/09
CHECKED	R.E.	8/09
REVIEWED	R.E.	8/09

2" HDPE WATER SERVICE WITH 1" OR 5/8" METER STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

52944 R.E. NO.

EDWARD WU
WGW ENGINEERING MANAGER

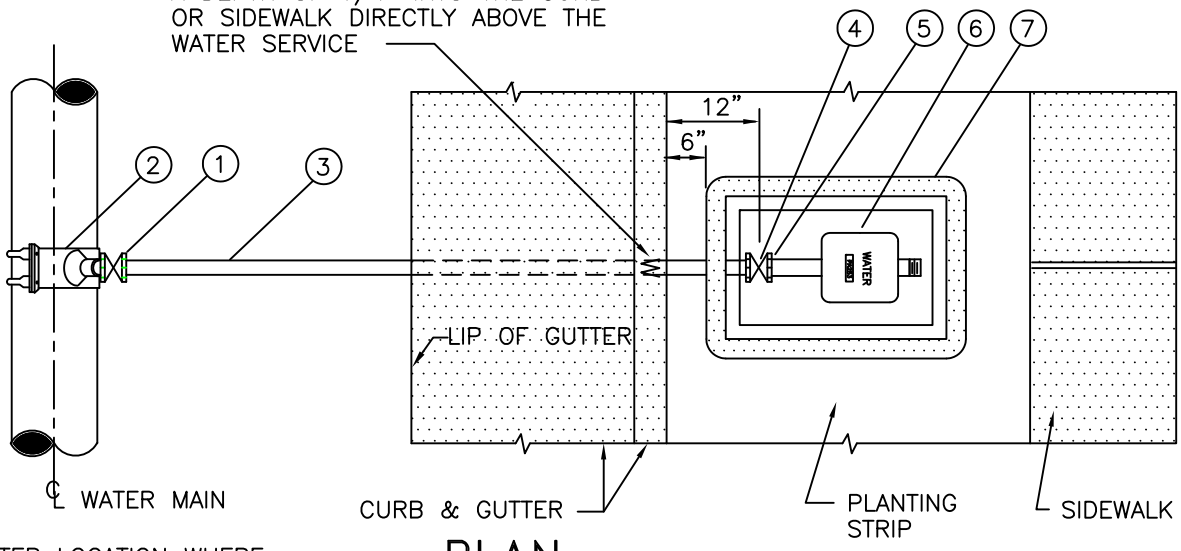
REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-01A

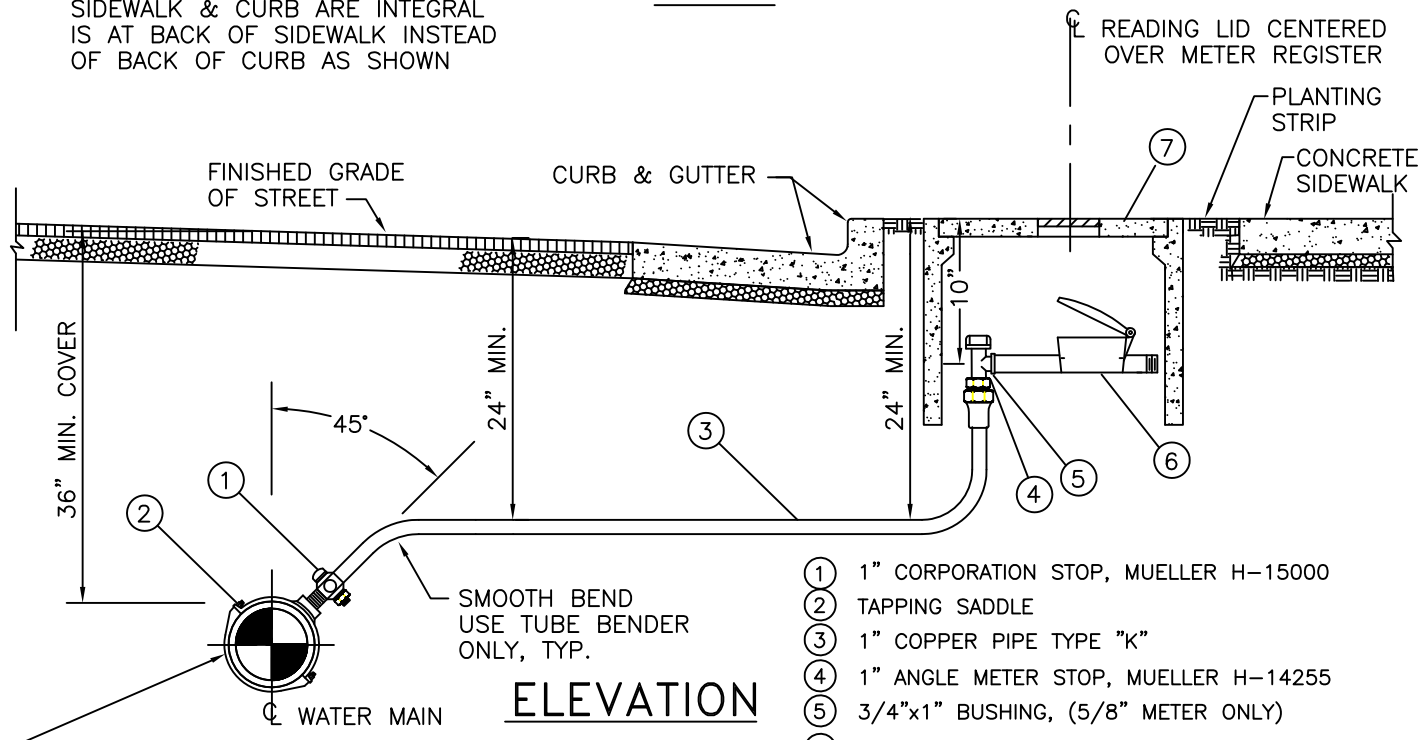
APPENDIX B

LOCATION OF SERVICE SHALL BE INDICATED BY LETTER "W" 2" IN HEIGHT IMPRESSED OR CHISELED TO A DEPTH OF 1/4" INTO THE CURB OR SIDEWALK DIRECTLY ABOVE THE WATER SERVICE



PLAN

* NOTE: METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN



ELEVATION

TAPPING SADDLE SHALL BE DOUBLE BRONZE STRAPPED MUELLER H-16100 SERIES FOR ALL MAINS EXCEPT PVC & HDPE MAINS. FOR PVC USE MUELLER H-13000 SERIES. FOR HDPE MAINS USE HDPE SERVICE, SEE WD-01A

METER	LAY LENGTH
5/8"	7-1/2"
1"	10-3/4"

1. 1" CORPORATION STOP, MUELLER H-15000
2. TAPPING SADDLE
3. 1" COPPER PIPE TYPE "K"
4. 1" ANGLE METER STOP, MUELLER H-14255
5. 3/4"x1" BUSHING, (5/8" METER ONLY)
6. BADGER 5/8" MODEL E-25 OR 1" MODEL E-55 ULTRASONIC METER
7. METER BOX W/ READING LID 1017 BOX FOR 5/8" METER & 1120 BOX FOR 1" METER. METER BOX & LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

	BY	DATE
DRAWN	J.J.	2/92
CHECKED	RE	12/09
REVIEWED	RE	12/09

1" COPPER WATER SERVICE CONNECTION STANDARD DETAIL

ONLY FOR CONTAMINATED SOIL AREAS

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

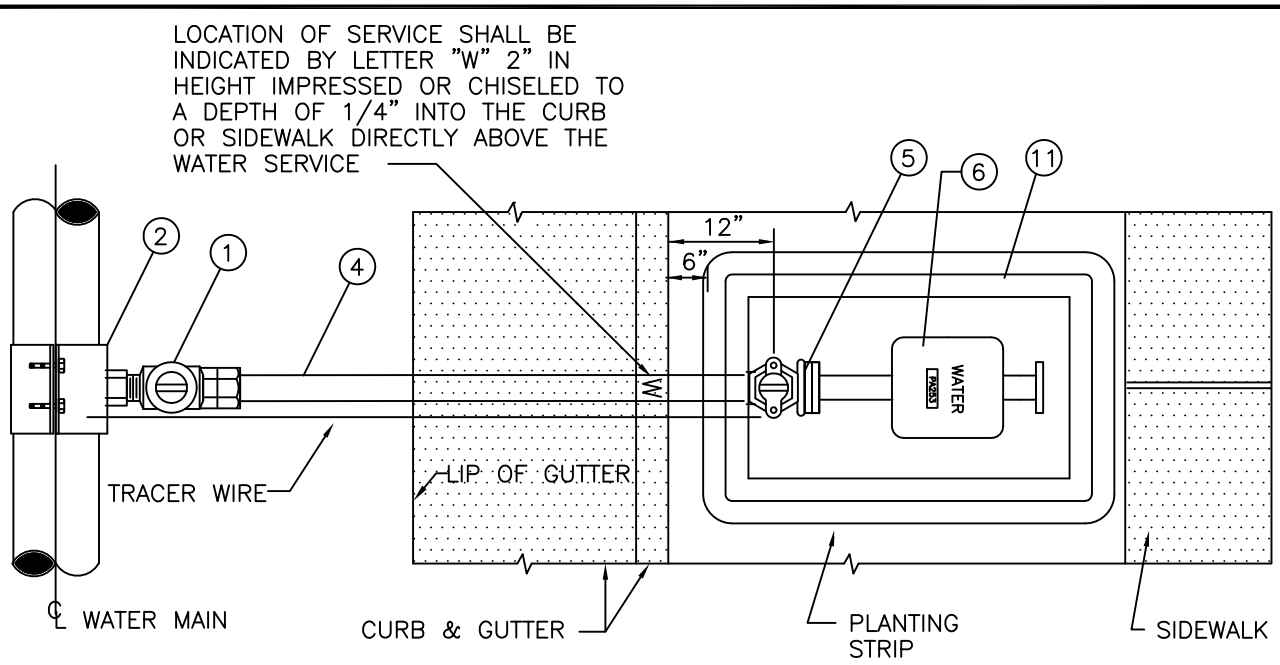
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-01B

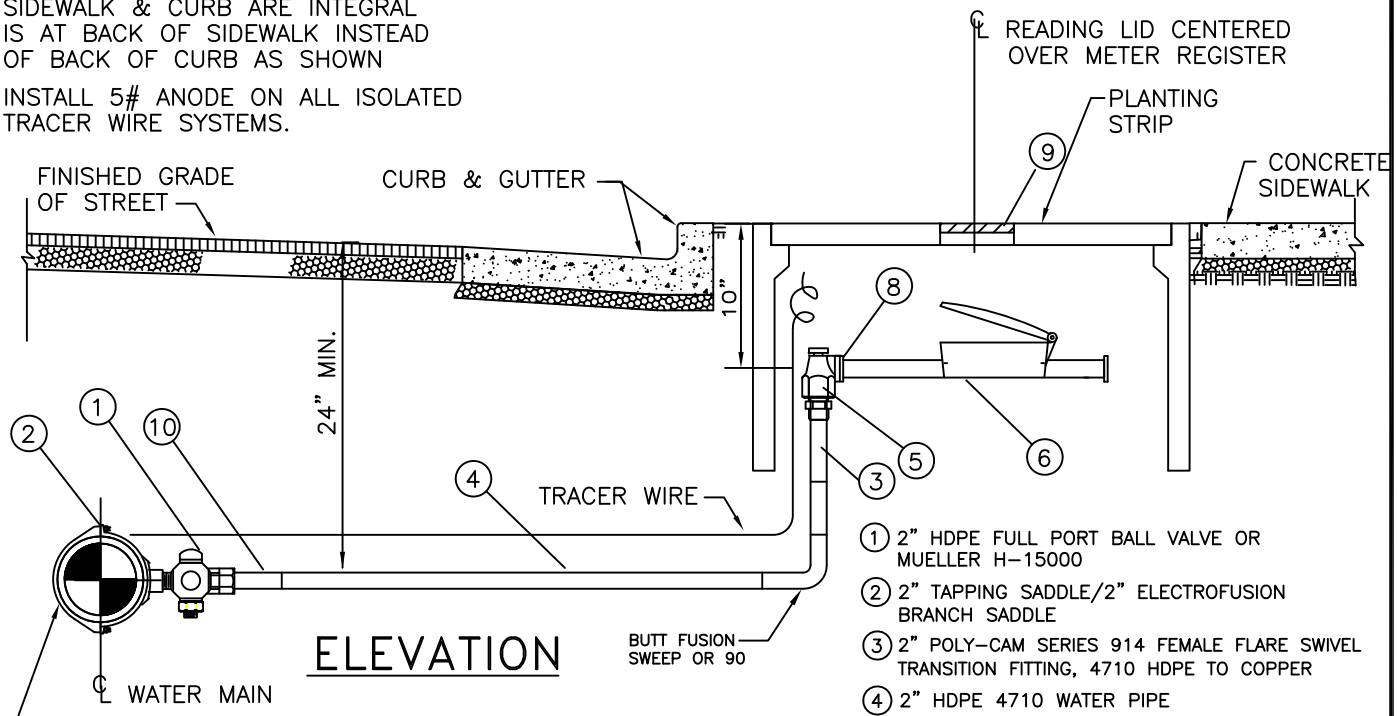
APPENDIX B



PLAN

NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.



ELEVATION

TAPPING SADDLE SHALL BE DOUBLE BRONZE STRAPPED MUELLER H-16100 SERIES FOR ALL MAINS EXCEPT PVC & HDPE MAINS. FOR PVC USE MUELLER H-13000 SERIES. FOR HDPE USE 2" ELECTROFUSION BRANCH SADDLE.

METER	LAY LENGTH
1-1/2"	13"
2"	17"

1. 2" HDPE FULL PORT BALL VALVE OR MUELLER H-15000
2. 2" TAPPING SADDLE/2" ELECTROFUSION BRANCH SADDLE
3. 2" POLY-CAM SERIES 914 FEMALE FLARE SWIVEL TRANSITION FITTING, 4710 HDPE TO COPPER
4. 2" HDPE 4710 WATER PIPE
5. 2" ANGLE METER STOP, MUELLER H-14276
6. BADGER MODEL E-1-1/2" OR E-2" ULTRASONIC METER.
8. 1-1/2" X 2" BUSHING FOR 1-1/2" MTR
9. METER BOX W/READING LID. 1324 BOX FOR 1-1/2" MTR & 1730 BOX FOR 2" MTR. METER BOX & LID SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

	BY	DATE
DRAWN	R.E.	8/09
CHECKED	R.E.	8/09
REVIEWED	R.E.	8/09

2" HDPE WATER SERVICE WITH 1-1/2" OR 2" BADGER E MTR STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

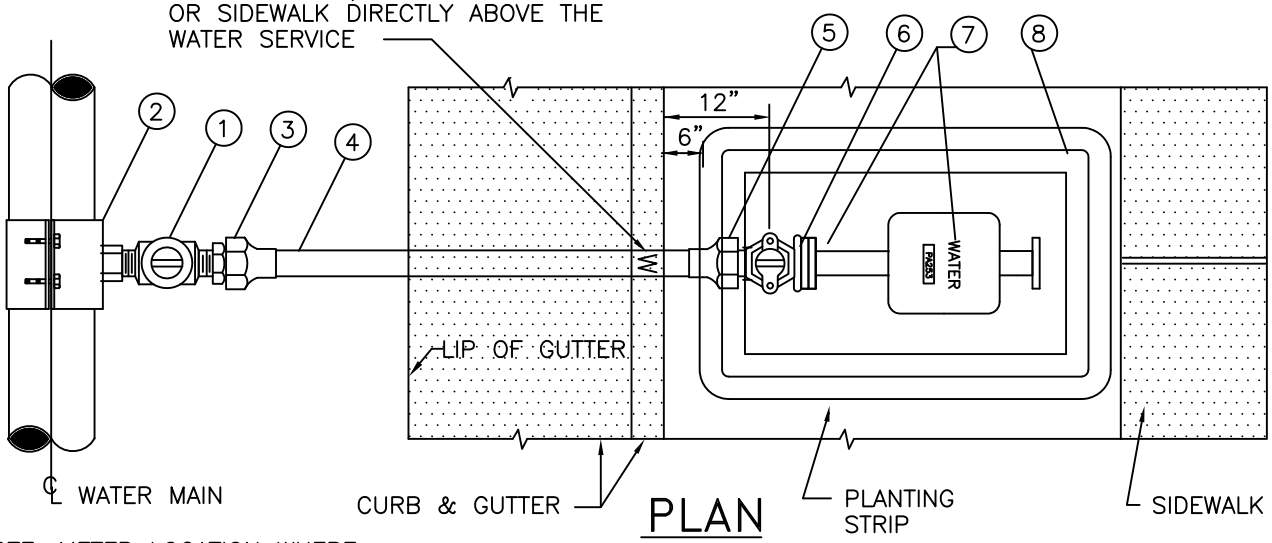
EDWARD WU
WGW ENGINEERING MANAGER
52944
R.E. NO.

REVISION: JAN 31, 2013

SCALE: NONE

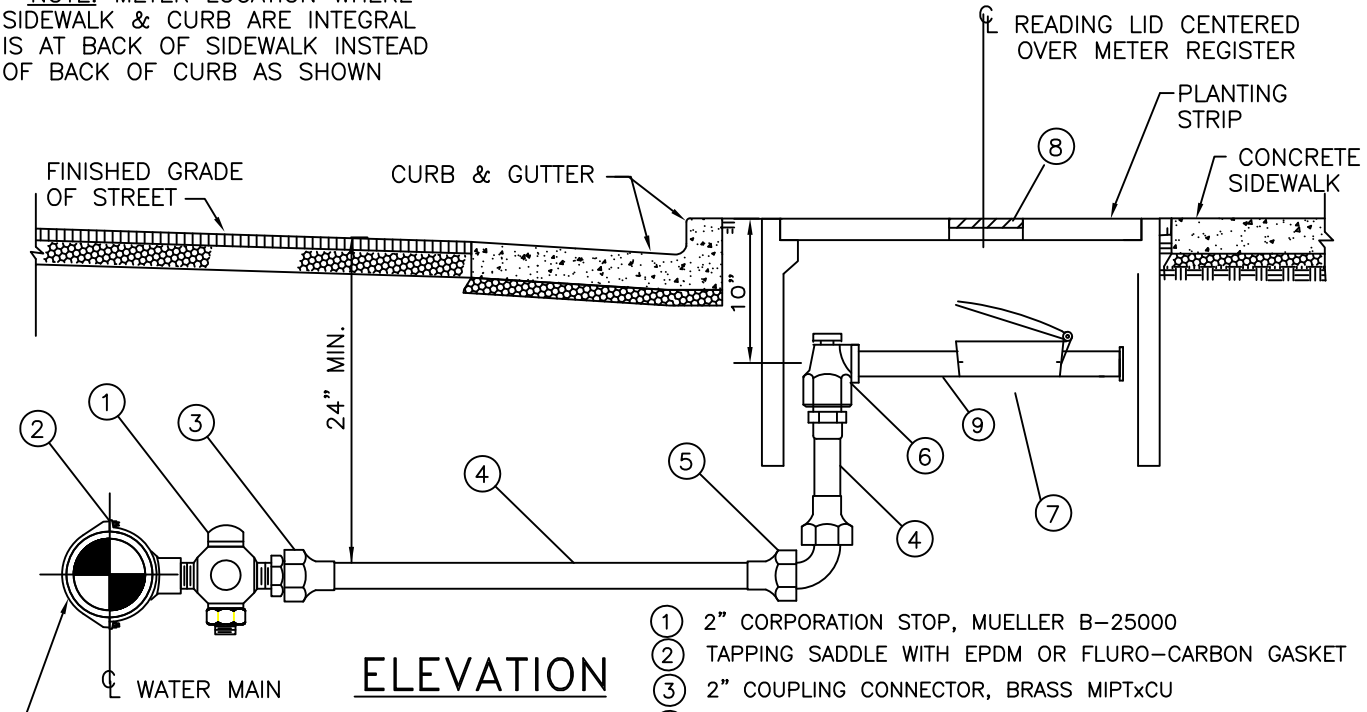
DWG. NO. STD. WD-02A

APPENDIX B



PLAN

* NOTE: METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN



ELEVATION

TAPPING SADDLE SHALL BE MUELLER H-16100 SERIES DOUBLE BRONZE STRAPPED FOR ALL MAINS EXCEPT PVC MAINS. FOR PVC USE MUELLER H-13000 SERIES.

1. 2" CORPORATION STOP, MUELLER B-25000
2. TAPPING SADDLE WITH EPDM OR FLURO-CARBON GASKET
3. 2" COUPLING CONNECTOR, BRASS MIPTxCU
4. 2" COPPER PIPE TYPE "K"
5. 2" – 90° ELL, BRASS
6. 2" ANGLE METER STOP, MUELLER H-14276
7. BADGER MODEL E-1-1/2" OR E-2" ULTRASONIC METER
8. 1-1/2" X 2" BUSHING FOR 1-1/2" MTR
9. METER BOX W/READING LID. 1324 BOX FOR 1-1/2" MTR & 1730 BOX FOR 2" MTR. METER BOX AND LID SHALL HAVE MIN. TIER 5 RATING FOR SW & PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

	BY	DATE
DRAWN	R.E.	8/09
CHECKED	R.E.	8/09
REVIEWED	R.E.	8/09

2" COPPER WATER SERVICE & 1-1/2" OR 2" BADGER E METER STANDARD DETAIL
ONLY FOR CONTAMINATED SOIL AREAS

CITY OF PALO ALTO, CALIFORNIA

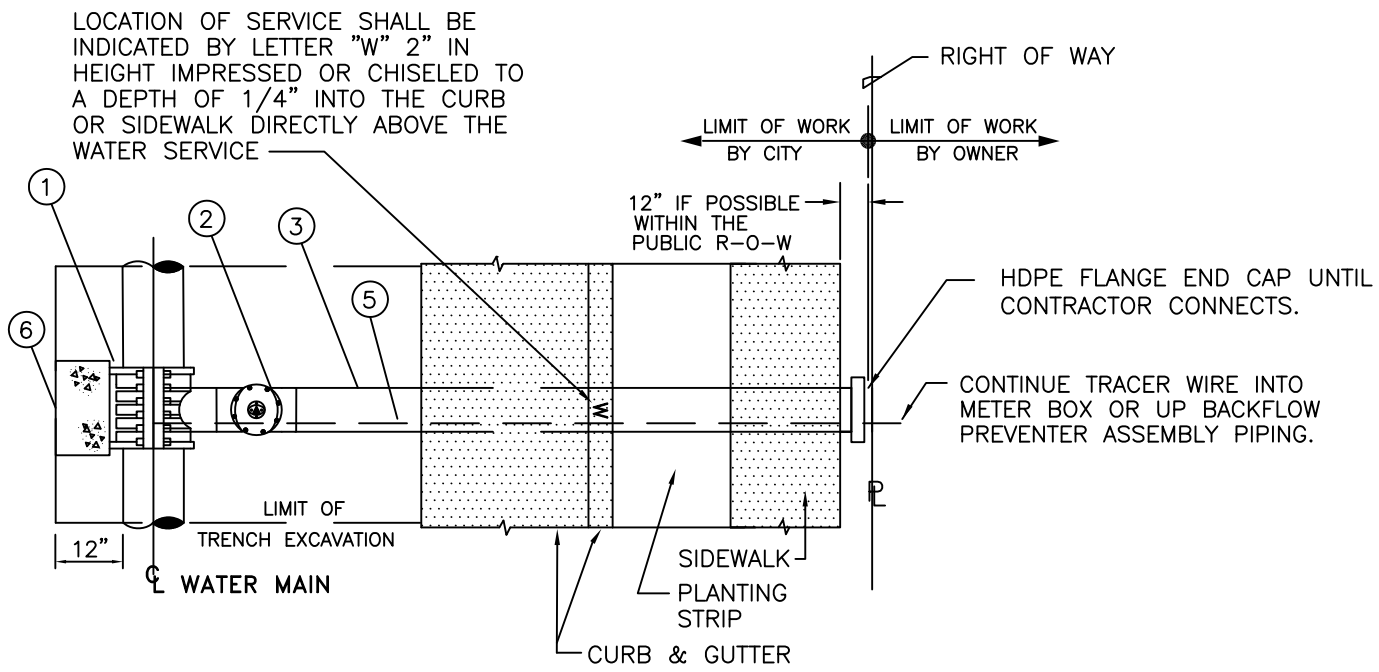
APPROVED: JANUARY, 31 2013
EDWARD WU, WGW ENGINEERING MANAGER, 52944 R.E. NO.

REVISION: JAN 31, 2013

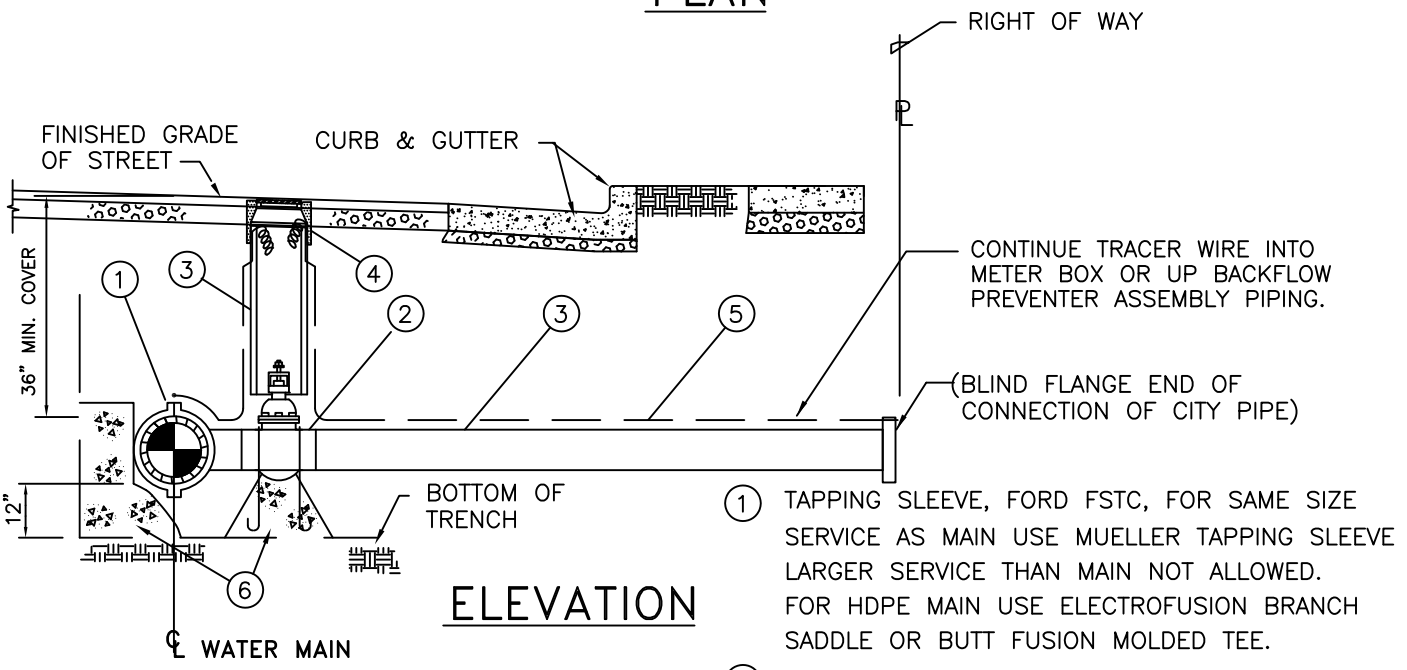
SCALE: NONE

DWG. NO. STD. WD-02B

APPENDIX B



PLAN



ELEVATION

NOTES:

1. METER AND REDUCED PRESSURE PRINCIPLE ASSEMBLY REQUIRED FOR DOMESTIC AND IRRIGATION CONNECTIONS
2. REDUCED PRESSURE DETECTOR REQUIRED FOR FIRE SERVICE
3. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

(1) TAPPING SLEEVE, FORD FSTC, FOR SAME SIZE SERVICE AS MAIN USE MUELLER TAPPING SLEEVE LARGER SERVICE THAN MAIN NOT ALLOWED. FOR HDPE MAIN USE ELECTROFUSION BRANCH SADDLE OR BUTT FUSION MOLDED TEE.

(2) AVK GATE VALVE WITH PE ENDS. USE MUELLER VALVE FOR TAPPING IF DIRECTED TO BY CPAU.

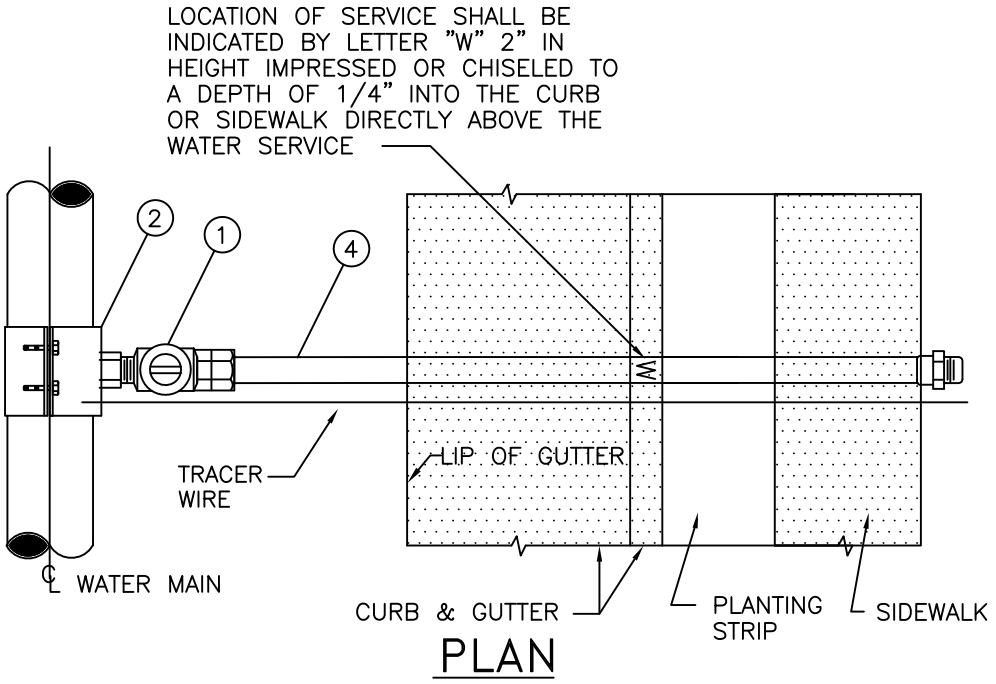
(3) 4710 HDPE SDR 11 PIPE

(4) STANDARD TRAFFIC VALVE BOX WITH H-20 RATED LID

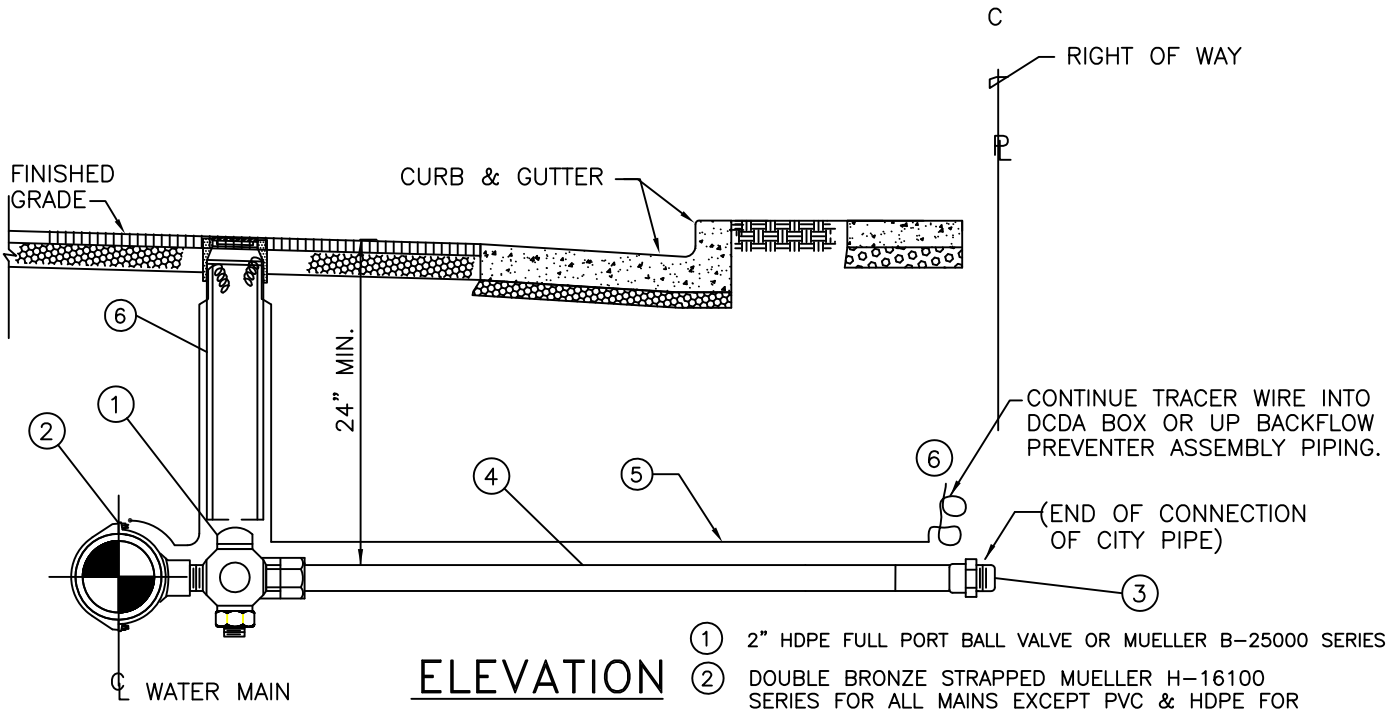
(5) TRACER WIRE #10 CU, SOLID BLUE

(6) CONCRETE THRUST BLOCK, SEE STD. WD-19 FOR SIZE

	BY	DATE			
DRAWN	J.J.	8/92	4" THRU 10" HDPE PIPE DOMESTIC & FIRE SERVICE CONNECTION STANDARD DETAIL	APPROVED: JANUARY, 31 2013 Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	SCALE: NONE
CHECKED	RE	12/09			DWG. NO. STD. WD-03A
REVIEWED	R.E.	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



PLAN



ELEVATION

1. 2" HDPE FULL PORT BALL VALVE OR MUELLER B-25000 SERIES
2. DOUBLE BRONZE STRAPPED MUELLER H-16100 SERIES FOR ALL MAINS EXCEPT PVC & HDPE FOR PVC USE MUELLER H-13000 SERIES. FOR HDPE USE ELECTROFUSION BRANCH SADDLE.
3. 2" POLY-CAM SERIES 911 MALE FLARE TRANSITION FITTING, 4710 HDPE TO COPPER WITH CAP
4. 2" HDPE WATER PIPE
5. TRACER WIRE #10 CU, SOLID BLUE
6. STANDARD TRAFFIC VALVE BOX WITH H-20 RATED LID

NOTES:

1. REDUCED PRESSURE DETECTOR ASSEMBLY REQUIRED FOR COMMERCIAL AND SINGLE FAMILY HOMES WITH SPECIAL HAZARD
2. DOUBLE CHECK DETECTOR OK WITH PRIOR APPROVAL FOR SINGLE FAMILY HOME FS
3. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

	BY	DATE
DRAWN	R.E.	8/09
CHECKED	R.E.	8/09
REVIEWED	R.E.	8/09

2" DEDICATED FIRE SERVICE CONNECTION STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

Edward Wu 52944

EDWARD WU R.E. NO.

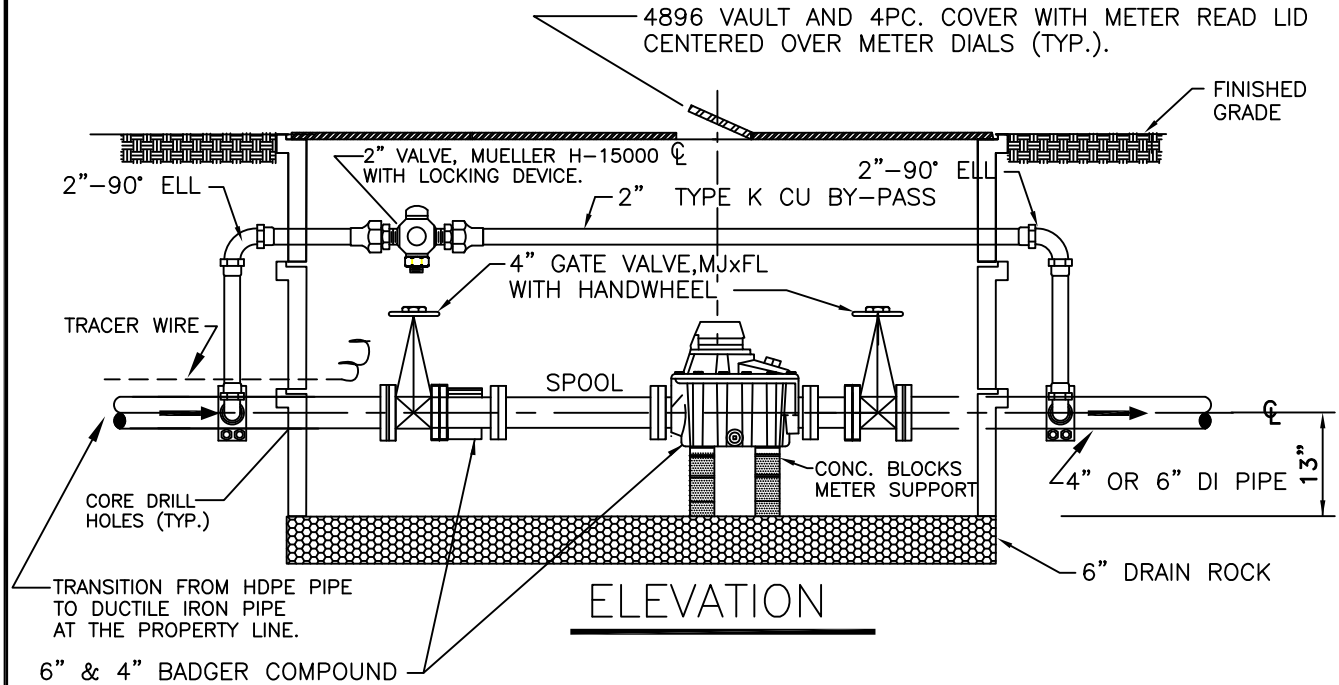
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

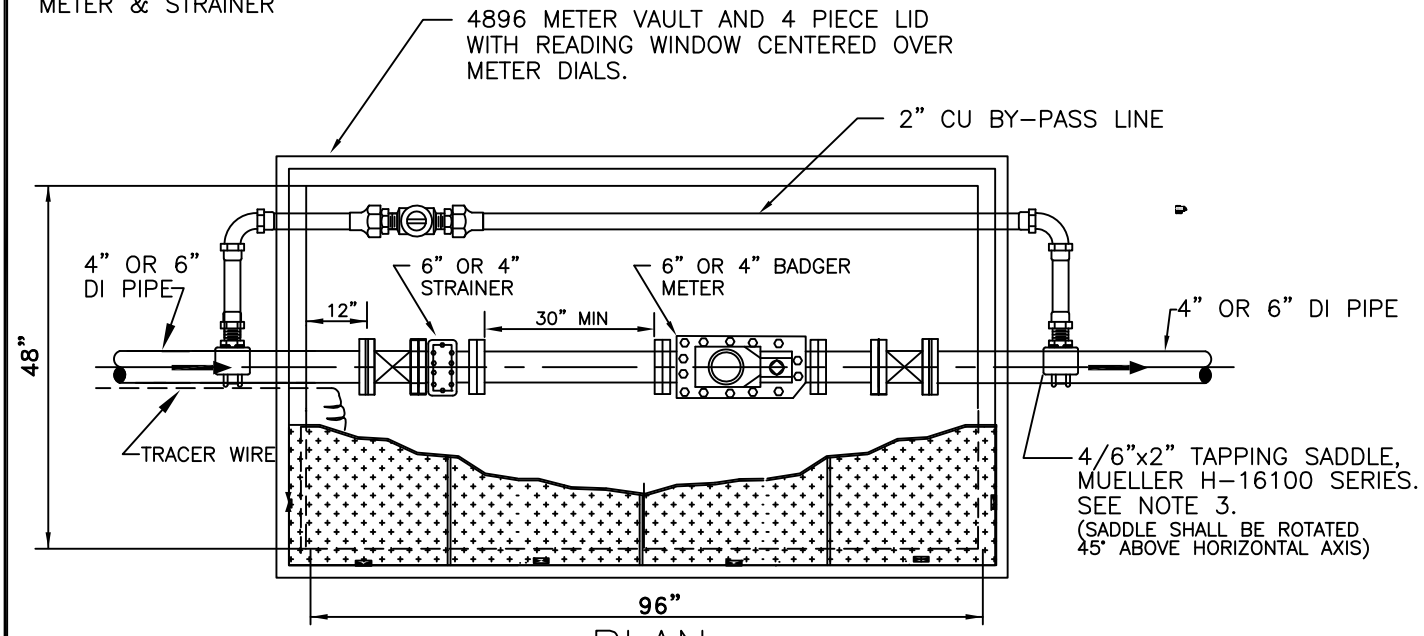
SCALE: NONE

DWG. NO. STD. WD-03B

APPENDIX B



ELEVATION



PLAN

NOTES:

1. FOR WATER CONNECTION TO MAIN, SEE STANDARD DETAIL STD. WD-03
2. GATE VALVES SHALL BE MUELLER RESILIENT SEAT WITH EPOXY COATED IRON BODY AND MODIFIED WEDGE DISK.
3. BYPASS LINE SERVICE SADDLE CLAMPS FOR PVC LINE SERVICE SHALL BE MUELLER H-13000 SERIES.
4. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.
5. METER READ LID SHALL BE CENTERED OVER METER DIALS.
6. WATER METERS SHALL NOT BE INSTALLED MORE THAN 4 FEET DEEP. BADGER READ-O-MATIC SHALL BE INSTALLED FOR METERS THAT ARE MORE THAN 3 FEET DEEP.
7. CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE AND CITY SPECIFICATIONS.
8. VAULT SHALL BE LOCATED ON PRIVATE PROPERTY NEXT TO THE PROPERTY LINE IN A PUBLIC UTILITY EASEMENT
9. VAULT & LID SHALL HAVE MIN. TIER 5 RATING FOR LANDSCAPE AREAS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

	BY	DATE
DRAWN	RE	12/09
CHECKED	R.E.	12/09
REVIEWED	R.E.	12/10

6" & 4" WATER METER SET WITH 2" BY-PASS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

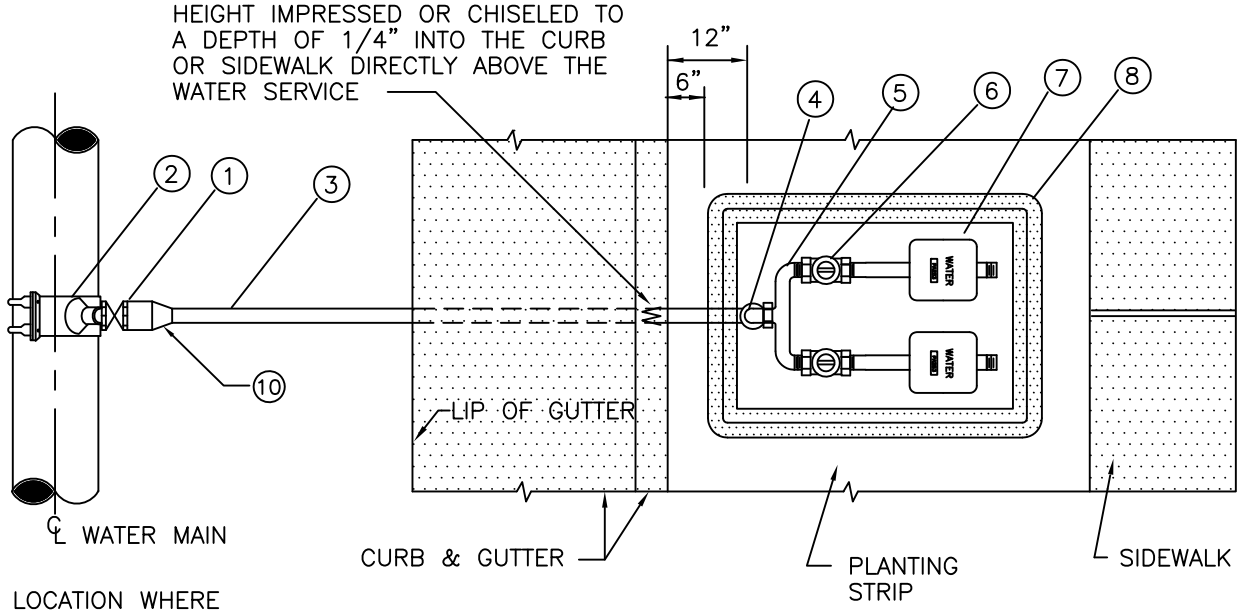
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-05

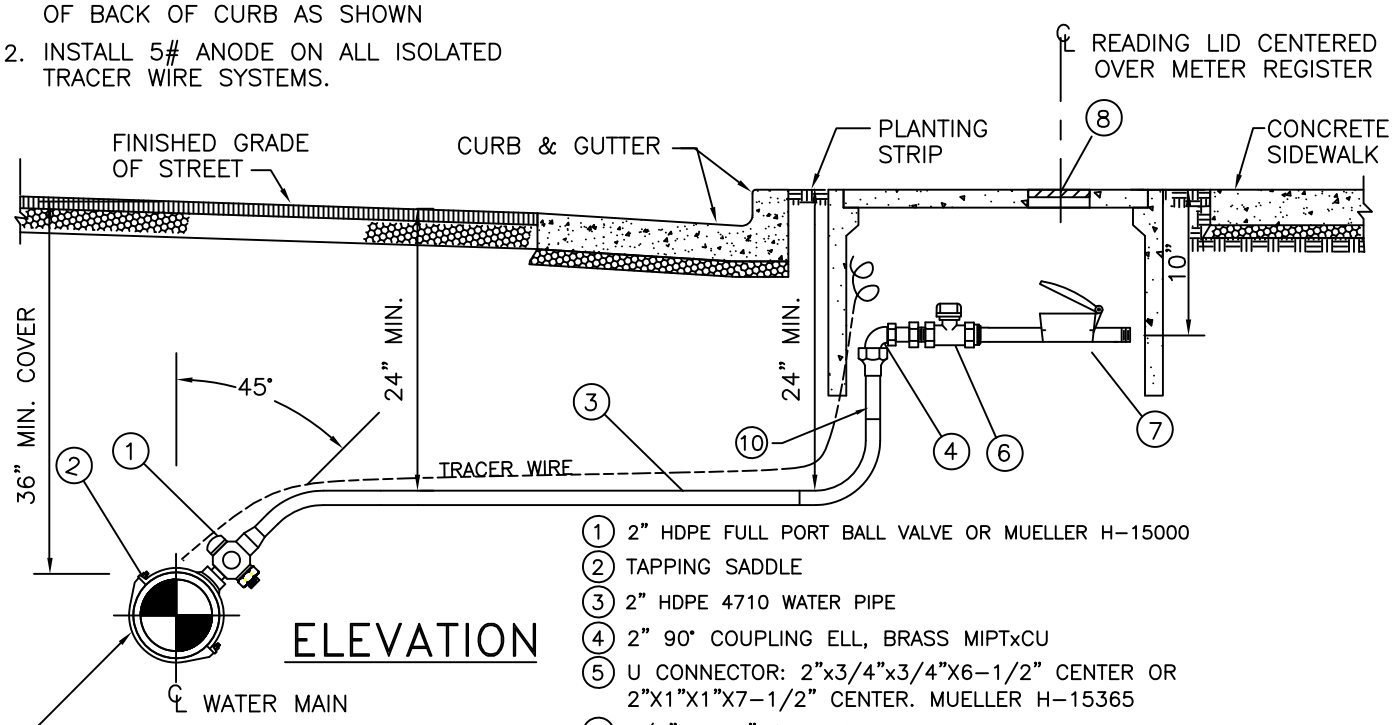
APPENDIX B



NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

PLAN



ELEVATION

TAPPING SADDLE SHALL BE DOUBLE BRONZE STRAPPED MUELLER H-16100 SERIES FOR ALL MAINS EXCEPT PVC & HDPE MAINS. FOR PVC USE MUELLER H-13000 SERIES. FOR HDPE USE ELECTROFUSION BRANCH SADDLE.

1. 2" HDPE FULL PORT BALL VALVE OR MUELLER H-15000
2. TAPPING SADDLE
3. 2" HDPE 4710 WATER PIPE
4. 2" 90° COUPLING ELL, BRASS MIPTxCU
5. U CONNECTOR: 2"x3/4"x3/4"X6-1/2" CENTER OR 2"X1"X1"X7-1/2" CENTER. MUELLER H-15365
6. 3/4" OR 1" CURB STOP, MUELLER H-14342
7. 5/8"x3/4" OR 1" BADGER E METER
8. METER BOX W/ READING LID, 1820 METER BOX FOR 5/8" METERS 2424 METER BOX FOR 1" METERS, BOX & LID SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICTIONS. NOT TO BE INSTALL IN STREET
10. POLY-CAM SERIES 914 TRANSITION FITTING

	BY	DATE
DRAWN	J.J.	2/92
CHECKED	RE	12/09
REVIEWED	R.E.	12/10

2" HDPE WATER SERVICE WITH TWO 5/8" OR 1" METERS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

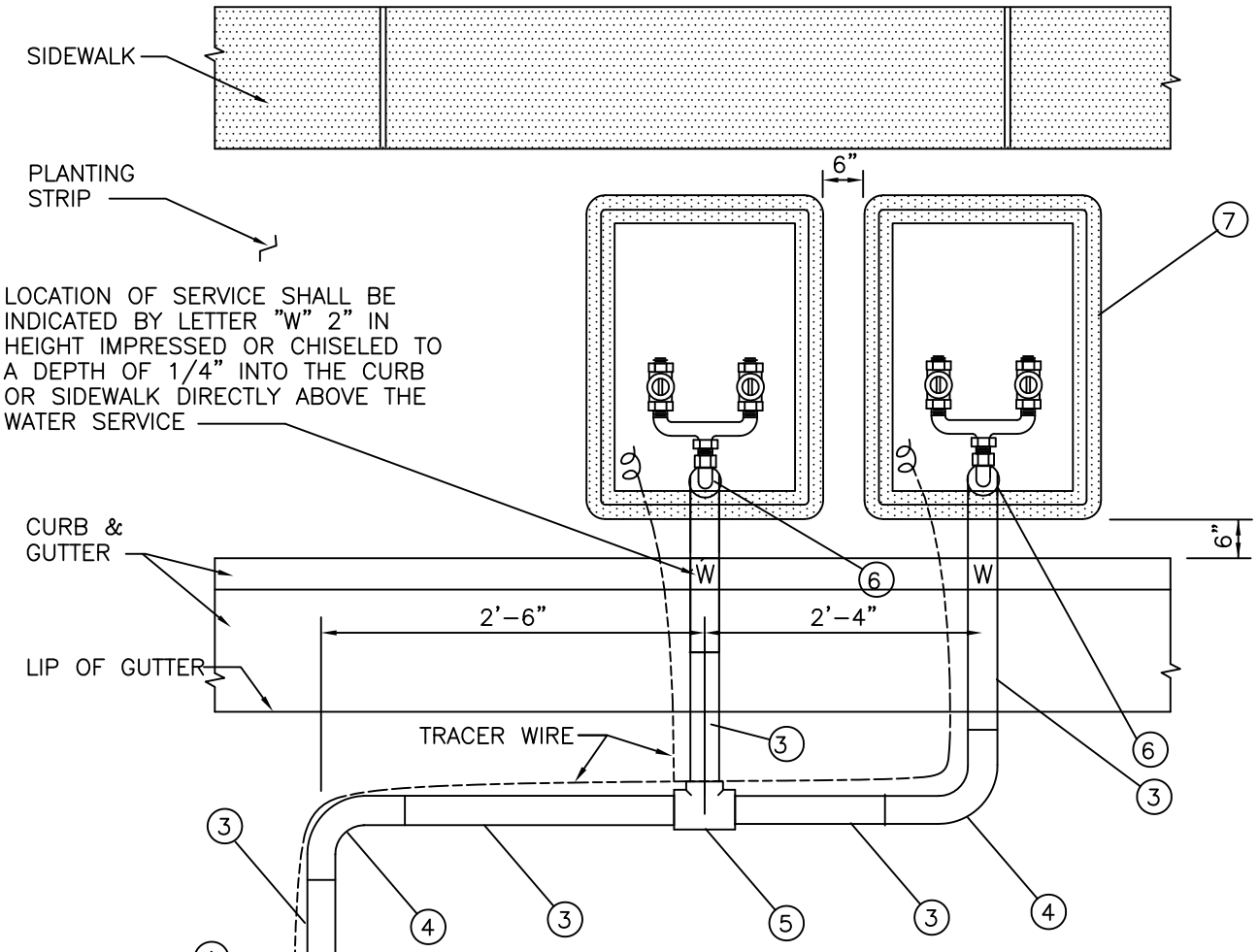
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-06

APPENDIX B



PLAN

1. 2" 4710 HDPE FULL PORT BALL VALVE
2. TAPPING SADDLE
3. 2" 4710 SDR 9 HDPE PIPE
4. 2" – 90° HDPE ELL
5. 2" HDPE TEE,
6. POLY–CAM SERIES 914 TRANSITION FITTING
7. SEE STD. DWG. WD–01 THROUGH WD–06 FOR WATER METER LAYOUTS.

NOTES:

1. METER LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

	BY	DATE
DRAWN	RE	12/09
CHECKED	RE	12/09
REVIEWED	GS	12/10

2" HDPE WATER SERVICE MANIFOLD WITH TWO OR MORE METERS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

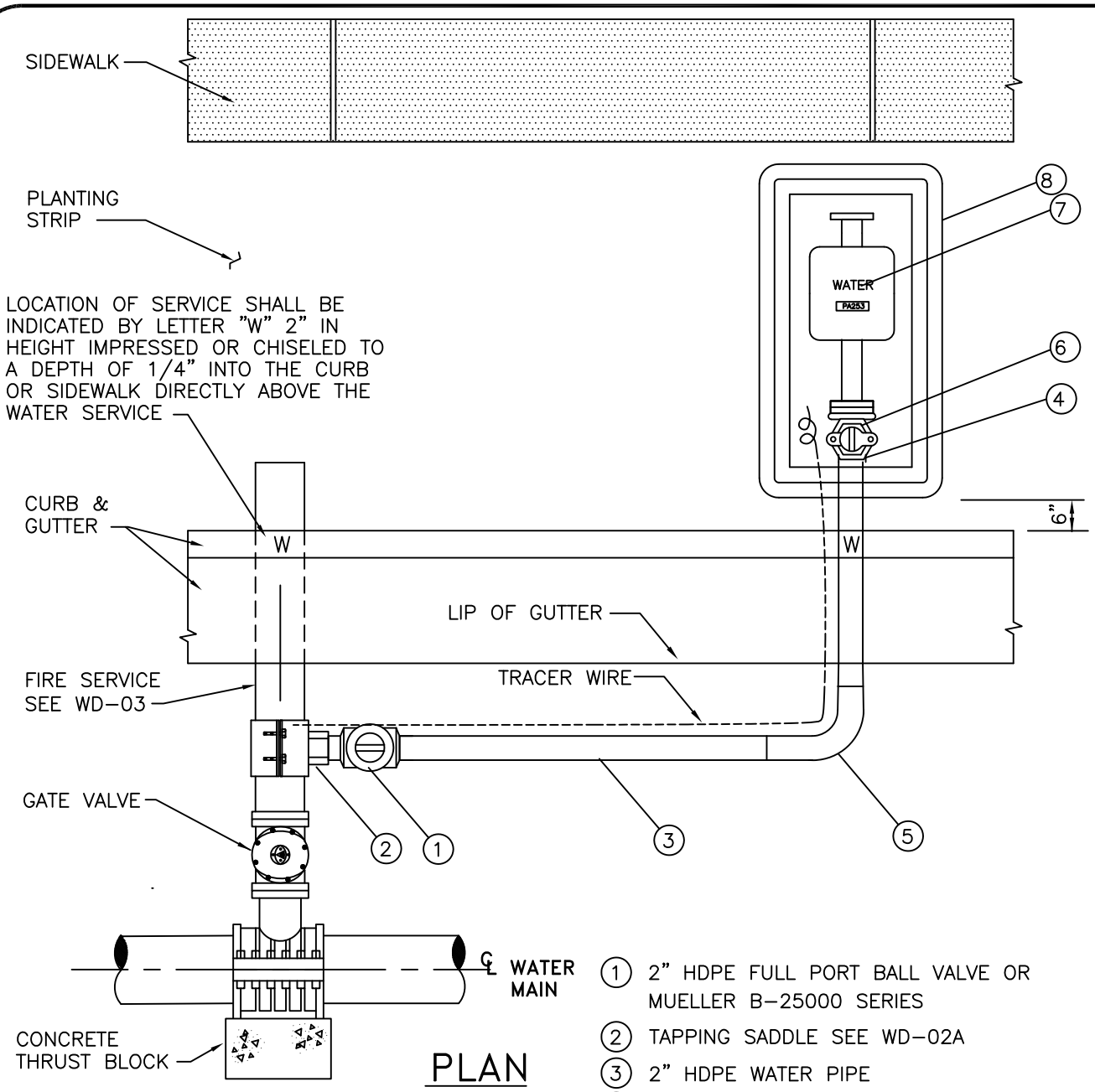
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD–07

APPENDIX B



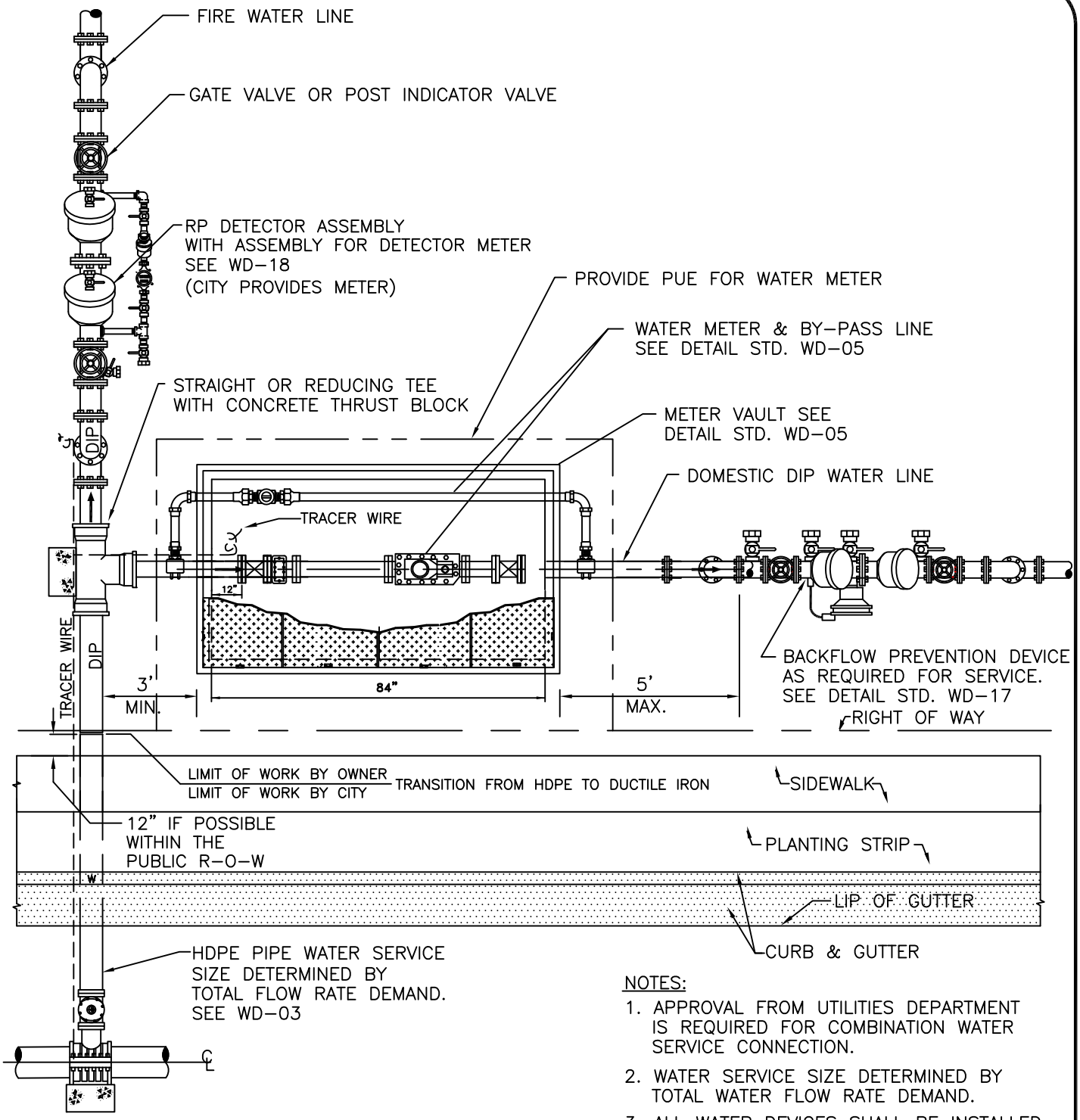
PLAN

NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR TAPPING TO FIRE SERVICE.
2. COMBINATION WATER SERVICE SIZE IS DETERMINED BY TOTAL WATER FLOW DEMAND.
3. METER LOCATION WHERE SIDEWALK AND CURB ARE INTEGRAL IS AT BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN.
4. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

(1) 2" HDPE FULL PORT BALL VALVE OR MUELLER B-25000 SERIES
(2) TAPPING SADDLE SEE WD-02A
(3) 2" HDPE WATER PIPE
(4) POLY-CAM SERIES 914 TRANSITION FITTING
(5) 2" – 90° HDPE ELL OR SWEEP
(6) 2" ANGLE METER STOP, MUELLER H-14276
(7) 2" BADGER WATER E METER
(8) METER BOX WITH READING LID, SEE WD-02A

BY	DATE	2" HDPE WATER SERVICE TAP FIRE SERVICE STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN J.J.	11/93		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD-08
CHECKED RE	12/09			
REVIEWED RE	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION.
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW RATE DEMAND.
3. ALL WATER DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.
4. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

PLAN

	BY	DATE
DRAWN	J.J.	9/92
CHECKED	RE	12/09
REVIEWED	RE	12/10

COMBINATION FIRE & DOMESTIC WATER SERVICE CONNECTION STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

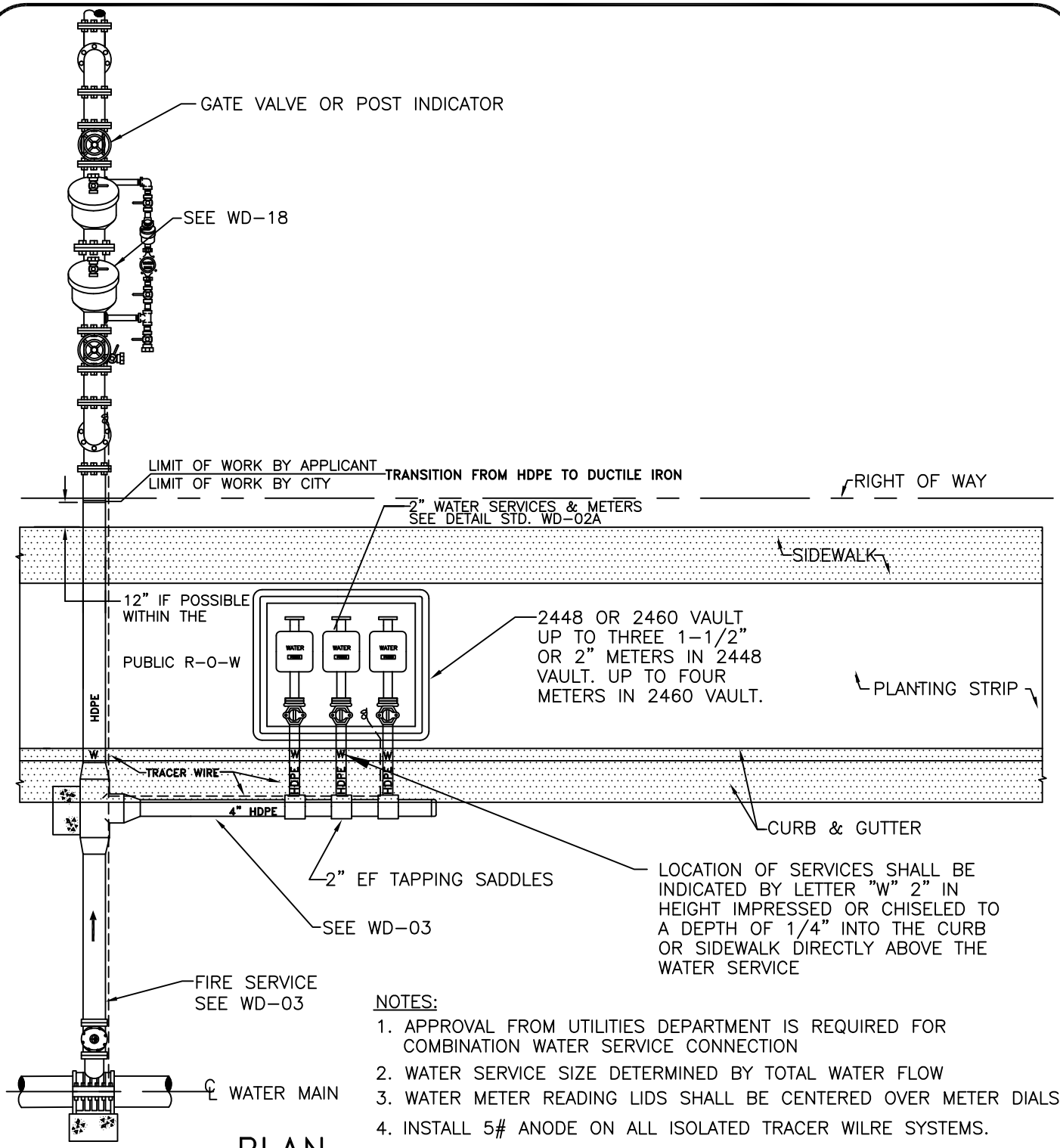
52944 R.E. NO.
EDWARD WU
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-10

APPENDIX B



PLAN

NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW
3. WATER METER READING LIDS SHALL BE CENTERED OVER METER DIALS
4. INSTALL 5# ANODE ON ALL ISOLATED TRACER WILRE SYSTEMS.
5. METER BOX AND LIDS SHALL HAVE MINIMUM TIER 5 RATING FOR SIDEWALK AND PLANTING STRIP APPLICATIONS AND MINIMUM TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET
6. CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE AND CITY SPECIFICATIONS.

	BY	DATE
DRAWN	R.E.	6/97
CHECKED	R.E.	12/09
REVIEWED	RE	12/10

COMBINATION FIRE & DOMESTIC WATER SERVICE CONNECTION WITH TWO OR MORE METERS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

52944
R.E. NO.

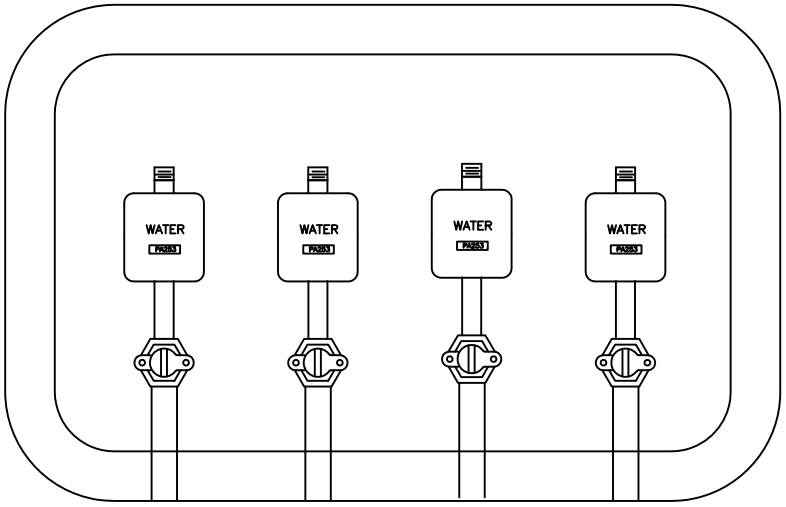
EDWARD WU
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

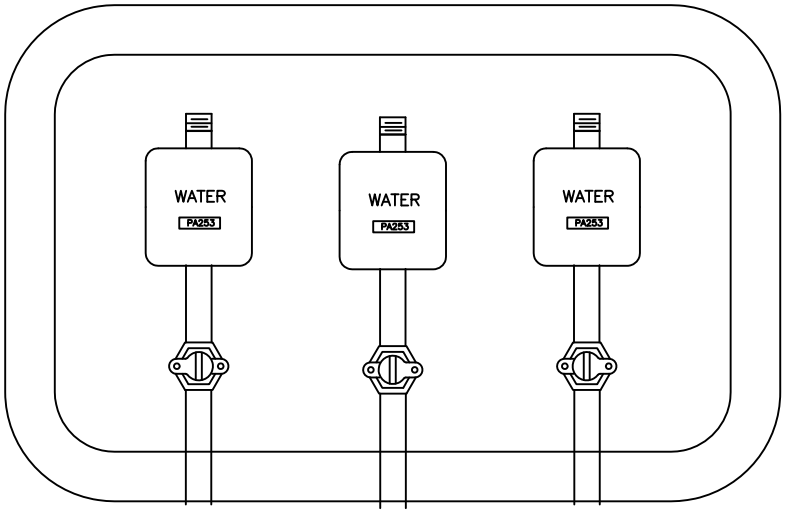
SCALE:
NONE

DWG. NO.
STD. WD-11

APPENDIX B



1730 FLARED BOX WITH FOUR 5/8x3/4 BADGER E METERS



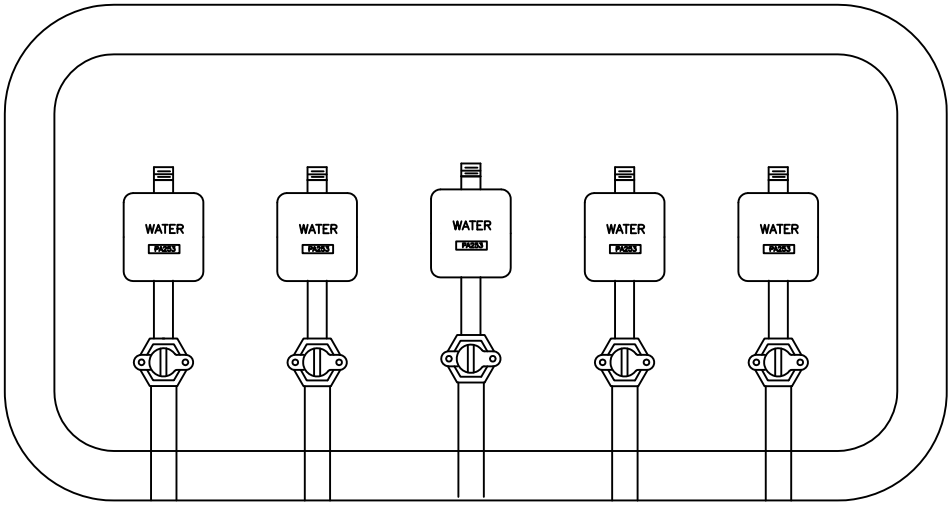
1730 FLARED BOX WITH THREE 1" BADGER E METERS

PLAN

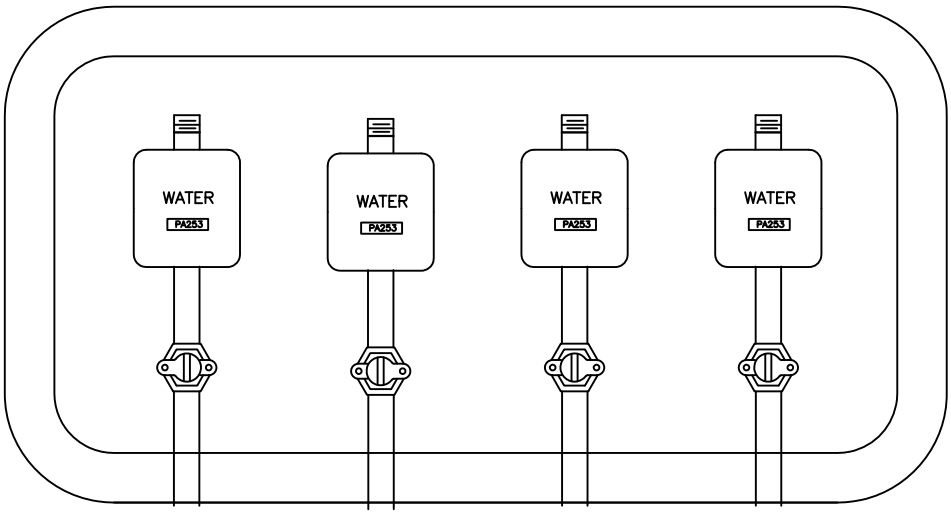
NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION.
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW RATE DEMAND.
3. WATER METER READING LID SHALL BE CENTERED OVER EACH METER DIAL.
4. ALL BACKFLOW PREVENTION DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.
5. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.
6. METER BOX & LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET
7. CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE AND CITY SPECIFICATIONS.

	BY	DATE			
DRAWN	R.E.	6/97	1730 BOX WITH MULTIPLE 1" OR 5/8" WATER METERS STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	R.E.	12/09		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WD-12A
REVIEWED	RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



2448 OR 2460 VAULT. FIVE 5/8" BADGER E METERS
FOR A 2448 VAULT AND SIX METERS FOR A 2460 VAULT



2448 OR 2460 VAULT. FOUR 1" BADGER E METERS
FOR A 2448 VAULT AND FIVE METERS FOR A 2460 VAULT

PLAN

NOTES:

1. APPROVAL FROM UTILITIES DEPARTMENT IS REQUIRED FOR COMBINATION WATER SERVICE CONNECTION.
2. WATER SERVICE SIZE DETERMINED BY TOTAL WATER FLOW RATE DEMAND.
3. WATER METER READING LID SHALL BE CENTERED OVER EACH METER DIAL.
4. ALL BACKFLOW PREVENTION DEVICES SHALL BE INSTALLED ON THE OWNER'S PROPERTY.
5. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.
6. METER BOX & LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS & MIN. TIER 22 RATING FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET
7. CUSTOMER TO SUPPLY, INSTALL, AND MAINTAIN VAULT TO GRADE AND CITY SPECIFICATIONS.

	BY	DATE
DRAWN	R.E.	6/97
CHECKED	R.E.	12/09
REVIEWED	RE	12/09

2448 OR 2460 VAULT WITH MULTIPLE 1" OR 5/8" WATER METERS STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

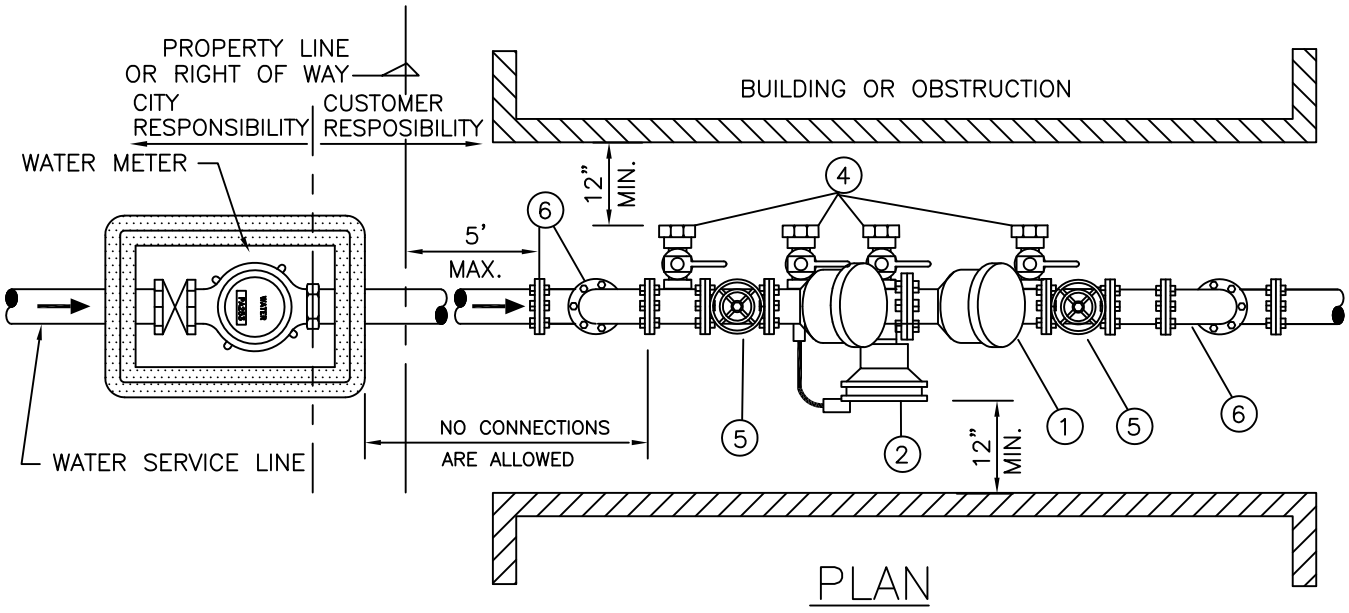
EDWARD WU — 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

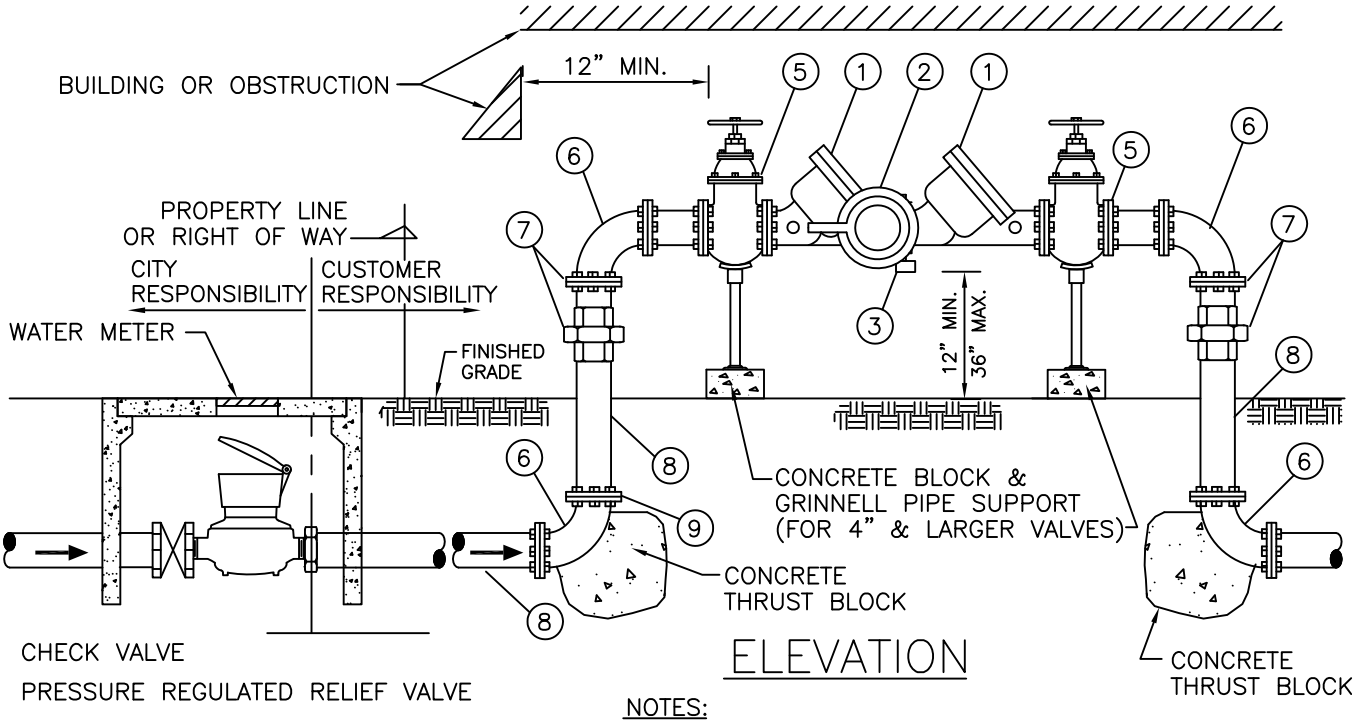
SCALE: NONE

DWG. NO. STD. WD-12B

APPENDIX B



PLAN



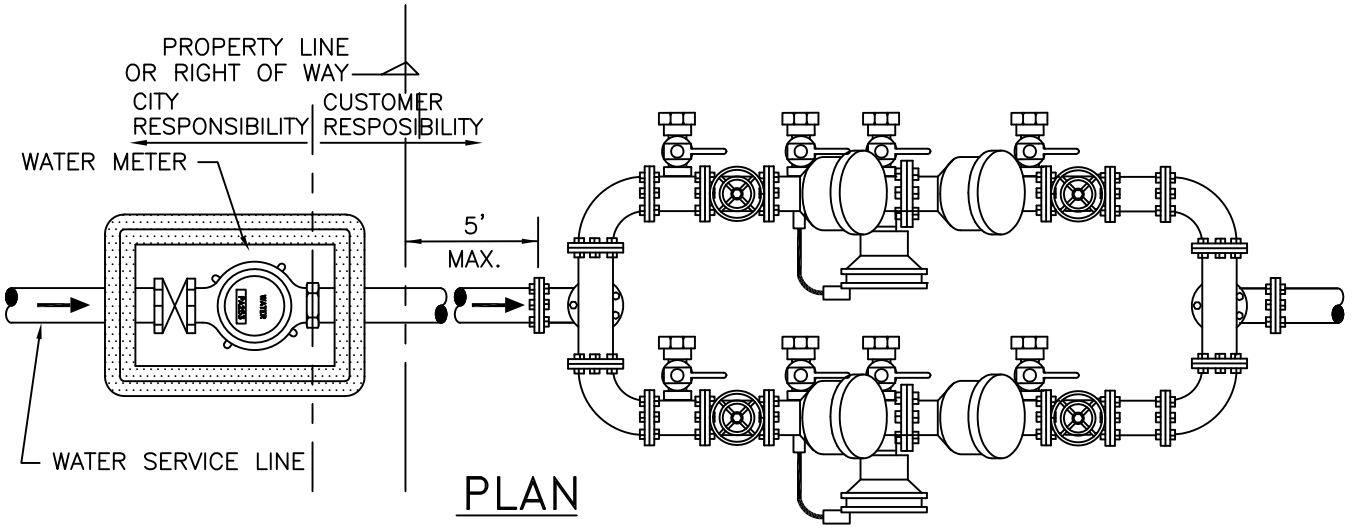
ELEVATION

1. CHECK VALVE
2. PRESSURE REGULATED RELIEF VALVE
3. DUMP OUTLET
4. TEST COCK WITH CAP, 4 REQUIRED
5. GATE VALVE OR BALL VALVE
6. 90° ELBOW
7. FLANGE OR UNION
8. DUCTILE IRON OR COPPER PIPE
9. BURIED JOINTS SHALL BE PLASTIC WRAPPED FLANGE & CORE TEN BOLTS OR MEGALUG

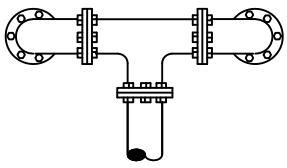
NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

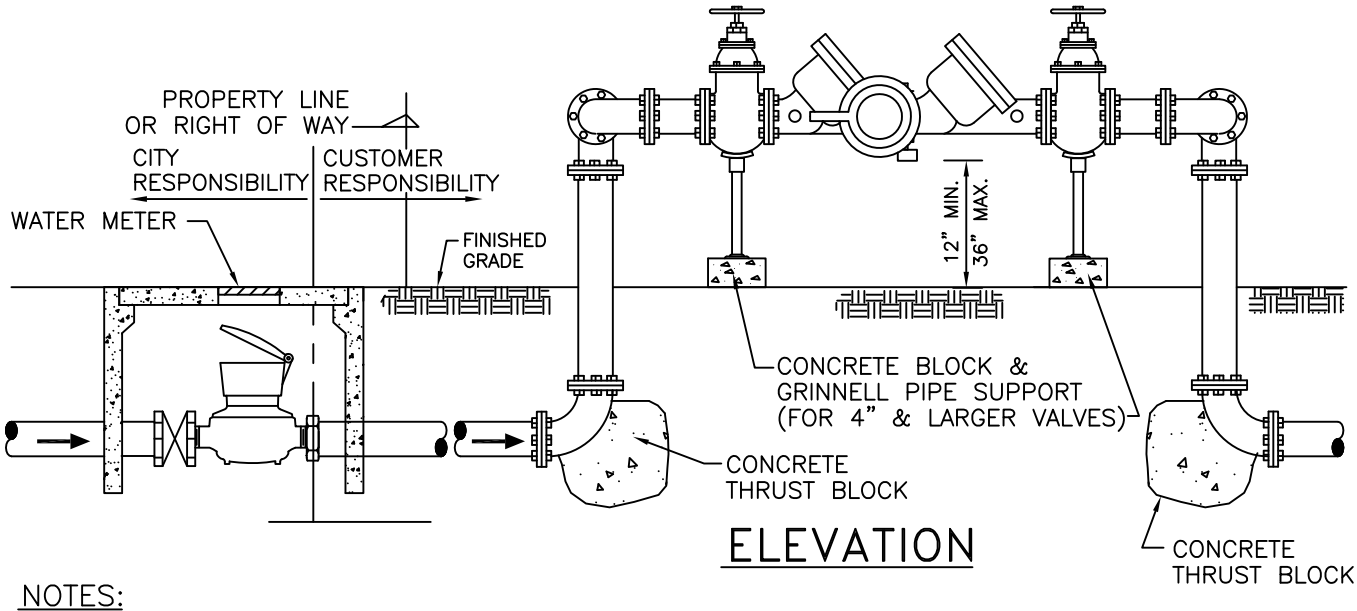
BY	DATE	REDUCED PRESSURE PRINCIPLE ASSEMBLY – RPPA STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN J.J.	8/92		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD-17A
CHECKED J.J.	8/92			
REVIEWED R.E.	1/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



PLAN



END VIEW

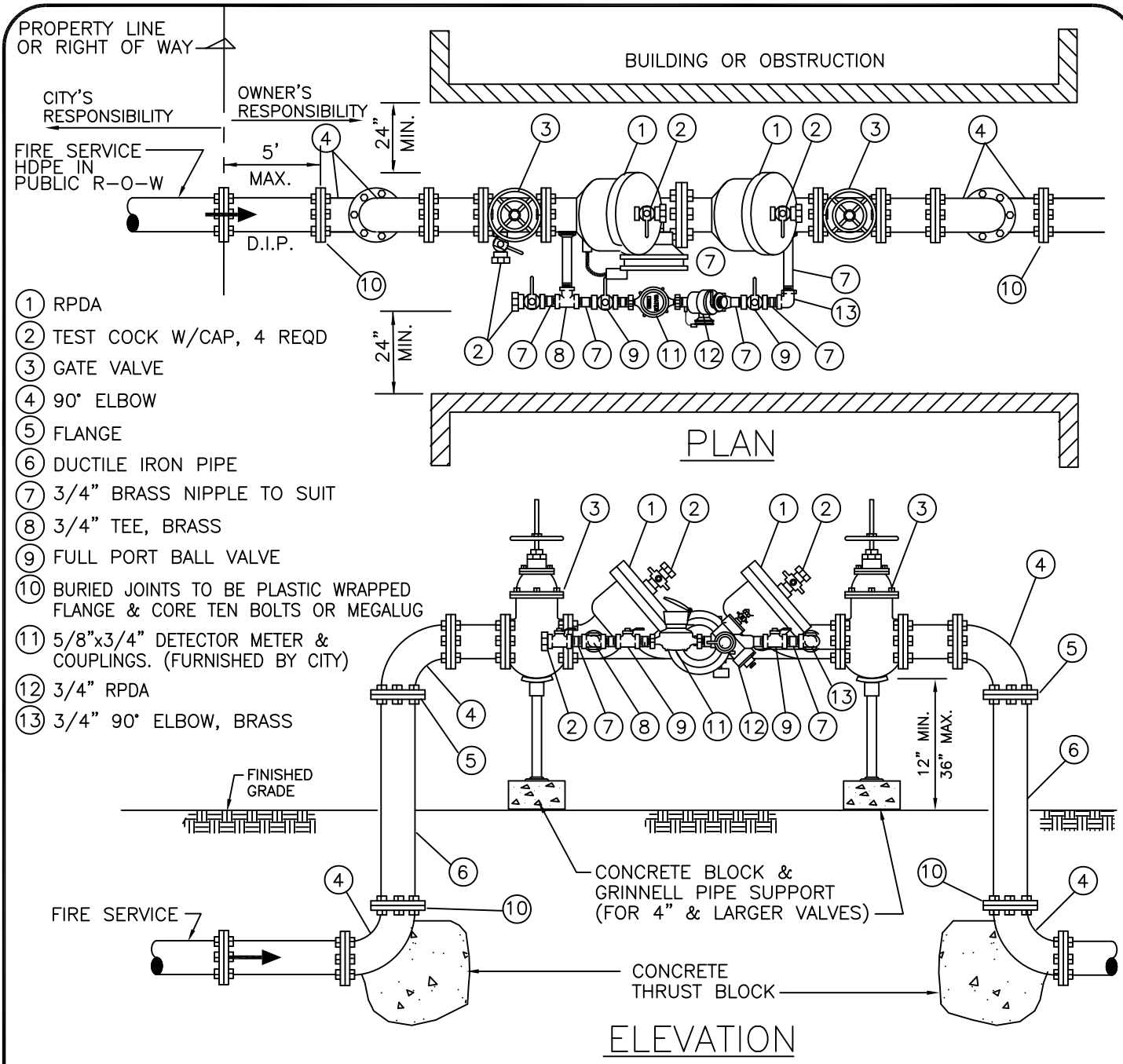


ELEVATION

NOTES:

1. PARALLEL RPPA ASSEMBLIES SHALL BE USED IN ALL LOCATIONS WHERE THE WATER CAN NOT BE INTERRUPTED DURING NORMAL WORKING HOURS.
2. FOR INSTALLATION AND MATERIALS REQUIREMENTS REFER TO DWG. STD WD–17A OF THESE STANDARDS
3. ALL DEVICES SHALL BE APPROVED BY WATER–GAS–WASTEWATER UTILITIES DEPARTMENT.
4. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER.
5. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

	BY	DATE			
DRAWN	R.E.	7/98	PARALLEL REDUCED PRESSURE PRINCIPLE ASSEMBLIES STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	R.E.	7/98		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WD–17B
REVIEWED	RE	1/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



1. RPDA
2. TEST COCK W/CAP, 4 REQD
3. GATE VALVE
4. 90° ELBOW
5. FLANGE
6. DUCTILE IRON PIPE
7. 3/4" BRASS NIPPLE TO SUIT
8. 3/4" TEE, BRASS
9. FULL PORT BALL VALVE
10. BURIED JOINTS TO BE PLASTIC WRAPPED FLANGE & CORE TEN BOLTS OR MEGALUG
11. 5/8"x3/4" DETECTOR METER & COUPLINGS. (FURNISHED BY CITY)
12. 3/4" RPDA
13. 3/4" 90° ELBOW, BRASS

NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.
4. DOUBLE CHECK DETECTOR ASSEMBLIES MAY ONLY BE USED ON EXISTING FIRE SPRINKLER SYSTEMS AND WITH THE PRIOR APPROVAL OF WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.

	BY	DATE
DRAWN	J.J.	9/92
CHECKED	J.J.	9/92
REVIEWED	R.E.	12/10

REDUCED PRESSURE DETECTOR ASSEMBLY (RPDA) FOR AUTOMATIC FIRE SPRINKLER STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

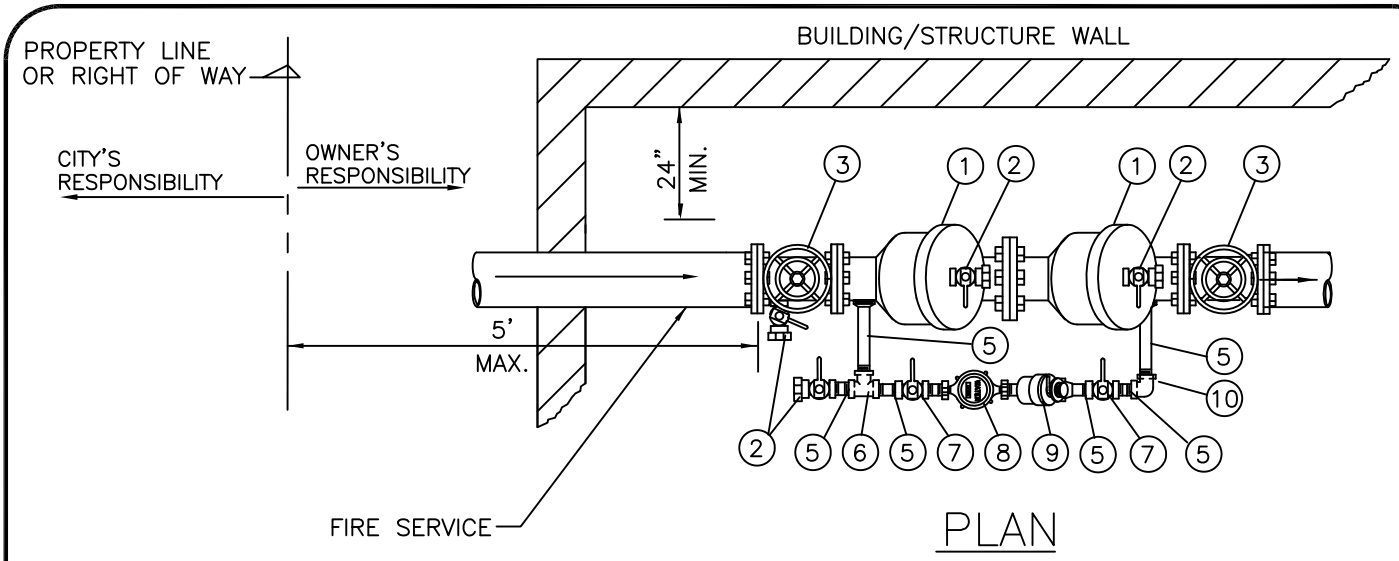
Edward Wu 52944
EDWARD WU R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

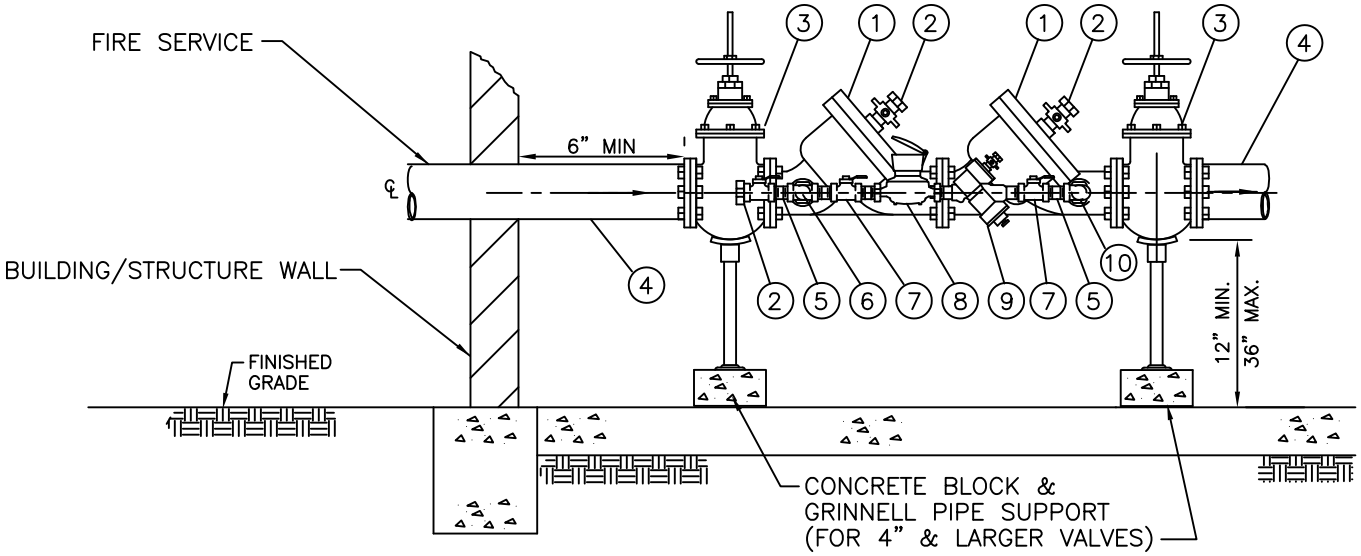
SCALE: NONE

DWG. NO. STD. WD-18A

APPENDIX B



PLAN



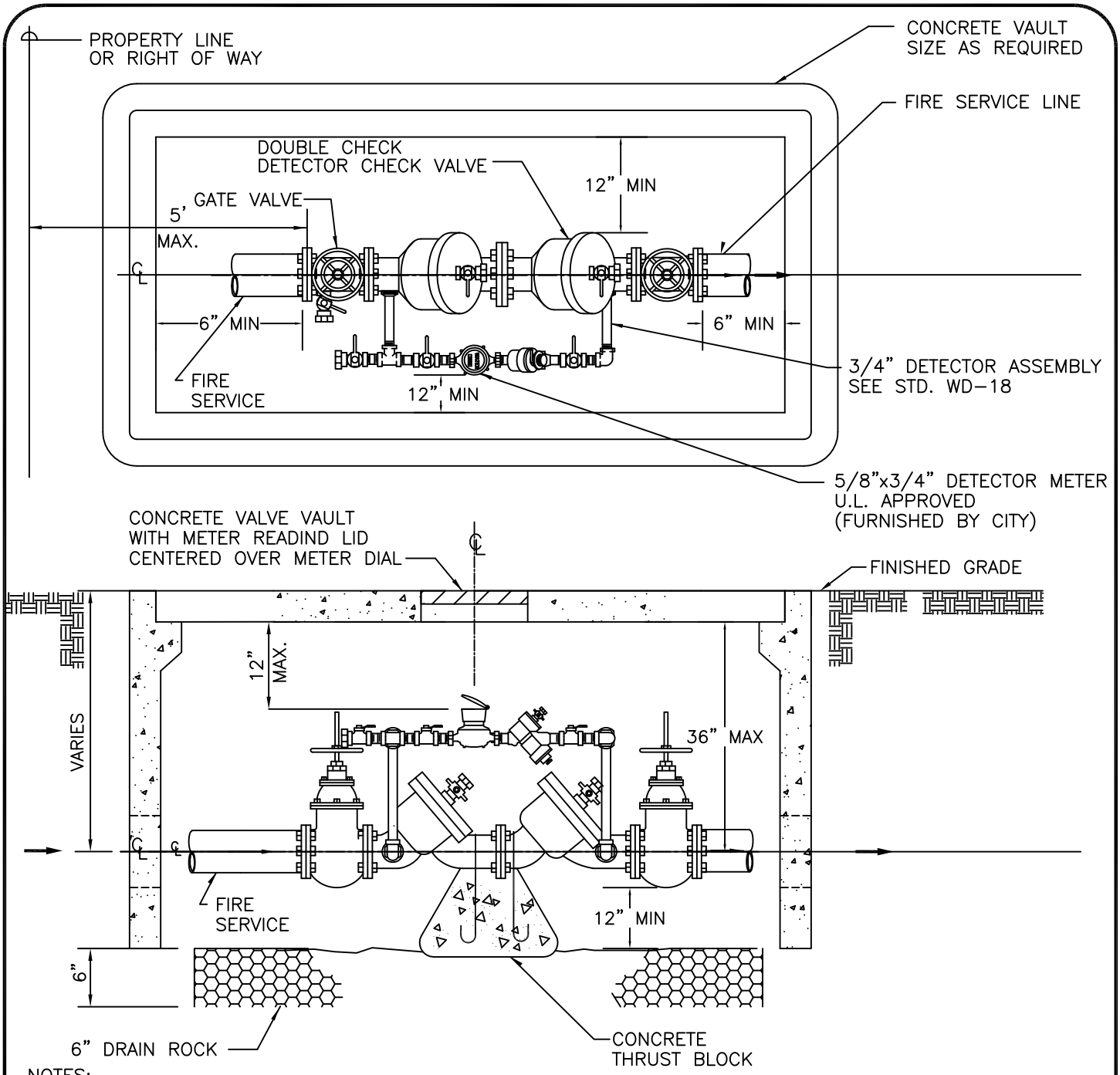
ELEVATION

1. RPDA
2. TEST COCK WITH CAP, 4 REQUIRED
3. GATE VALVE
4. DUCTILE IRON PIPE
5. 3/4" BRASS NIPPLE TO SUIT
6. 3/4" TEE, BRASS
7. FULL PORT BALL VALVE
8. 5/8"x3/4" DETECTOR METER & COUPLINGS. (FURNISHED BY CITY)
9. RPDA
10. 3/4" 90° ELBOW, BRASS

NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

	BY	DATE			
DRAWN	C.W.	10/04	REDUCE PRESSURE DETECTOR ASSEMBLY (RPDA) INSIDE INSTALLATION STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	C.W.	10/04		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD-18B
REVIEWED	R.E.	1/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.
4. DOUBLE CHECK DETECTOR ASSEMBLIES MAY ONLY BE USED ON EXISTING FIRE SPRINKLER SYSTEMS AND WITH THE PRIOR APPROVAL OF WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.

	BY	DATE
DRAWN	J.J.	8/92
CHECKED	J.J.	8/92
REVIEWED	R.E.	1/10

DOUBLE CHECK DETECTOR - DCD VAULT INSTALLATION STANDARD

ONLY FOR EXISTING FIRE SPRINKLER SYSTEMS WITH PRIOR APPROVAL FROM CPA UTILITIES

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

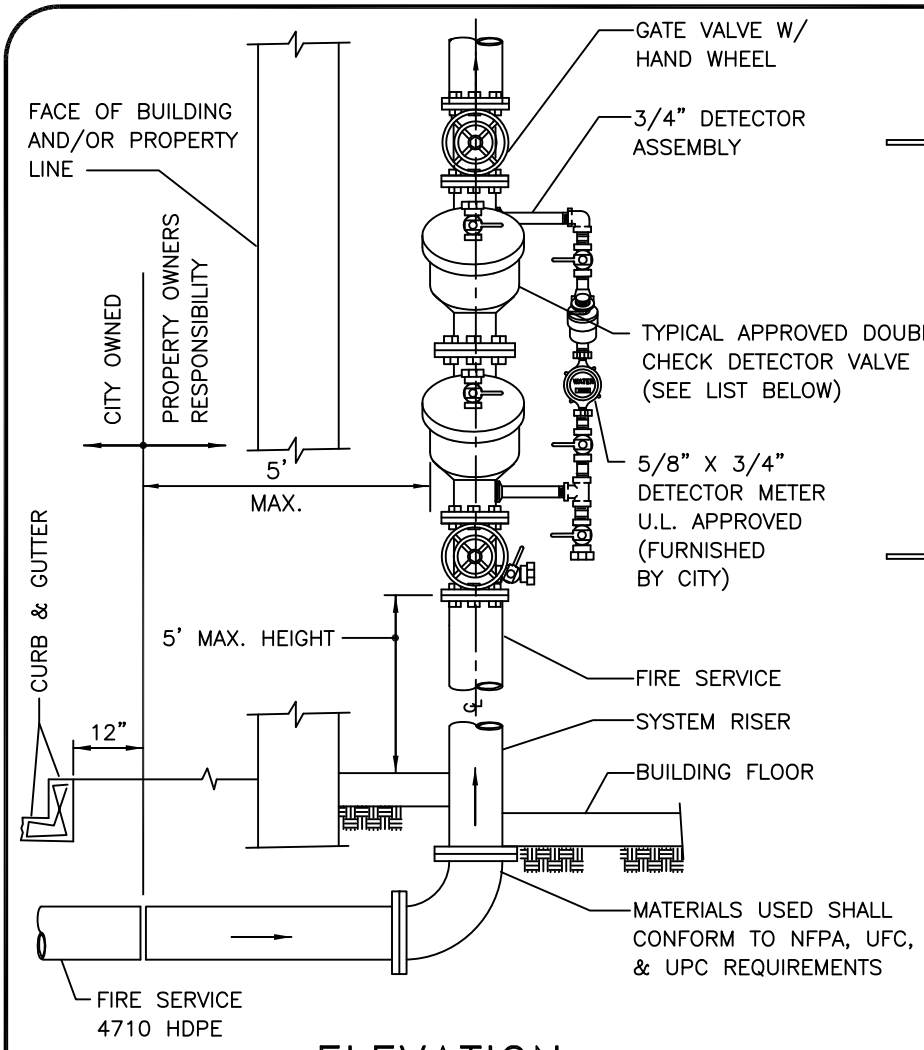
EDWARD WU, WGW ENGINEERING MANAGER — 52944 R.E. NO.

REVISION: JAN 31, 2013

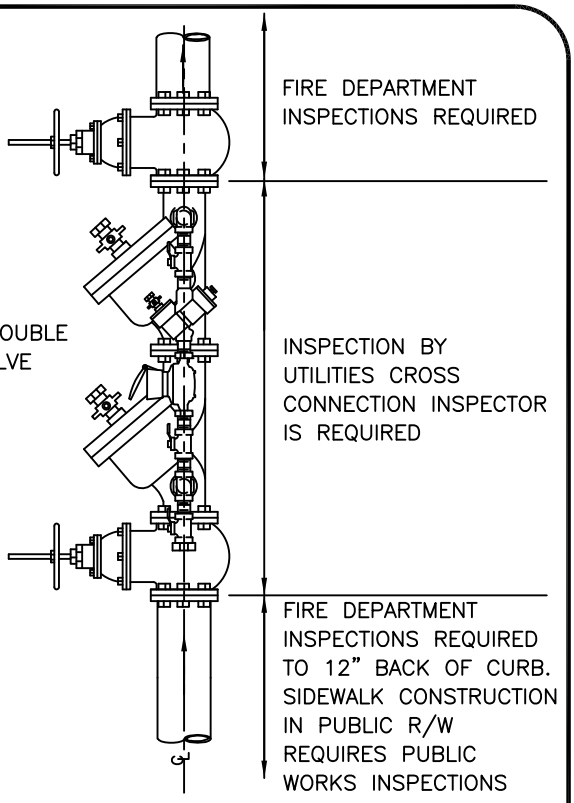
SCALE: NONE

DWG. NO. STD. WD-18C

APPENDIX B



ELEVATION

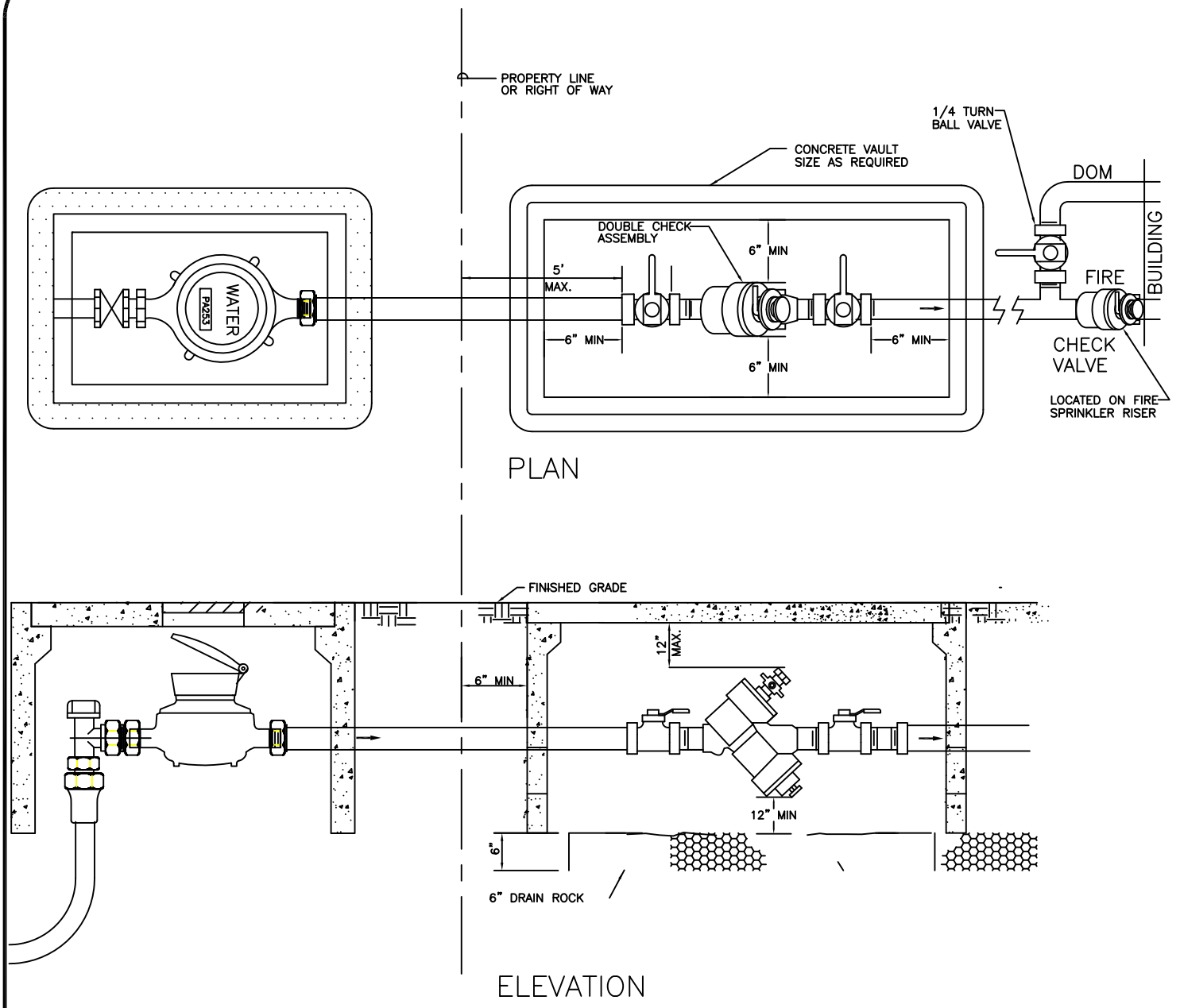


SIDE VIEW

NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH FOR VERTICAL INSTALLATION AND APPROVED BY WATER-GAS-WASTEWATER (WGW) UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION BY UTILITITES CROSS CONNECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.
4. DOUBLE CHECK DETECTOR ASSEMBLIES MAY ONLY BE USED ON EXISTING HAZ CL 1 AND 2 FIRE SPRINKLER SYSTEMS AND WITH THE PRIOR APPROVAL OF WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
5. RPDA DEVICES APPROVED FOR VERTICAL INSTALLATION BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH WILL BE ACCEPTABLE FOR USE WITH NEW FIRE SPRINKLER SYSTEMS.

	BY	DATE	FOR EXIST FIRE SPRINKLER SYSTEMS ONLY CL 1 & 2 DOUBLE CHECK DETECTOR – DCD STANDARD DETAIL FOR VERTICAL INSTALLATIONS		SCALE: NONE
DRAWN	B.C.	4/95			DWG. NO. STD. WD-18D
CHECKED	RE	12/09			
REVIEWED	RE	12/09	CITY OF PALO ALTO, CALIFORNIA		APPENDIX B



NOTES:

1. ALL DEVICES SHALL BE AS APPROVED BY USC FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH AND APPROVED BY WATER-GAS-WASTEWATER UTILITIES DEPARTMENT.
2. THE DEVICE SHALL BE INSTALLED ON THE OWNER'S PROPERTY DIRECTLY BEHIND THE METER WITHIN 5' OF THE PROPERTY LINE.
3. INSPECTION IS REQUIRED FOR SUPPLY PIPE BETWEEN THE METER AND THE VALVES.

	BY	DATE
DRAWN	R.E.	25/11
CHECKED	R.E.	25/11
REVIEWED	R.E.	25/11

RESIDENTIAL DOUBLE CHECK ASSEMBLY VAULT INSTALLATION STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

EDWARD WU
WGW ENGINEERING MANAGER

52944
R.E. NO.

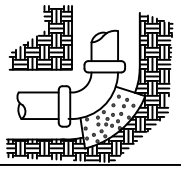
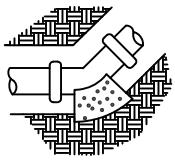
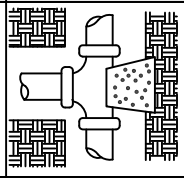
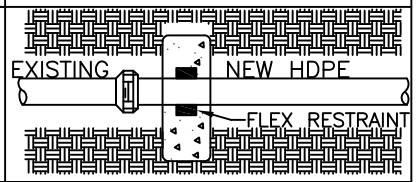
REVISION:
JAN 31, 2013

SCALE:
NONE

DWG. NO.
STD. WD-18E

APPENDIX B

THRUST BLOCK TABLE

TYPE OF FITTING	90° BEND & BURIES	45° BEND	11 1/4° OR 22 1/2° BEND	TEE OR DEAD END	AT CONNECTION OF NEW HDPE PIPE WITH EXISTING NON–HDPE PIPE
TYPICAL PLAN VIEW					

MAIN SIZE	REQUIRED BEARING TOTAL AREA IN SQUARE FEET					MINIMUM CAPACITY OF FLEX RESTRAINTS
4”	2	2	1	2	2	4,000# *
6”	4	2	1	2.5	4	8,000# *
8”	6.5	3.5	2	4.5	6.5	12,000#
10”	10	5	3	7.0	10	18,000#
12”	14	8	4	10	14	25,000#
14”	19	11	5	14	19	31,000#
16”	25	14	7	18	25	40,000#
18”	32	17	9	22	32	50,000#
20”	39	21	11	27	39	62,000#

* MINIMUM TWO FLEX RESTRAINTS INSTALLED SYMETRICALLY

THRUST BLOCK NOTES:

1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS ”B” CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. JOINTS TO BE KEPT FREE OF CONCRETE. ALLOW WORKING ROOM AROUND NUTS & BOLTS. PLACE BITUMASTIC AROUND NUTS & BOLTS.
4. ABRUPT CHANGES IN VERTICAL ALIGNMENT SHALL BE ANCHORED AS SPECIFY IN REVERSE AND VERTICAL BENDS STANDARD DETAIL STD. WD–23.
5. AREAS GIVEN ARE FOR CLASS 200 PIPE AT TEST PRESSURE OF 150 PSI IN SOIL WITH 2,000 PSI BEARING CAPACITY. CHANGES SUBJECT TO FIELD CONDITIONS AND APPROVAL OF THE ENGINEER.
6. TAPPING SLEEVES SHALL HAVE THRUST BLOCKS SIZED THE SAME AS TEES.

	BY	DATE
DRAWN	E.L.	5/92
CHECKED	C.B.	5/92
REVIEWED	R.C.	5/92

THRUST BLOCK TABLE STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

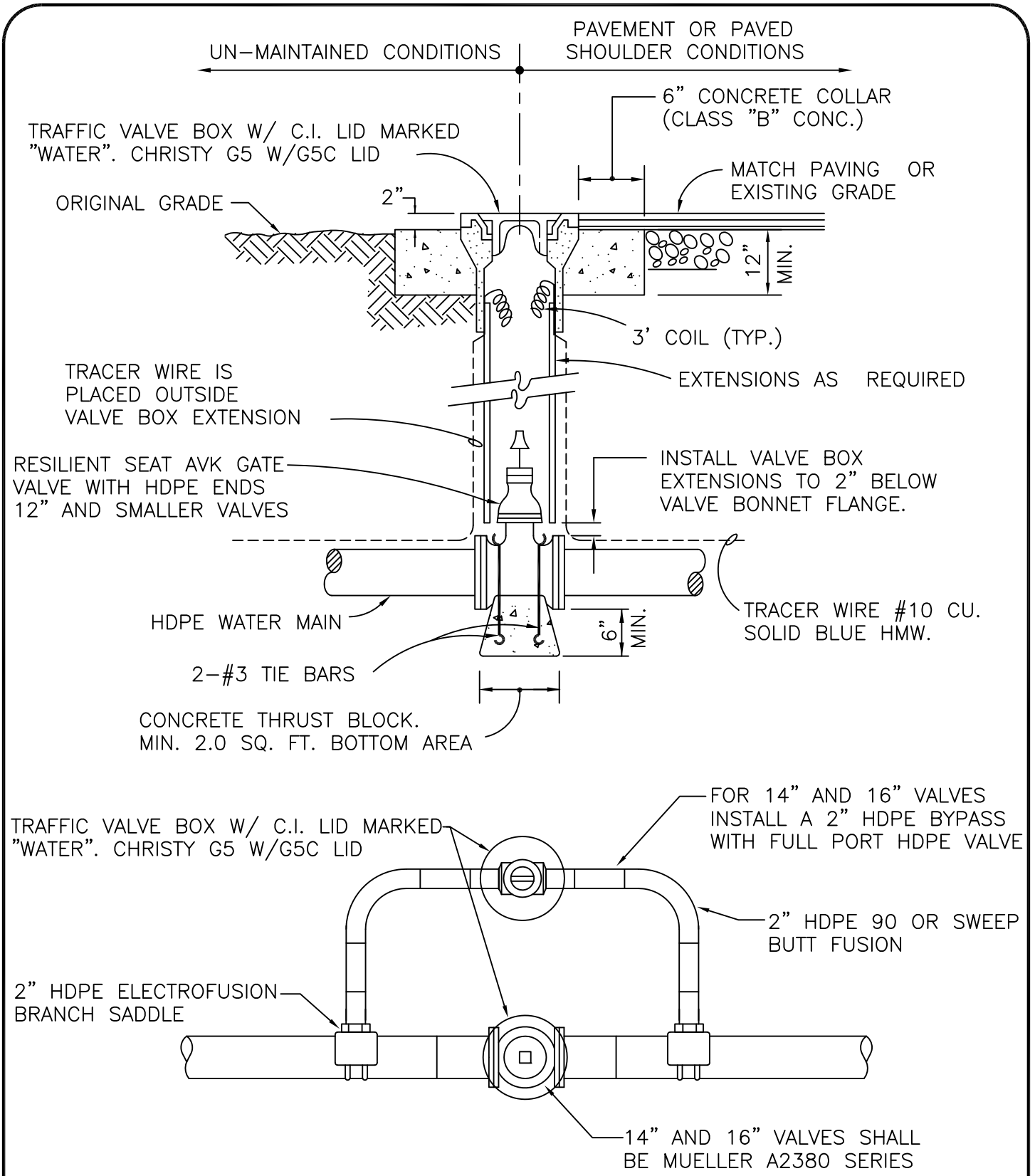
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD–19

APPENDIX A



	BY	DATE
DRAWN	E.L.	5/92
CHECKED	RE	4/11
REVIEWED	RE	4/11

GATE VALVE ASSEMBLY STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

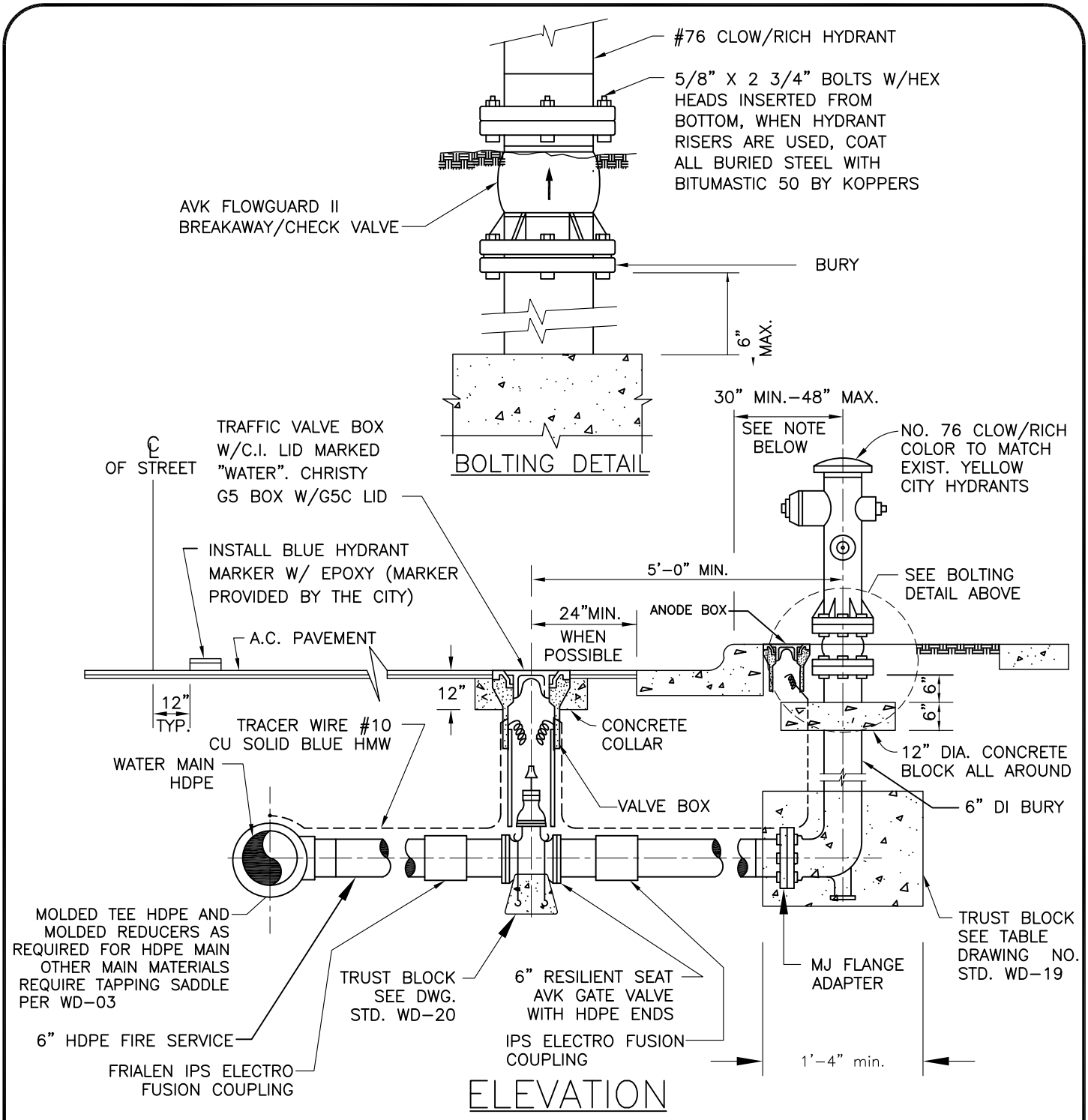
EDWARD WU 52944
WGW ENGINEERING MANAGER R.E. NO.

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD–20

APPENDIX B

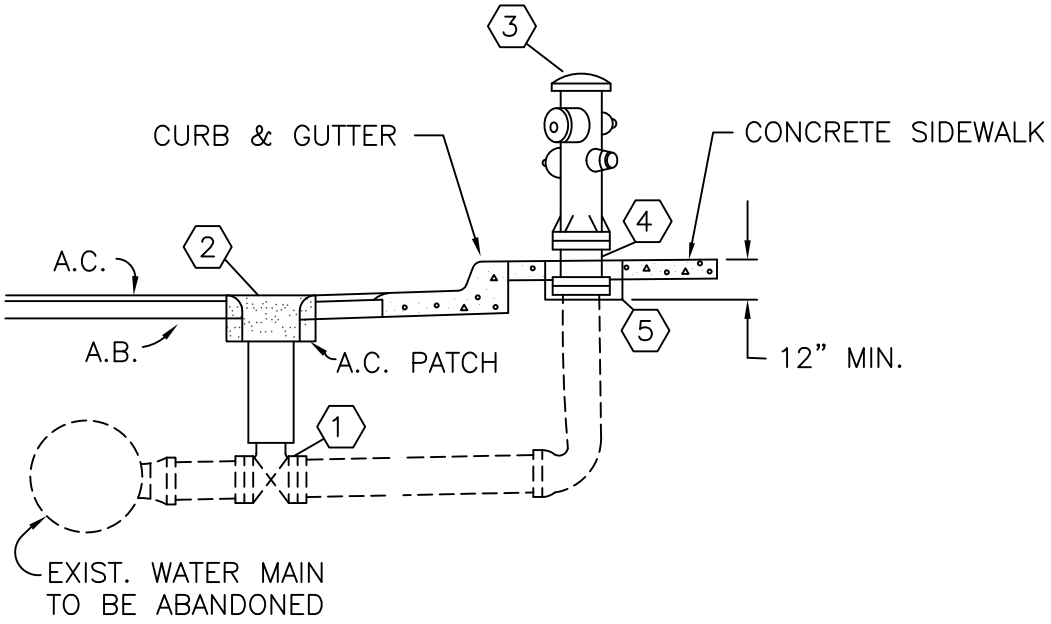


ELEVATION

NOTES:

1. CENTER OF BURY LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS 12" FROM BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

	BY	DATE			
DRAWN	AP	7/09	HDPE PIPE FIRE HYDRANT ASSEMBLY STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	GS	7/09		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WD–21
REVIEWED	RE	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



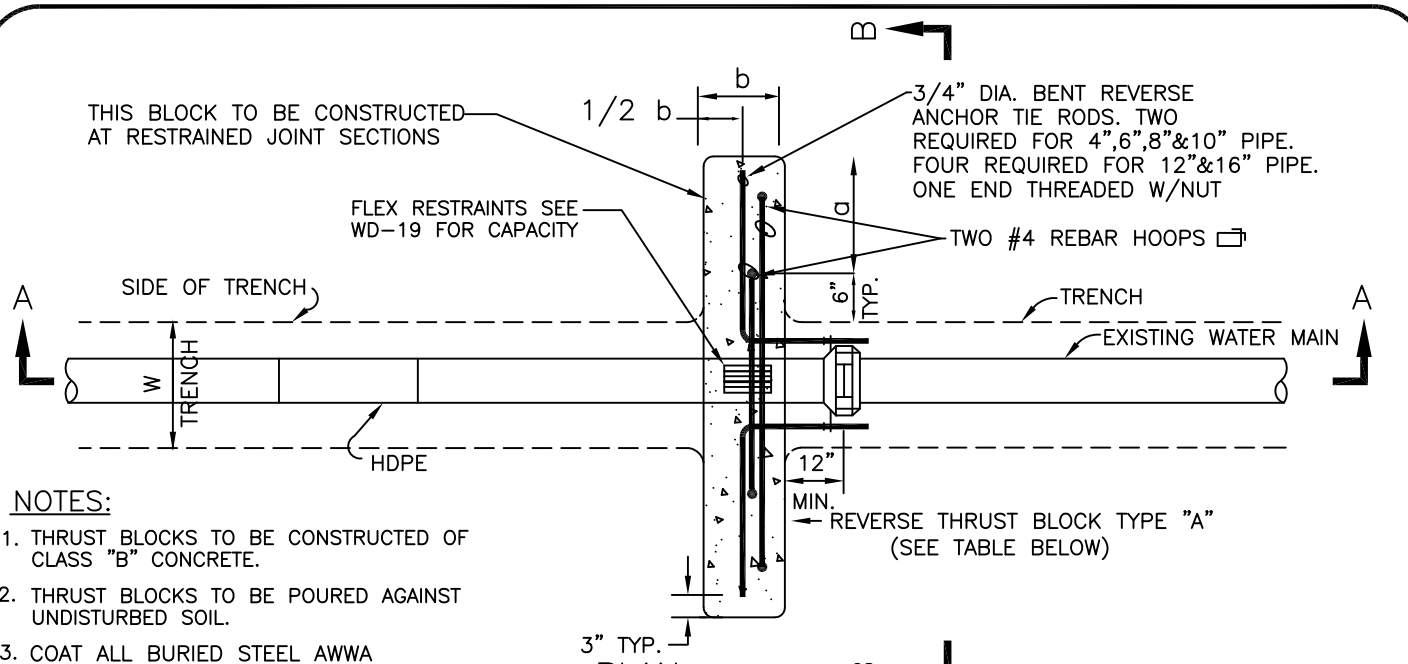
PROCEDURE FOR FIRE HYDRANT ABANDONMENT

1. CLOSE VALVE TO HYDRANT.
2. REMOVE VALVE BOX AND FILL RISER WITH CLEAN SAND, JET SAND, BACKFILL HOLE WITH A.C. PATCH.
3. REMOVE HYDRANT AND SALVAGE TO CITY OF PALO ALTO CORPORATION YARD WATER–GAS–WASTEWATER REPAIR SHOP.
4. REMOVE 6" SNAP RING AND CUT BURY 12" BELOW EXISTING GRADE.
5. FILL BURY WITH SAND TO CUT RIM, JET SAND; THEN FILL 12 ± REMAINER WITH CLASS "B" CONCRETE OR OTHER MATERIAL TO MATCH EXISTING GROUND SURFACE.

FIRE SERVICE ABANDONMENT PROCEDURE IF NECESSARY

1. NOTIFY ALL EFFECTED WATER CUSTOMERS OF THE SERVICE INTERRUPTION. COORDINATE WATER SHUTDOWN WITH AFFECTED CUSTOMERS AND C.P.A. UTILITIES.
2. EXCAVATE THE EXISTING FIRE HYDRANT SERVICE AT THE MAIN AND SHUT DOWN THE MAIN
3. FOR SERVICE WITH TAPPING SADLE, REMOVE THE TAPPING SADDLE AND INSTALL A MUELLER OR FORD REPAIR CLAMP. ANY LEAKS, FAILURES, OR DEFECTIVE REPAIRS SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR.
4. FOR SERVICES WITH A TEE, REMOVE THE TEE AND REPLACE WITH HDPE STRAIGHT PIPE SECTION
5. REMOVE THE FIRE HYDRANT AND SALVAGE TO THE CITY OF PALO ALTO CORPORATION YARD WGW REPAIR SHOP.
6. BACKFILL, COMPACT AND PAVE HOLE AT THE MAIN PER TRENCH BACKFILL STANDARD DETAIL STD. WD–01.

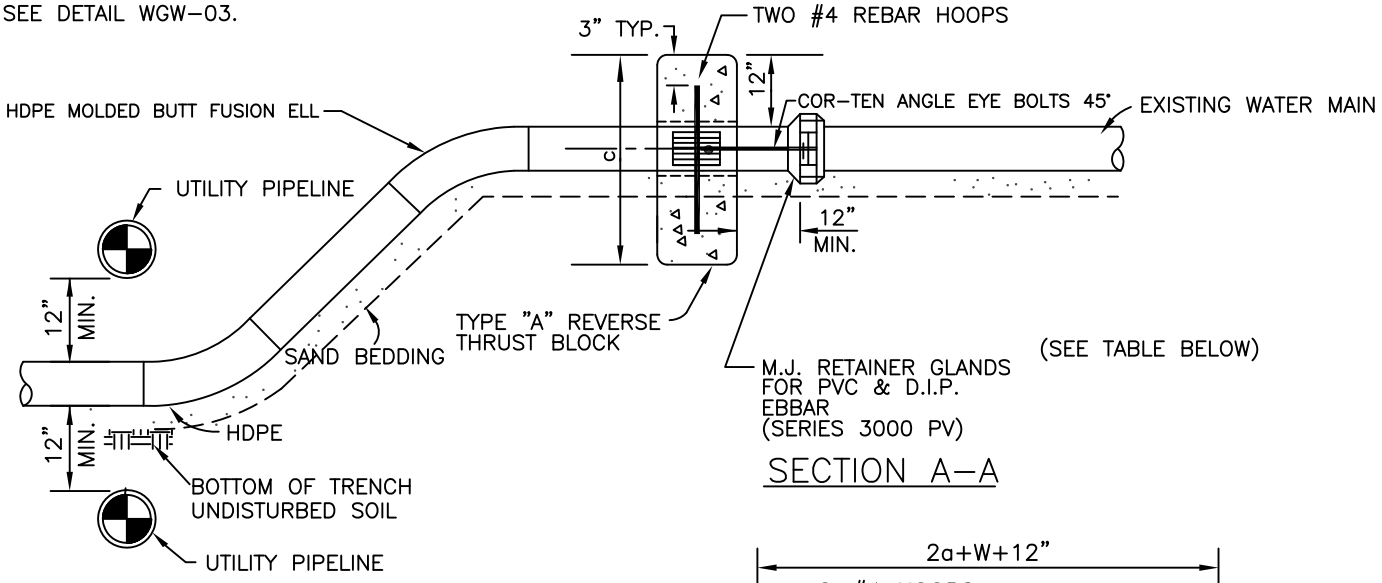
BY	DATE	FIRE HYDRANT ABANDONMENT STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN E.L.	5/92		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD–22
CHECKED C.B.	5/92			
REVIEWED R.C.	5/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



PLAN

NOTES:

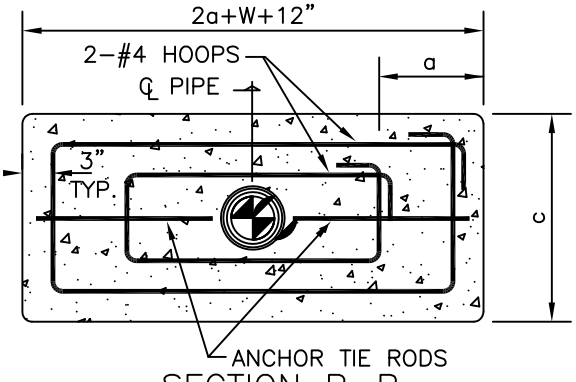
1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. COAT ALL BURIED STEEL AWWA C-203 SEC. 3.7 COAL TAR PROTECTIVE COATING (CA-14 MASTIC)
4. FOR MAINS INSTALLED LESS THAN 3' DEEP SEE DETAIL WGW-03.



SECTION A-A

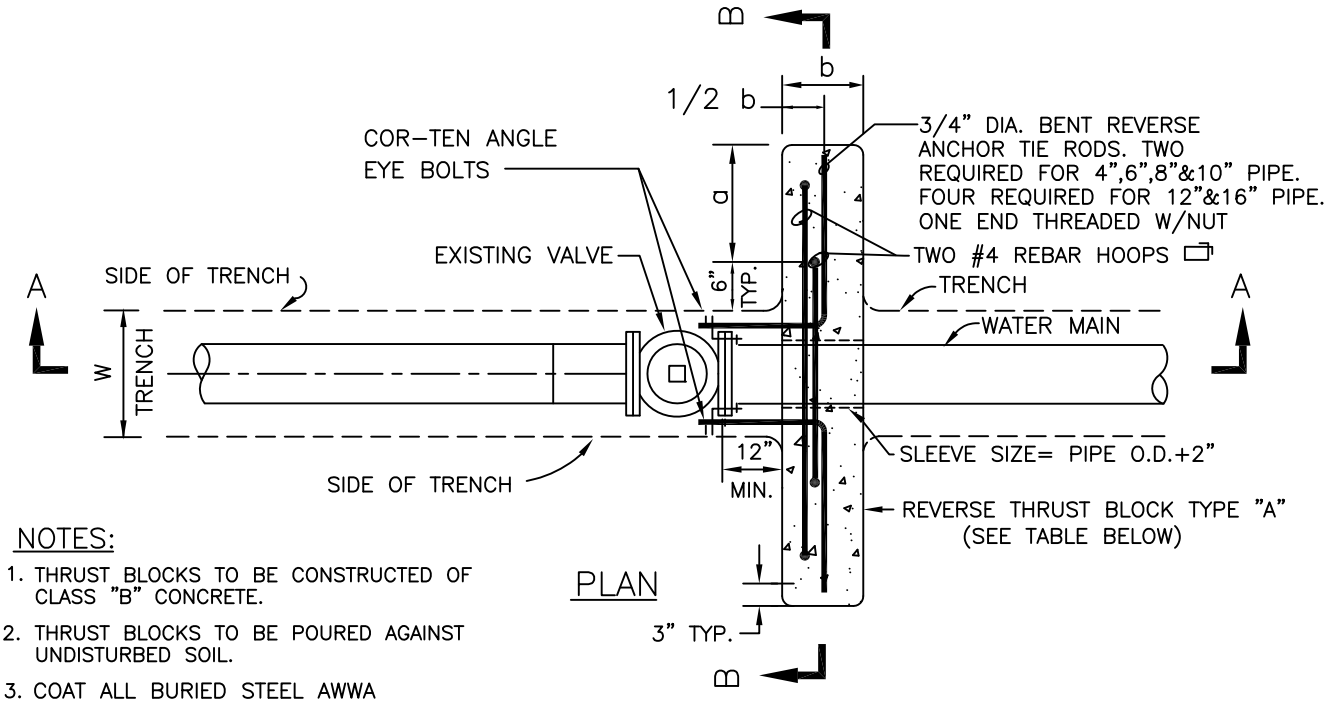
THRUST BLOCK TABLE				
PIPE SIZE	DIMENSIONS a	b	c	TYPE "A" VOLUME
4" & 6"	1'-0"	1'-6"	2'-8"	0.75 C.Y.
8" & 10"	1'-6"	1'-6"	3'-0"	1.00 C.Y.
12" & 16"	2'-0"	2'-0"	3'-10"	1.90 C.Y.

BOTTOM OF TRENCH



SECTION B-B

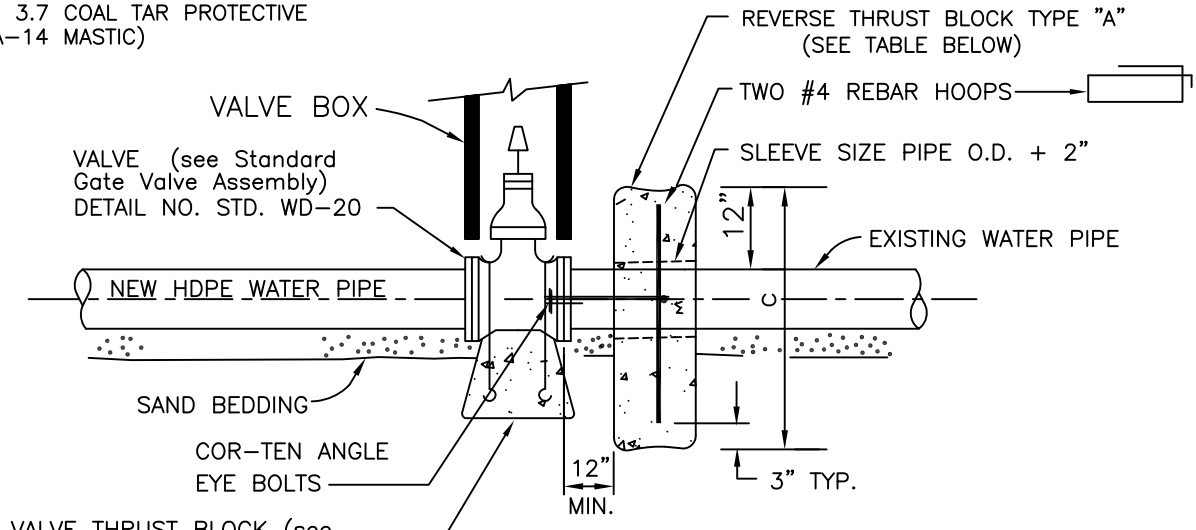
BY	DATE	VERTICAL BENDS HDPE PIPE CONNECTING TO NON HDPE PIPE STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN E.L.	5/92		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WD-23
CHECKED C.B.	5/92			
REVIEWED R.E.	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



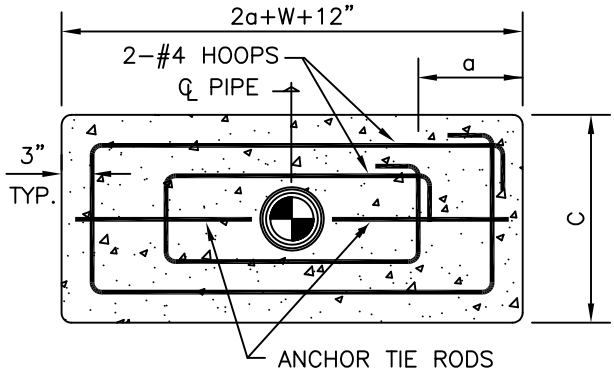
PLAN

NOTES:

1. THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
3. COAT ALL BURIED STEEL AWWA C-203 SEC. 3.7 COAL TAR PROTECTIVE COATING (CA-14 MASTIC)



SECTION A-A



SECTION B-B

THRUST BLOCK TABLE				
PIPE SIZE	DIMENSIONS			TYPE "A" VOLUME
	a	b	c	
4" & 6"	1'-0"	1'-6"	2'-8"	0.75 C.Y.
8" & 10"	1'-6"	1'-6"	3'-0"	1.00 C.Y.
12" & 16"	2'-0"	2'-0"	3'-10"	1.90 C.Y.

	BY	DATE
DRAWN	E.L.	5/92
CHECKED	C.B.	5/92
REVIEWED	R.E.	12/09

VALVE TIE-BACK DURING CONSTRUCTION STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

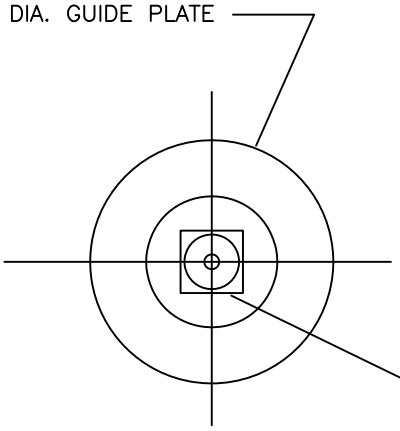
EDWARD WU, WGW ENGINEERING MANAGER, R.E. NO. 52944

REVISION: JAN 31, 2013

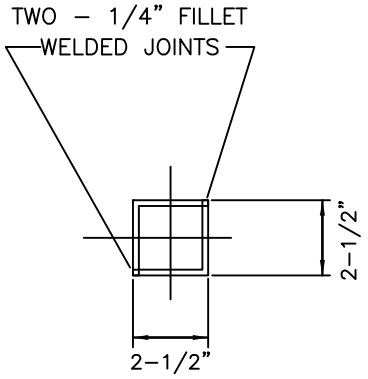
SCALE: NONE

DWG. NO. STD. WD-24

APPENDIX B



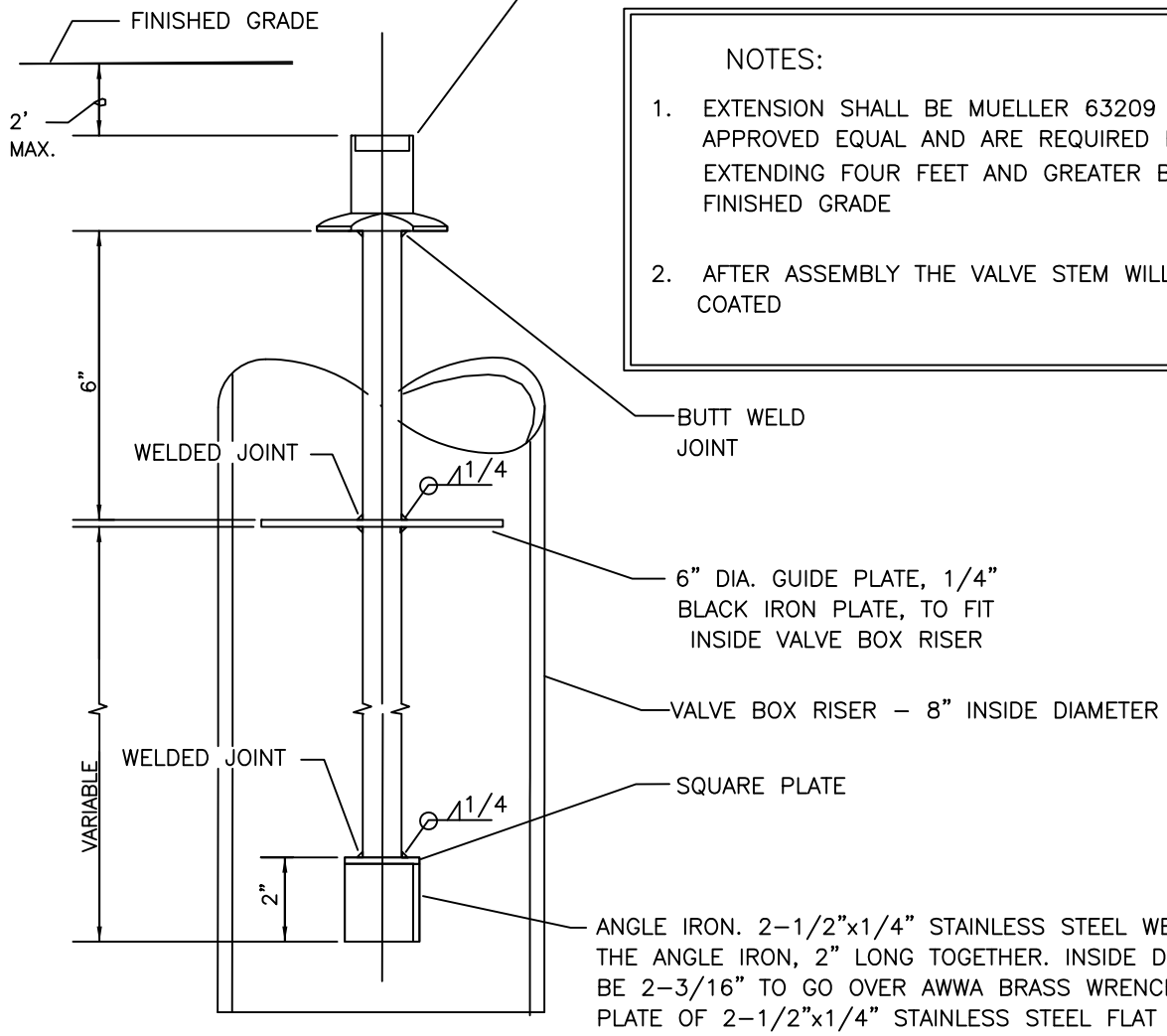
TOP VIEW



BOTTOM VIEW

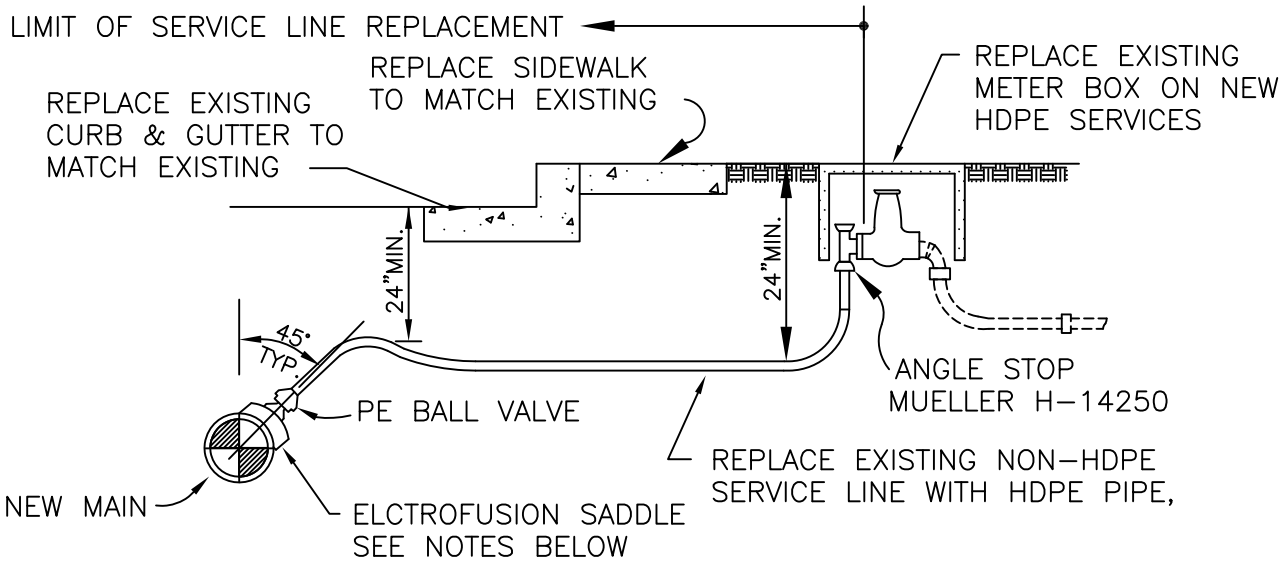
NOTES:

1. EXTENSION SHALL BE MUELLER 63209 SERIES OR APPROVED EQUAL AND ARE REQUIRED FOR VALVES EXTENDING FOUR FEET AND GREATER BELOW THE FINISHED GRADE
2. AFTER ASSEMBLY THE VALVE STEM WILL BE FUSION COATED



SIDE VIEW

	BY	DATE			
DRAWN	EL	2/96	VALVE STEM EXTENSION STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	RE	12/09		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WD–25
REVIEWED	RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



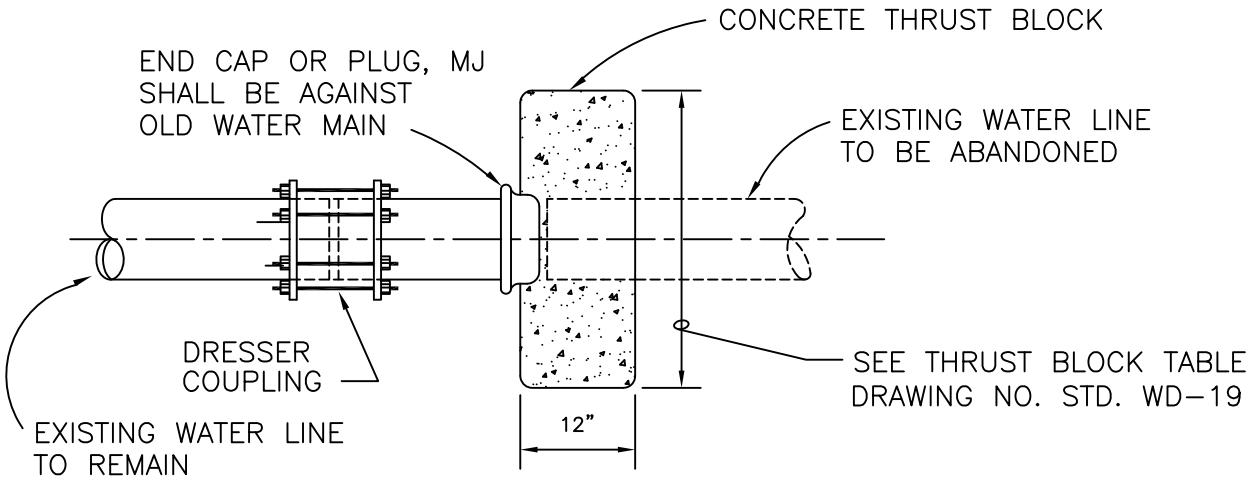
NEW SERVICE LINE REPLACE EXISTING GALVANIZED/COPPER PIPE

NOTES:

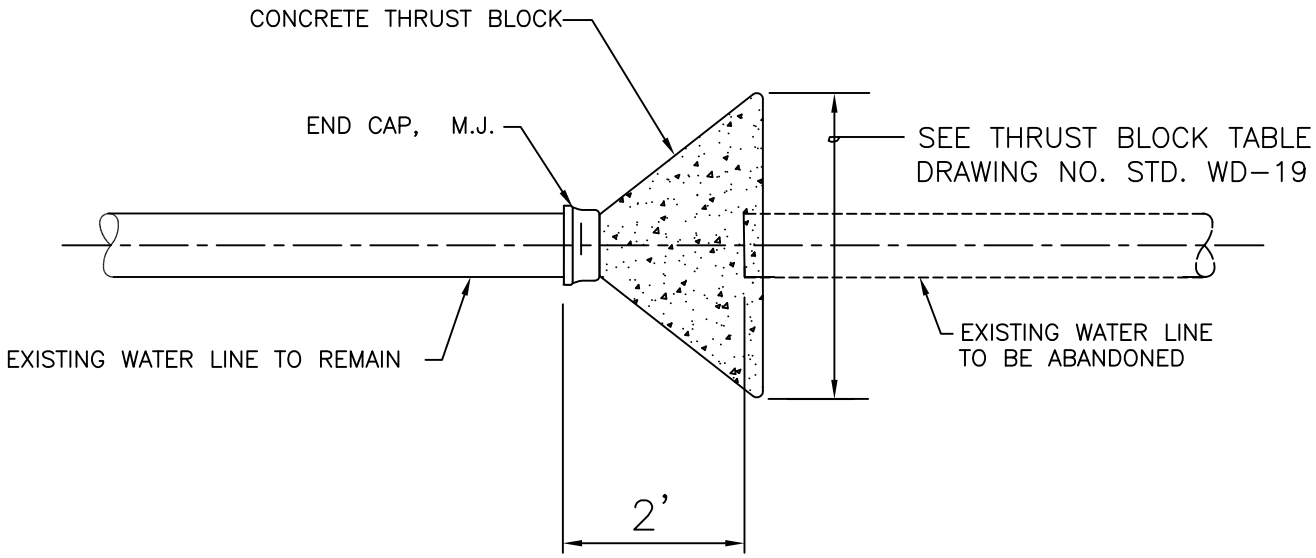
1. ALL TRENCHING FOR SERVICES SHALL BE DONE IN ACCORDANCE WITH THE TRENCH BACKFILL DETAIL. NEW SERVICES CAN BE INSTALLED BY PULLING OLD SERVICE OR BORING.

2. ALL SERVICE SHALL BE REPLACED OR RECONNECTED TO NEW MAIN IN THE ORIGINAL SIZE OR 2" HDPE WHICHEVER IS LARGER. ALL SERVICES SHALL BE CONSTRUCTED USING 4710 HDPE SDR 9 PIPE.

BY	DATE	2" WATER SERVICE LINE REPLACEMENT STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN E.L.	5/92		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD-26
CHECKED C.B.	5/92			
REVIEWED R.C.	5/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B

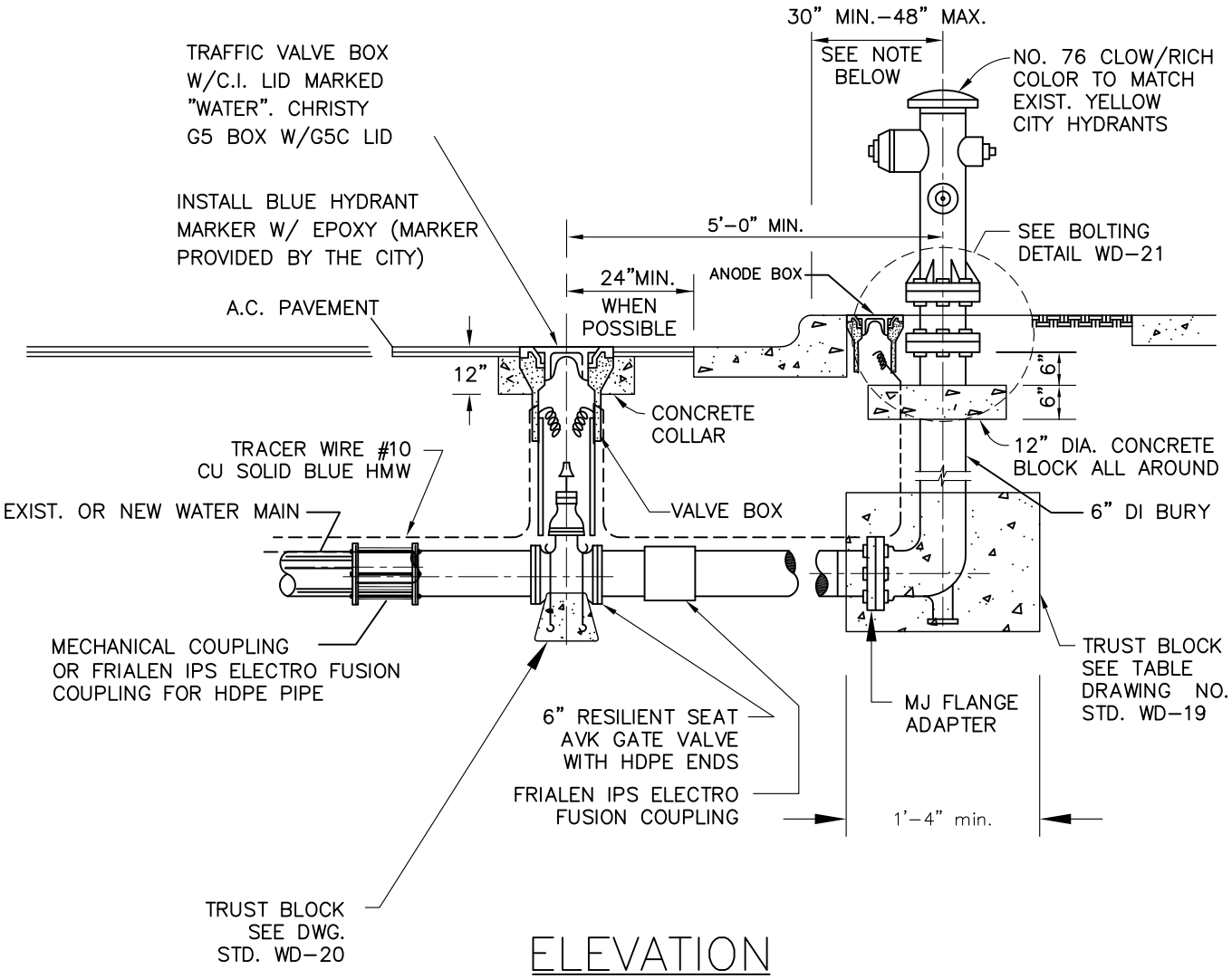


OPTION NO. 1



OPTION NO. 2

	BY	DATE			
DRAWN	E.L.	5/92	CUT & CAP EXISTING MAIN STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	C.B.	5/92		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD-27
REVIEWED	R.C.	5/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B



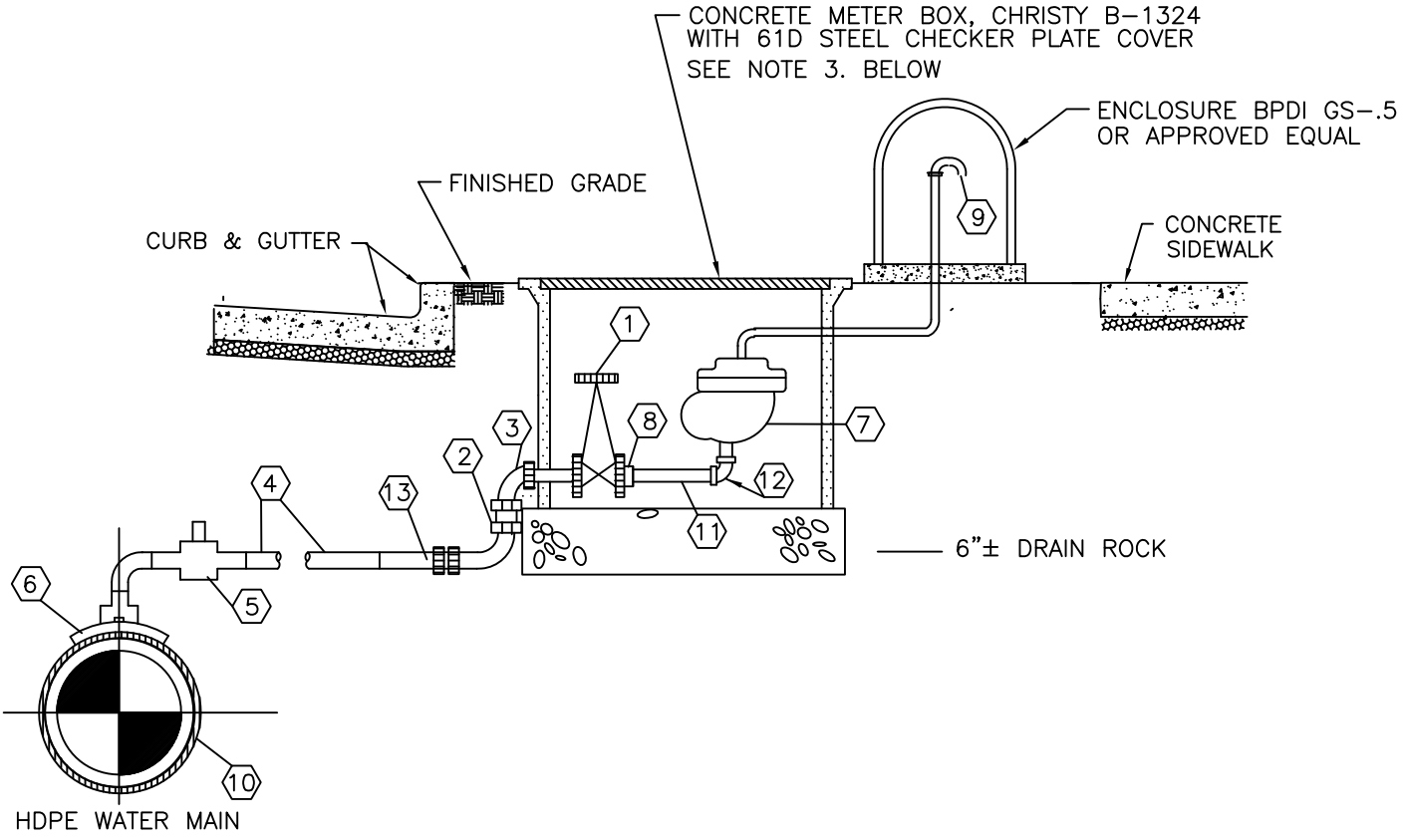
ELEVATION

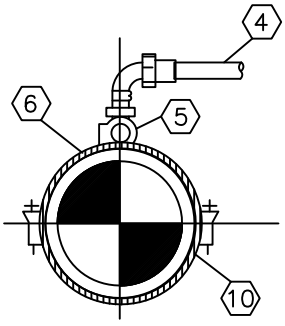
NOTES:

1. CENTER OF BURY LOCATION WHERE SIDEWALK & CURB ARE INTEGRAL IS 12" FROM BACK OF SIDEWALK INSTEAD OF BACK OF CURB AS SHOWN
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

	BY	DATE			
DRAWN	B.C.	12/04	FIRE HYDRANT BLOW–OFF STANDARD DETAIL REQUIRED ON ALL DEAD END MAINS	APPROVED: JANUARY, 31 2013 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	SCALE: NONE
CHECKED	R.A.	12/04			DWG. NO. STD. WD–28
REVIEWED	RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B

1. MUELLER H-10914 1" NRS BRONZE GATE VALVE (IP. THREADS)
2. MUELLER H-15425 FITTING
3. MUELLER H-10096 1/4 BEND
4. 2" HDPE PIPE
5. 2" HDPE BALL VALVE
6. ELECTROFUSION SADDLE OR MUELLER H-16100S
7. APCO, CRISPIN AIR RELEASE VALVE OR APPROVED EQUAL
8. 1" BRASS BUSHING
9. CU. SCREEN FINE SCREEN
10. WATER MAIN
11. 1" BRASS NIPPLE
12. 1" BRASS 90° ELL
13. POLY-CAM SERIES 911 TRANSITION





NOTES:

1. VALVES SHALL HAVE STAINLESS STEEL FLOAT WITH THE MINIMUM INLET/OUTLET SIZE OF 1 INCH FOR MAIN SIZES UP TO 10 INCH. ENGINEERING DESIGN REQUIRED FOR MAINS LARGER THAN 10 INCH.
2. SERVICE SADDLE SHALL BE BRONZE WITH DOUBLE STRAPS FOR ACP, CIP, & DIP MAINS FOR PVC USE MUELLER H-13000 SERIES. FOR HDPE USE ELECTROFUSION TAPPING SADDLE.
3. STEEL CHECKER PLATE COVER SHALL BE RATED FOR AASHTO H/20 LOADING WHERE SPECIFIED.

	BY	DATE
DRAWN	E.L.	5/92
CHECKED	C.B.	5/92
REVIEWED	R.C.	5/92

AIR RELEASE VALVE STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

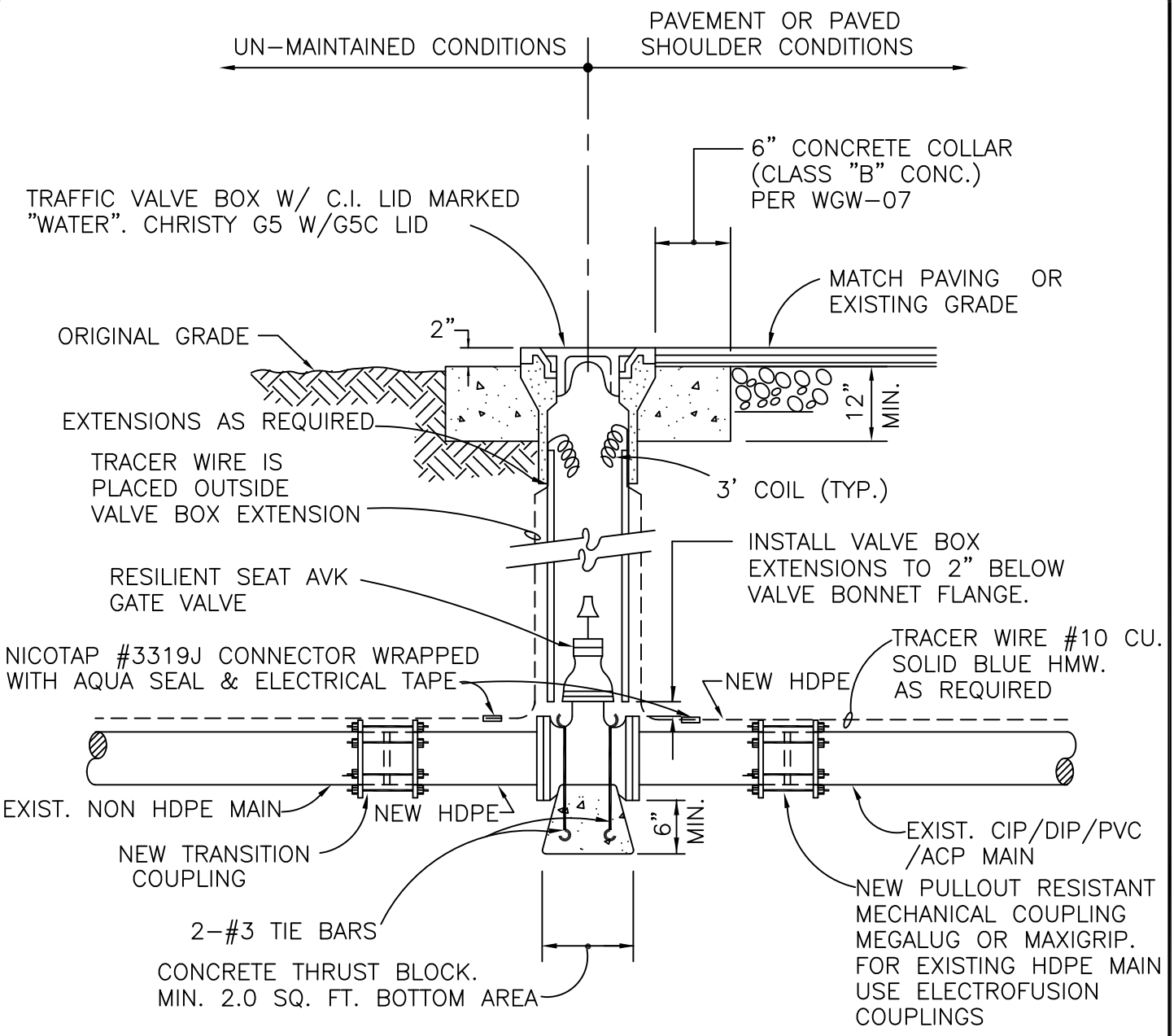
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WD-29

APPENDIX B



NOTES:

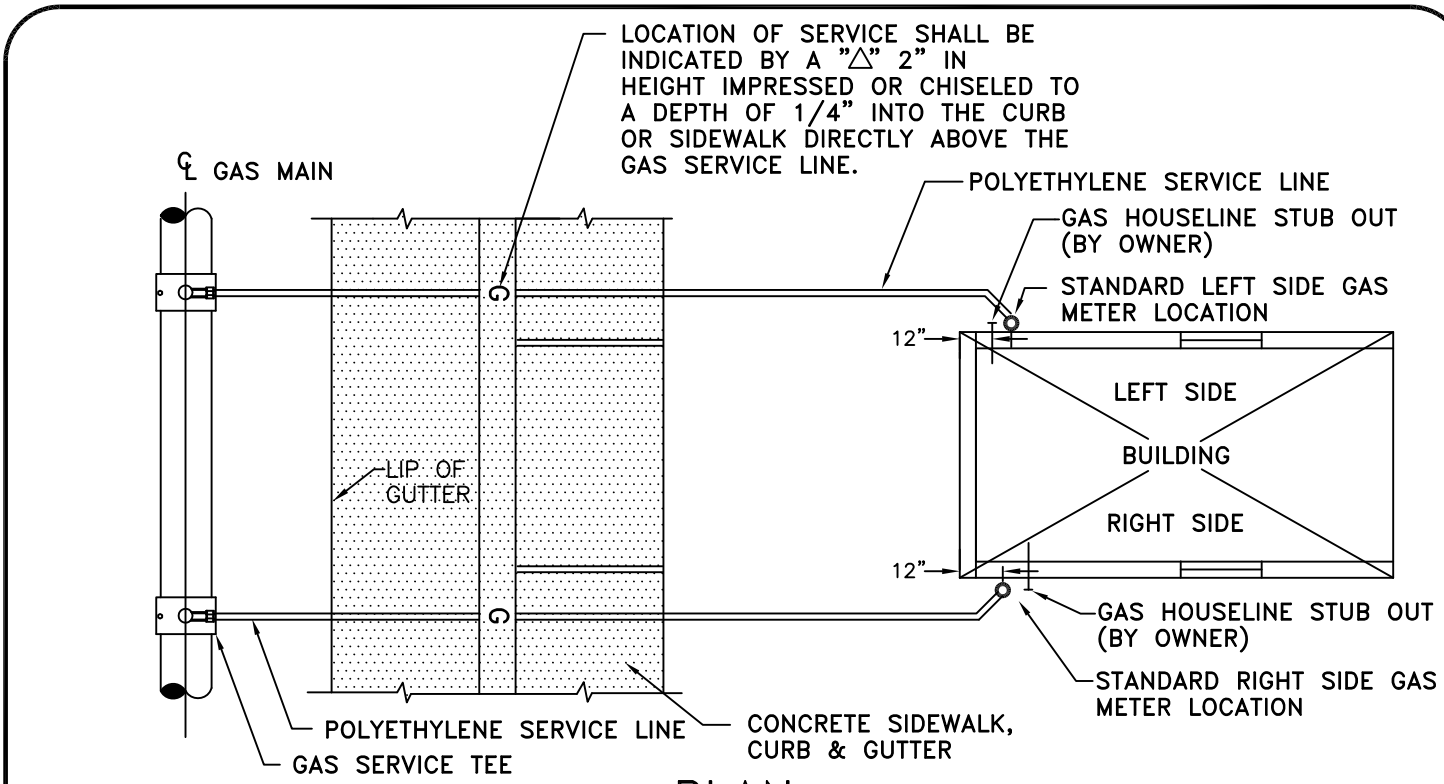
1. COUPLINGS SHALL BE ASSEMBLED AND INSTALLED ACCORDING TO THE STANDARDS RECOMMENDED BY THE MANUFACTURER.
2. INSTALL 5# ANODE ON ALL ISOLATED TRACER WIRE SYSTEMS.

	BY	DATE			
DRAWN	B.C.	8/04	NEW GATE VALVE (INSTALLATION ON EXIST. MAIN) STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	R.A.	8/04		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WD–30
REVIEWED	RE	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX B

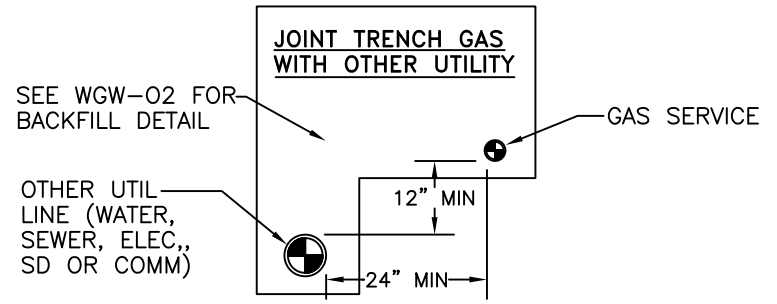
APPENDIX C.

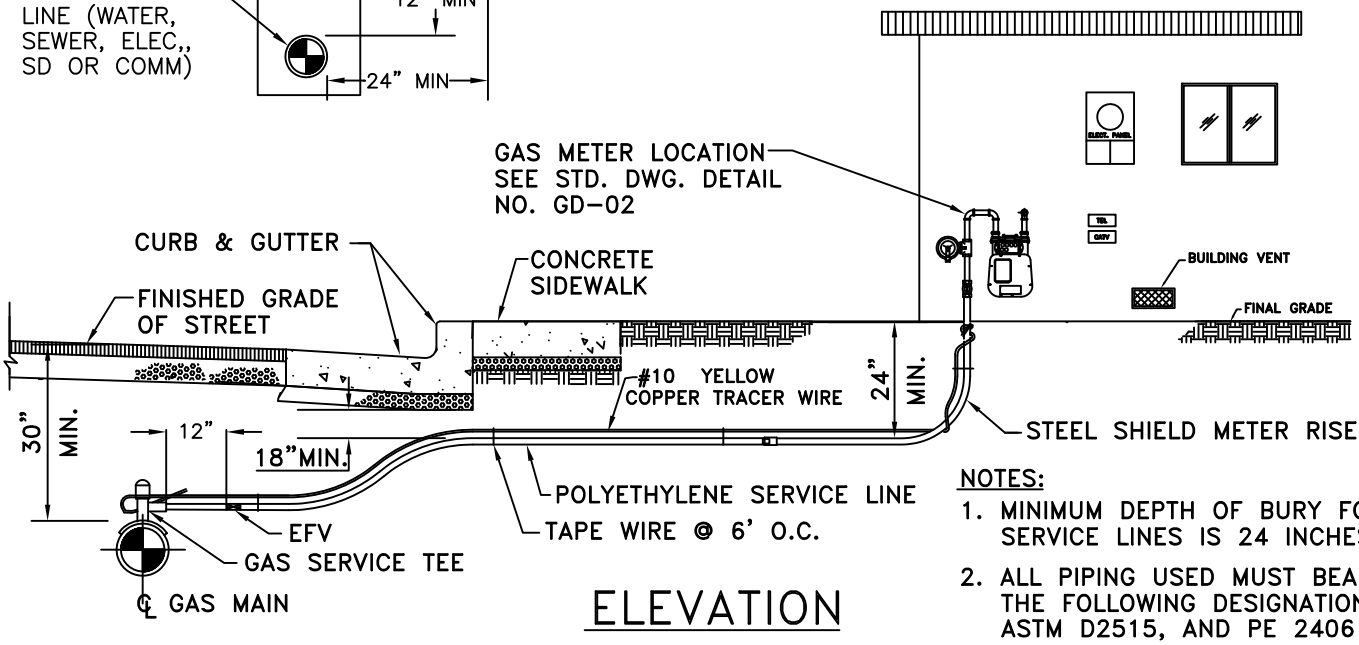
Gas Standard Details

STANDARD DETAIL DESCRIPTION	STANDARD DETAIL NO.
Gas Service Connection Standard Detail	GD-01
250-800 SCFH Residential Diaphragm Gas Meter Clearance	GD-02A
1000-1500 SCFH Gas Meter Clearance	GD-02B
Multiple 250 SCFH Gas Meter Location (Three Max)	GD-03A
Multiple 250 SCFH Gas Meter Location (Four or More)	GD-03B
Multiple 250 SCFH Gas Meter Location (Four or More stacked In Two Rows)	GD-03C
Commercial/Industrial 250-630 SCFH Diaphragm Meter Assembly	GD-04A
Commercial/Industrial 800-1000 SCFH Diaphragm Meter Assembly	GD-04B
Residential 250-800 Diaphragm SCFH Meter Assembly	GD-05
Multiple Curb Gas Meters For 250-630 SCFH	GD-06
Curb Gas Meter 250-630 SCFH	GD-07
Commercial/Industrial 1500 SCFH Rotary Meter Assembly	GD-14, GD-15, GD-17
Commercial/Industrial 1000 - 1500 SCFH Rotary Meter Assembly (Curb Location)	GD-19, GD-20, GD-21
Commercial/Industrial 2000 - 7000 SCFH Diaphragm & Rotary Meter Assembly	GD-24, GD-25, GD-27, GD-28
Commercial/Industrial 2000 - 7000 SCFH Rotary Meter Assembly (Curb Location)	GD-30, GD-31, GD-32, GD-33, GD-34
Commercial/Industrial 11000 - 23000 SCFH Rotary Meter Assembly	GD-35, GD-36
Gas Service Regulator Vent Extension	GD-37, GD-38



PLAN



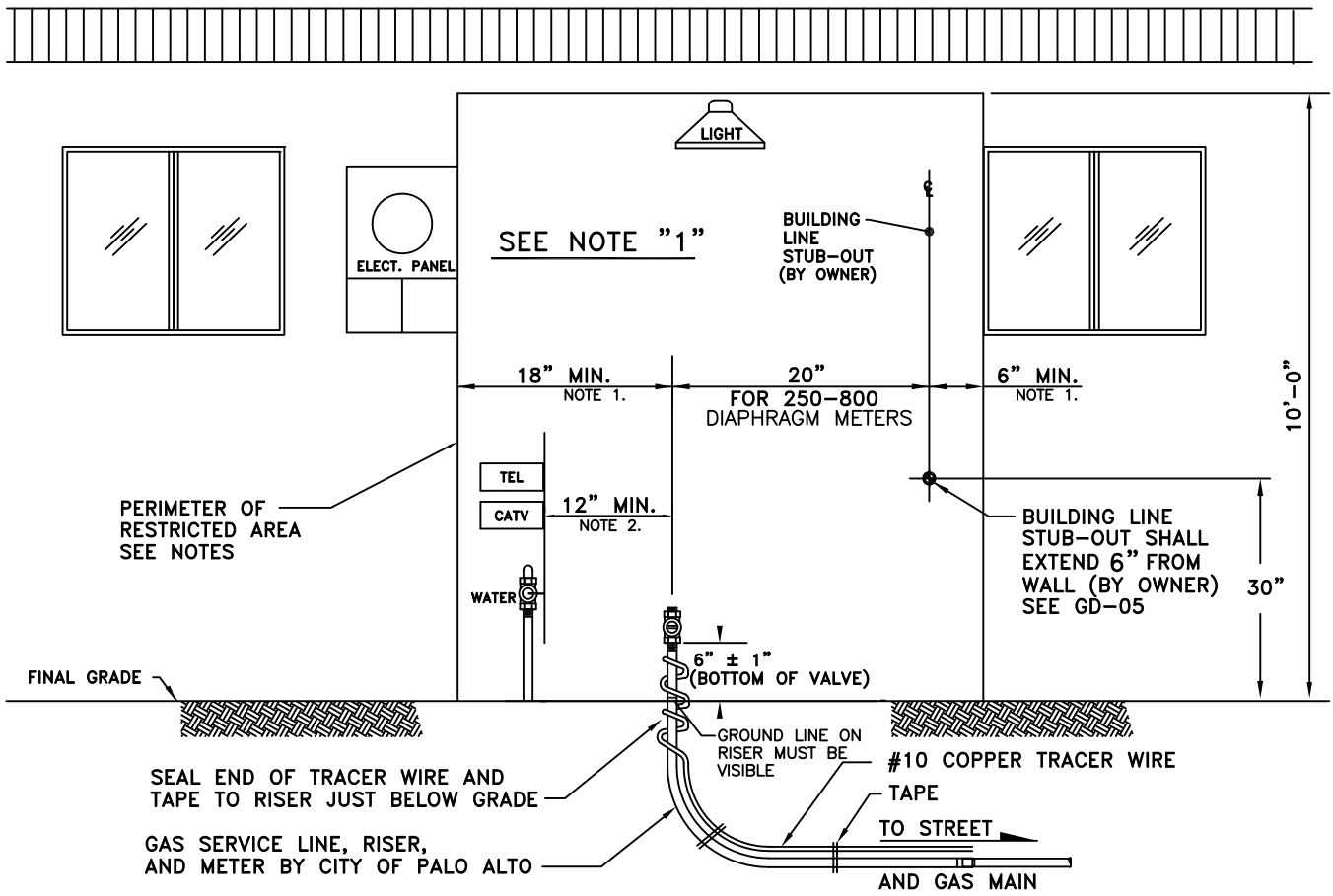


ELEVATION

NOTES:

1. MINIMUM DEPTH OF BURY FOR SERVICE LINES IS 24 INCHES.
2. ALL PIPING USED MUST BEAR THE FOLLOWING DESIGNATIONS: ASTM D2515, AND PE 2406 GAS.
2. ALL CONSTRUCTION BY C.P.A.

	BY	DATE			
DRAWN	J.J.	2/92	GAS SERVICE AND METER STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	RE	12/09		Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-01
REVIEWED	RE	12/10	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS ARE ALLOWED WITHIN 18" OF C.P.A. GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CPA GAS RISER OR WITHIN 6" OF BUILDING LINE STUB-OUT.
3. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
4. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE. ENCLOSURES ARE NOT ALLOWED, LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY C.P.A. IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR RESIDENTIAL INSTALLATIONS AND WHEN WITHIN 8' OF A DRIVEWAY OR PARKING FOR COMMERCIAL INSTALLATIONS. ANY METER WITHIN 8' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN C.P.A. STANDARD DETAILS WGW-05 & WGW-06.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

	BY	DATE
DRAWN	J.J.	5/91
REVISED	R.E.	10/09
REVIEWED	R.E.	15/09

250-800 CFH RESIDENTIAL DIAPHRAGM GAS METER CLEARANCE STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

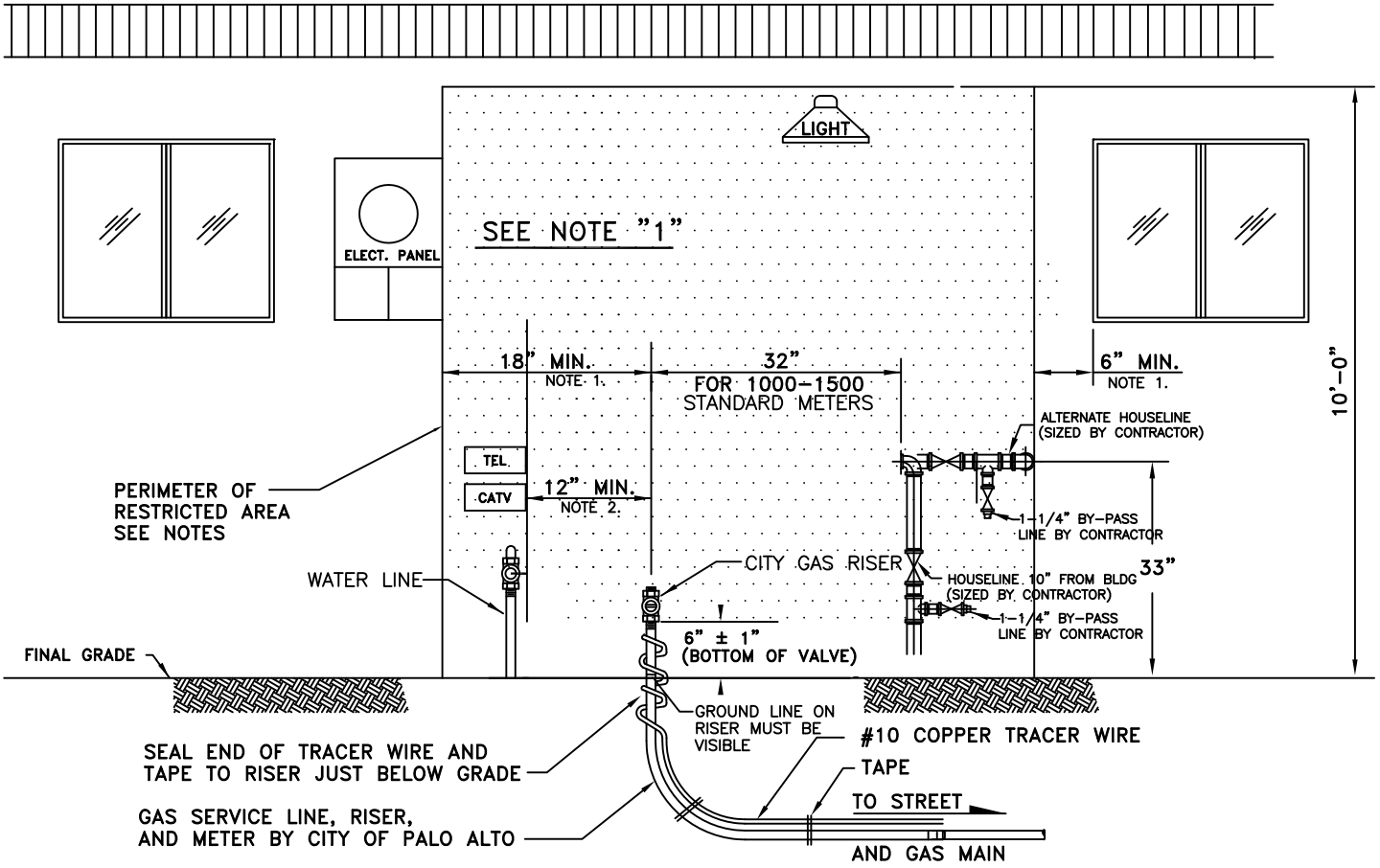
EDWARD WU — 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD.GD-02A

APPENDIX C



BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS ARE ALLOWED WITHIN 18" OF C.P.A. GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB–OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CPA GAS RISER OR WITHIN 6" OF BUILDING LINE STUB–OUT.
3. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
4. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE. ENCLOSURES ARE NOT ALLOWED, LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY C.P.A. IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR RESIDENTIAL INSTALLATIONS AND WHEN WITHIN 8' OF A DRIVEWAY OR PARKING FOR COMMERCIAL INSTALLATIONS. ANY METER WITHIN 8' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN C.P.A. STANDARD DETAILS WGW–05 & WGW–06.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

	BY	DATE
DRAWN	J.J.	5/91
CHECKED	RE	12/09
REVIEWED	RE	12/09

1000 – 1500 CFH GAS METER CLEARANCE STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

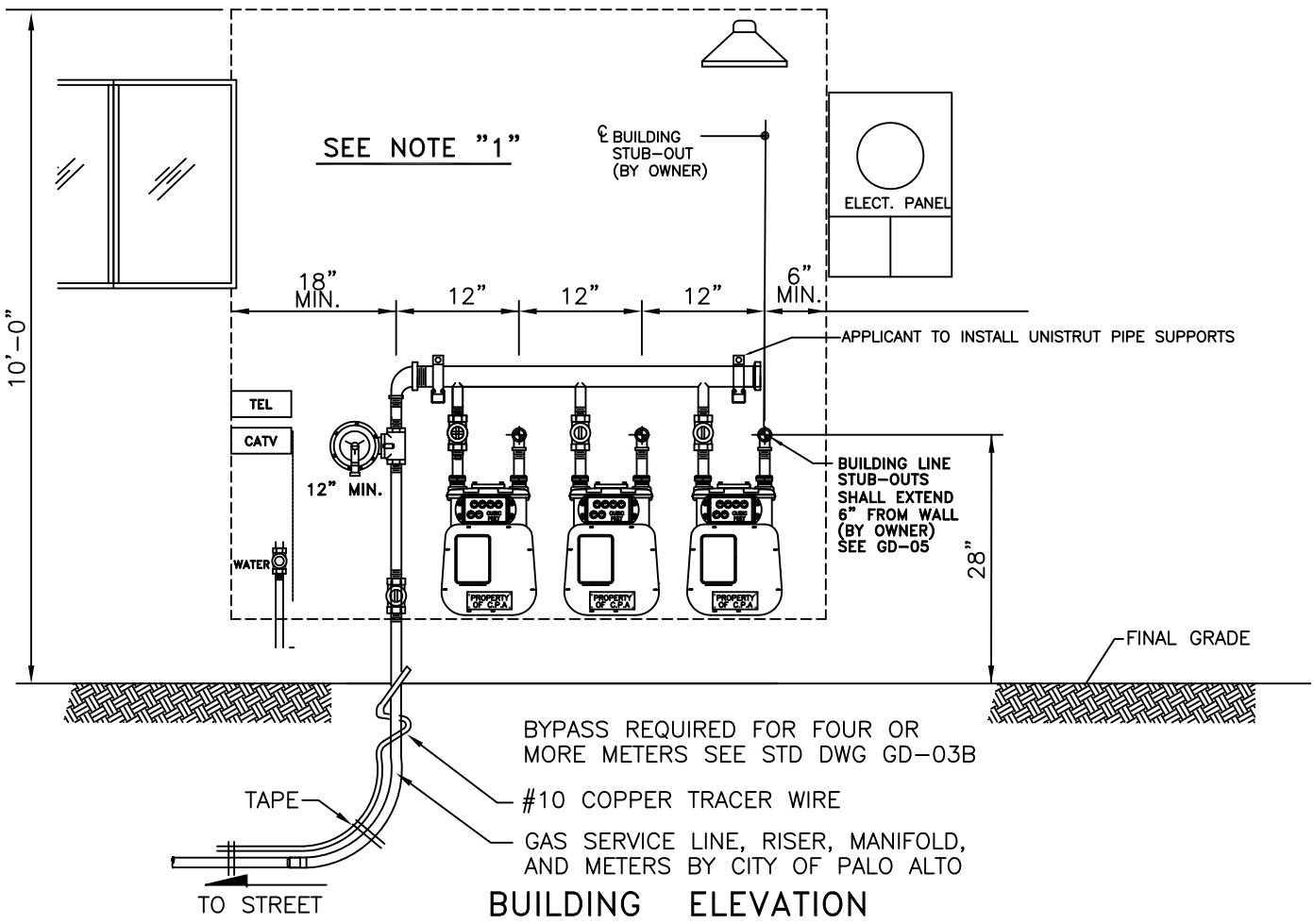
EDWARD WU, WGW ENGINEERING MANAGER — 52944 R.E. NO.

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD.GD–02B

APPENDIX C

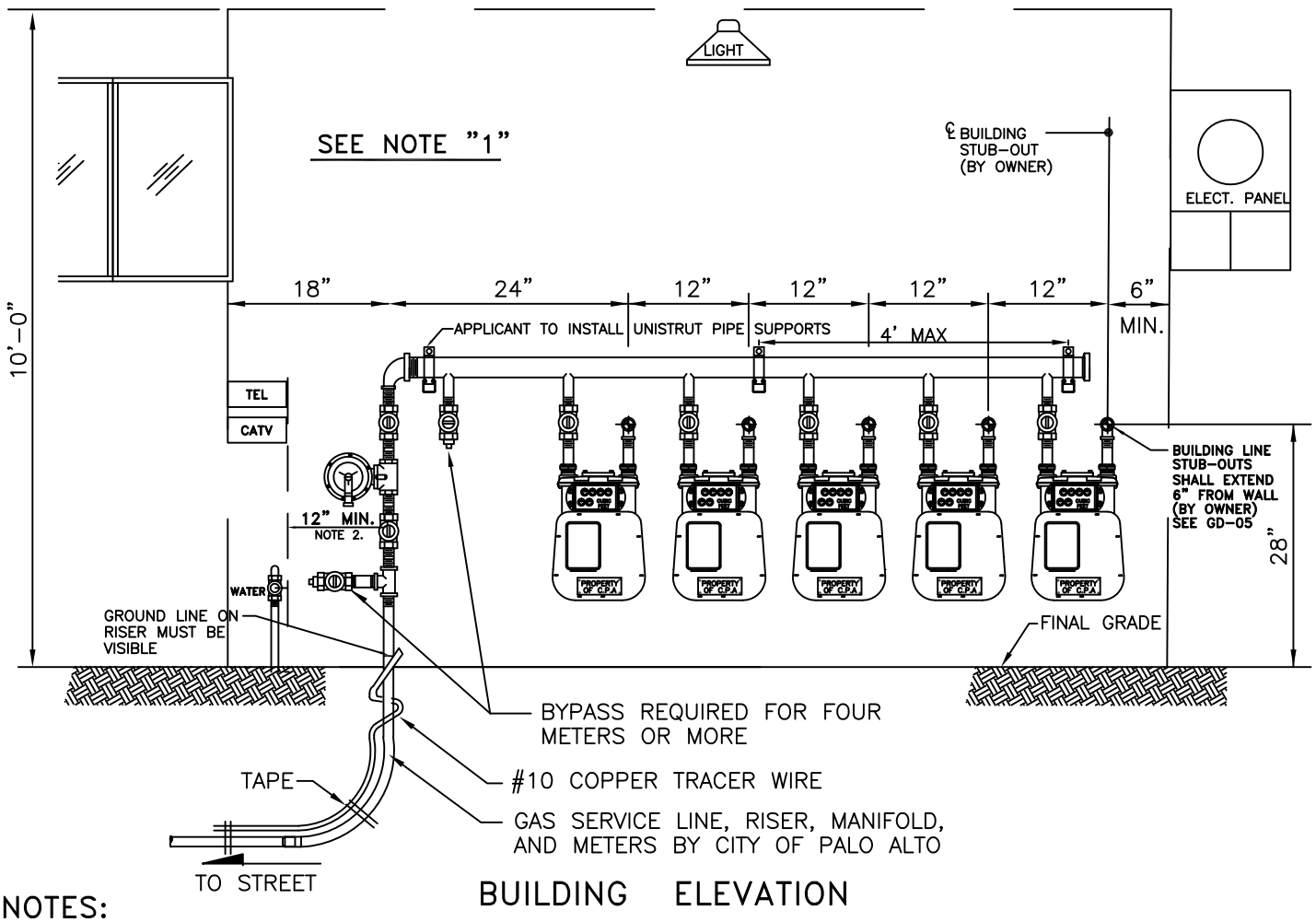


BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS ARE ALLOWED WITHIN 18" OF C.P.A. GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CPA GAS RISER OR WITHIN 6" OF BUILDING LINE STUB-OUT.
3. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
4. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE. ENCLOSURES ARE NOT ALLOWED, LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY C.P.A. IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR RESIDENTIAL INSTALLATIONS AND WHEN WITHIN 8' OF A DRIVEWAY OR PARKING
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

BY	DATE	MULTIPLE 250 CFH GAS METER LOCATION STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN CW	8/09		Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-03A
CHECKED RE	12/09			
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

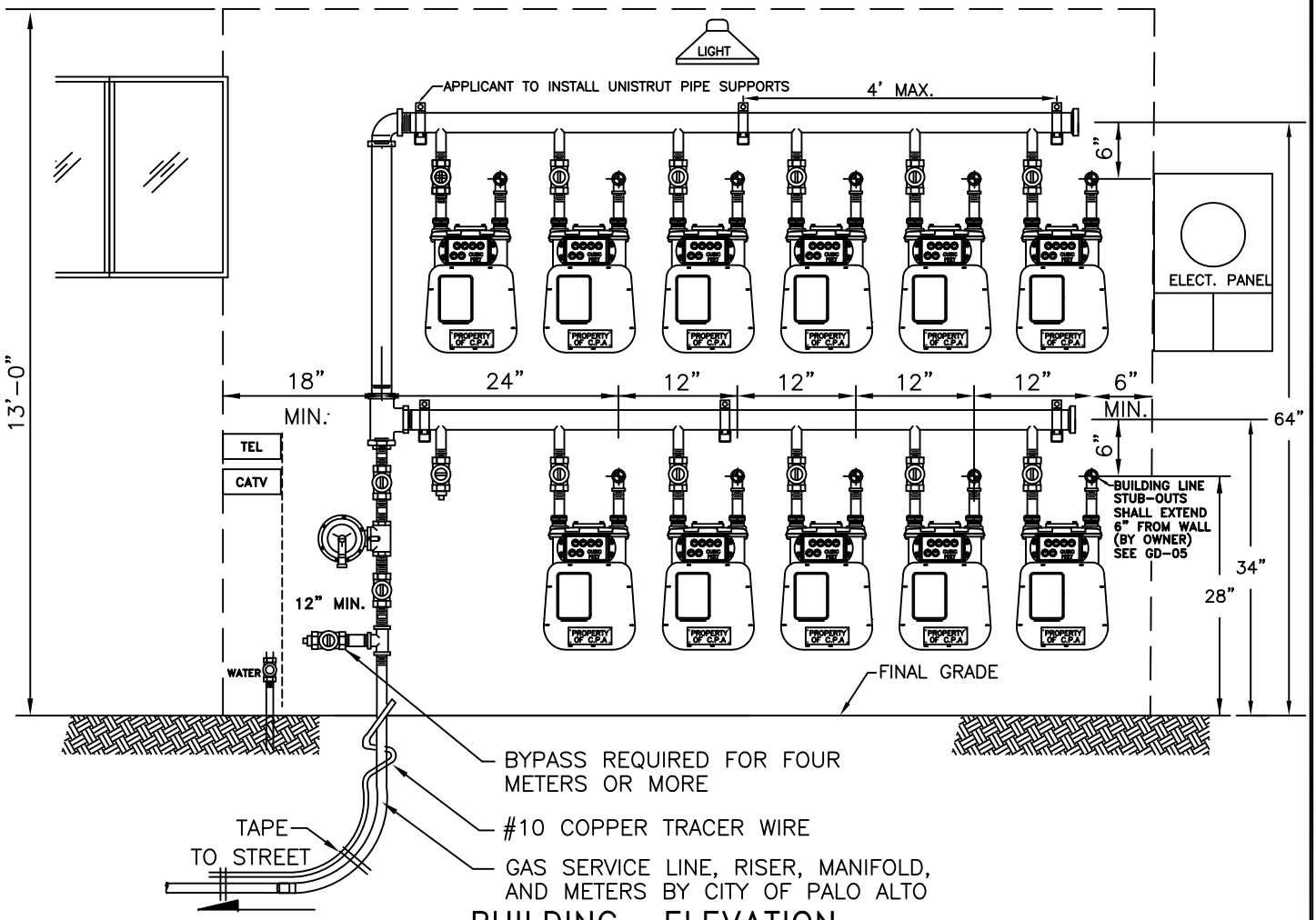


BUILDING ELEVATION

NOTES:

1. NO WINDOW, OR OTHER OPENINGS ARE ALLOWED WITHIN 18" OF C.P.A. GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB–OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CPA GAS RISER OR WITHIN 6" OF BUILDING LINE STUB–OUT.
3. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
4. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE. ENCLOSURES ARE NOT ALLOWED, LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY C.P.A. IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR RESIDENTIAL INSTALLATIONS AND WHEN WITHIN 8' OF A DRIVEWAY OR PARKING FOR COMMERCIAL INSTALLATIONS. ANY METER WITHIN 8' OF A STREET SHALL BE PROTECTED BY BOLLARDS AS SET FORTH IN C.P.A. STANDARD DETAILS WGW–05 & WGW–06.
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

BY	DATE	STANDARD DETAIL FOR FOUR OR MORE 250 CFH GAS METERS	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN CW	6/09		Edward Wu 52944 R.E. NO.	DWG. NO. STD. GD–03B
CHECKED RE	12/09		EDWARD WU WGW ENGINEERING MANAGER	
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

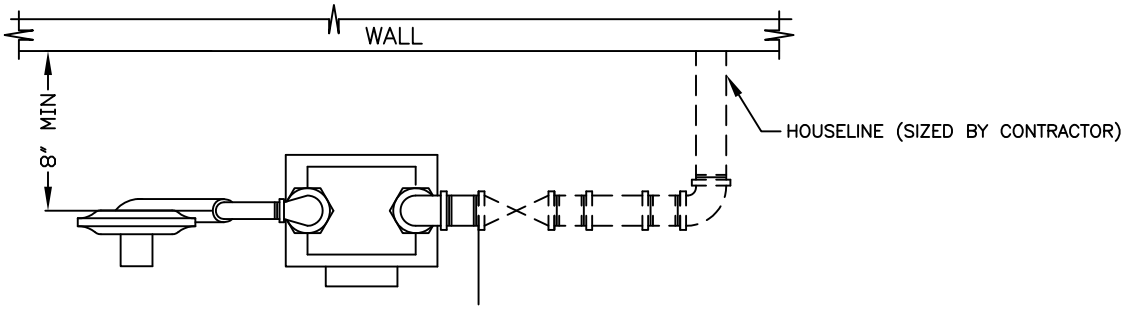


BUILDING ELEVATION

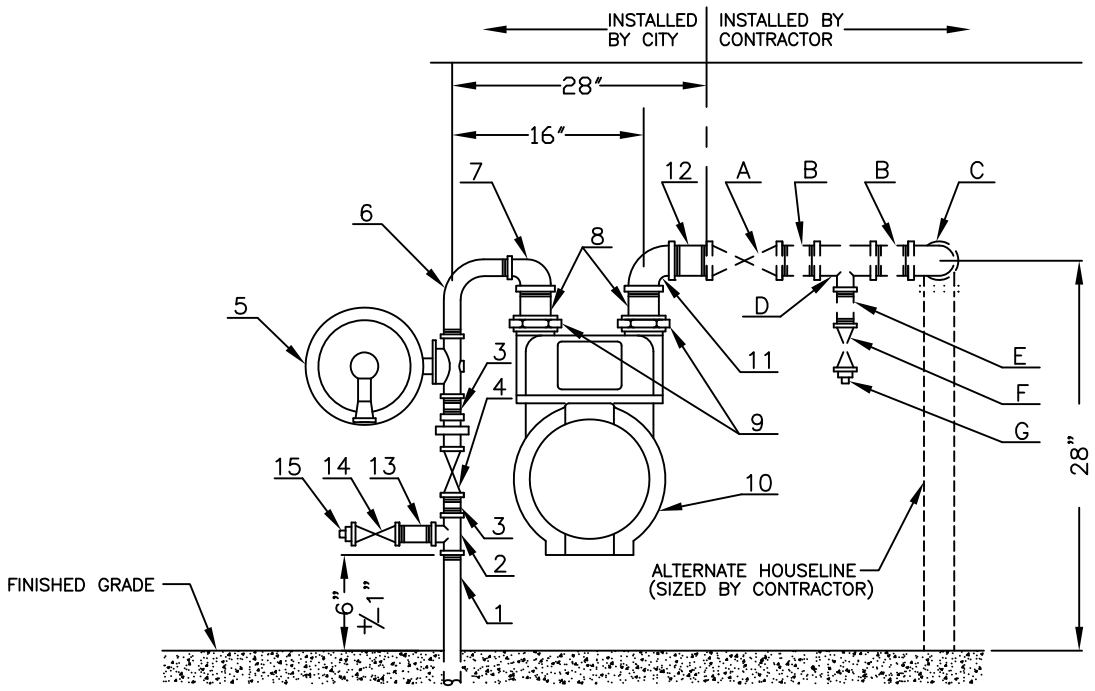
NOTES:

1. NO WINDOW, OR OTHER OPENINGS ARE ALLOWED WITHIN 18" OF C.P.A. GAS RISER, OR WITHIN 6" OF THE BUILDING LINE STUB-OUT, FROM FINAL GRADE TO A HEIGHT OF 10 FEET. MANUFACTURED FIXED CLOSED WINDOWS ARE ACCEPTABLE.
2. NO OBSTRUCTIONS SUCH AS WATER PIPES, FAUCETS, SEWER CLEANOUTS, ELECTRIC CONDUITS, ETC. ARE ALLOWED ON THE WALL BEHIND THE METER SET ASSEMBLY OR WITHIN 12" OF THE CPA GAS RISER OR WITHIN 6" OF BUILDING LINE STUB-OUT.
3. MAINTAIN 3 FEET CLEAR AND LEVEL WORKING SPACE IN FRONT OF THE GAS METER.
4. GAS METERS AND REGULATORS MUST VENT TO OUTSIDE ATMOSPHERE. ENCLOSURES ARE NOT ALLOWED, LOCATION MUST BE APPROVED BY THE UTILITIES DEPARTMENT.
5. GAS METER SET ASSEMBLIES MUST BE INSTALLED BY C.P.A. IN A LOCATION READILY ACCESSIBLE TO CITY PERSONNEL, PROTECTED FROM DAMAGE DUE TO VEHICULAR TRAFFIC, CORROSION (e.g., IRRIGATION SPRINKLERS, POOL CHEMICALS, ETC.) VIBRATION, OR EXTREME TEMPERATURES.
6. GAS METERS EXPOSED TO VEHICULAR TRAFFIC SHALL BE PROTECTED BY BOLLARDS WHEN WITHIN 3' OF A DRIVEWAY OR PARKING FOR RESIDENTIAL INSTALLATIONS AND WHEN WITHIN 8' OF A DRIVEWAY OR PARKING
7. CITY OF PALO ALTO WILL NOT SET A METER UNTIL THE ABOVE SPECIFICATIONS ARE MET AND THE BUILDING INSPECTION DIVISION APPROVES THE GAS PLUMBING AND RELEASES A SET TAG FOR THE GAS METER TO UTILITIES.

BY	DATE			
DRAWN CW	7/09	MULTIPLE 250 GAS METER LOCATION STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED RE	12/09		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-03C
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



PLAN



ELEVATION

MATERIALS SUPPLIED AND INSTALLED BY THE CITY OF PALO ALTO

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" TEE, BLK	41800	1
3	3/4" x 2" NIPPLE, BLK	41401	2
4	3/4" H-11174 MUELLER	42998	1
	METER VALVE, WITH INSULATED		
	OUTLET, BLK		
5	3/4" REGULATOR	44300	1
6	3/4" SCH. 40 90° BEND	44224	1
	WITH 2" RADIUS		
7	3/4" x 1-1/2" 90° ELBOW RED.	41350	1
8	1 1/2" PIPE SWIVEL, MALE	44203	2
9	#4 SPRAGUE SWIVEL NUT	44209	2
10	250 - 630 SCFH METER		1
11	1-1/2" 90° ELBOW, BLK	41313	1
12	1-1/2" x 3 1/2" NIPPLE, BLK	41444	1
13	3/4" x 3" NIPPLE, BLK	41403	1
14	3/4" METER VALVE, BLK	43000	1
15	3/4" PLUG, BLK	41600	1

BYPASS

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	1-1/2" H-11170 MUELLER	1
	METER VALVE	
B	1-1/2" NIPPLE	2
	(LENGTH AS REQUIRED)	
C	1-1/2" 90° ELBOW	1
D	1-1/2" x 1-1/2" x 3/4" TEE	1
E	3/4" NIPPLE	1
	(LENGTH AS REQUIRED)	
F	3/4" H-11170 MUELLER	1
	METER VALVE	
G	3/4" PLUG	1

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-02 APPENDIX C.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

	BY	DATE
DRAWN	A.P.	7/96
DESIGNED	A.P.	7/96
REVIEWED	RE	12/09

COMMERCIAL/INDUSTRIAL 250 - 630 SCFH METER ASSEMBLY STANDARD

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

52944 R.E. NO.

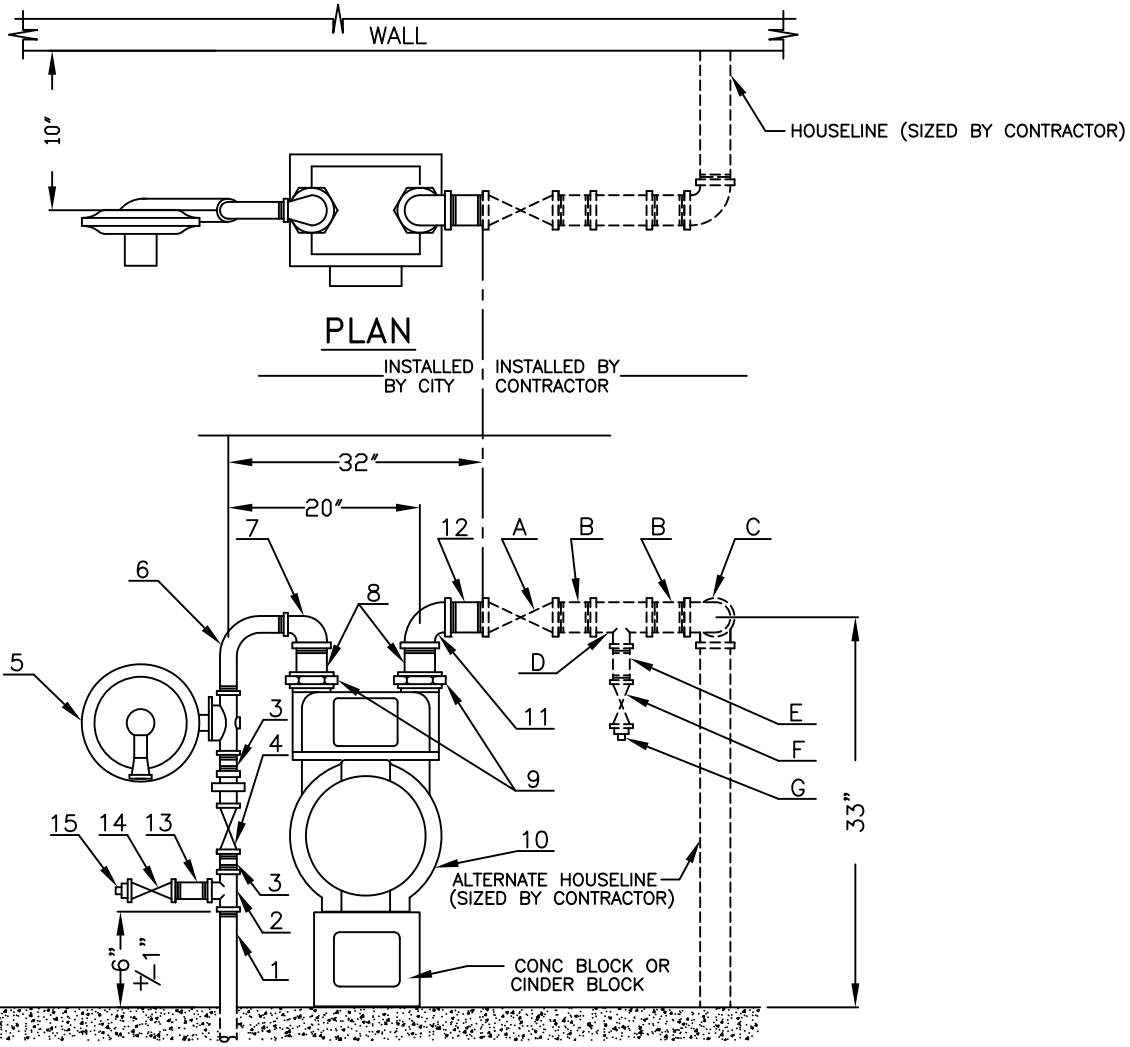
EDWARD WU
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: 1"=1'-0"

DWG. NO. STD. GD-04A

APPENDIX C



ELEVATION

MATERIALS SUPPLIED AND INSTALLED BY THE CITY OF PALO ALTO

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	1-1/4" IPS x 1" CTS RISER	43052	1
2	1-1/4" TEE, BLK	41800	1
3	1-1/4" x 2" NIPPLE, BLK	41401	2
4	1-1/4" H-11174 MUELLER	42998	1
	METER VALVE, WITH INSULATED		
	1-1/2" OUTLET, BLK		
5	1-1/2" REGULATOR	44300	1
6	1-1/2" SCH. 40 90° BEND	44224	1
	WITH 2" RADIUS		
7	1-1/2" 90° ELBOW RED.	41350	1
8	1 1/2" PIPE SWIVEL, MALE	44203	2
9	#4 SPRAGUE SWIVEL NUT	44209	2
10	400, 630, 800 OR 1000 DIAPHRAGM METER		1
11	1-1/2" 90° ELBOW, BLK	41313	1
12	1-1/2" x 3 1/2" NIPPLE, BLK	41444	1
13	1-1/4" x 3" NIPPLE, BLK	41403	1
14	1-1/4" METER VALVE, BLK	43000	1
15	1-1/4" PLUG, BLK	41600	1

BYPASS

MATERIALS SUPPLIED AND INSTALLED BY CONTRACTOR

NO.	DESCRIPTION	QUANTITY
A	1-1/2" H-11170 MUELLER	1
	METER VALVE	
B	1-1/2" NIPPLE	2
	(LENGTH AS REQUIRED)	
C	1-1/2" 90° ELBOW	1
D	1-1/2" x 1-1/2" x 1-1/4" TEE	1
E	1-1/4" NIPPLE	1
	(LENGTH AS REQUIRED)	
F	1-1/4" H-11170 MUELLER	1
	METER VALVE	
G	1-1/4" PLUG	1

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-02 APPENDIX C.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

	BY	DATE
DRAWN	A.P.	7/96
CHECKED	RE	12/09
REVIEWED	RE	12/09

COMMERCIAL/INDUSTRIAL 800-1000 SCFH DIAPHRAGM METER ASSEMBLY STANDARD

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

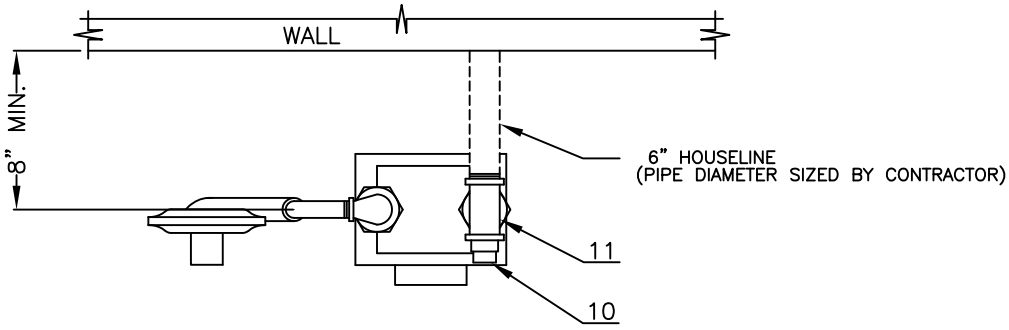
EDWARD WU, WGW ENGINEERING MANAGER, 52944 R.E. NO.

REVISION: JAN 31, 2013

SCALE: 1"=1'-0"

DWG. NO. STD. GD-04B

APPENDIX C



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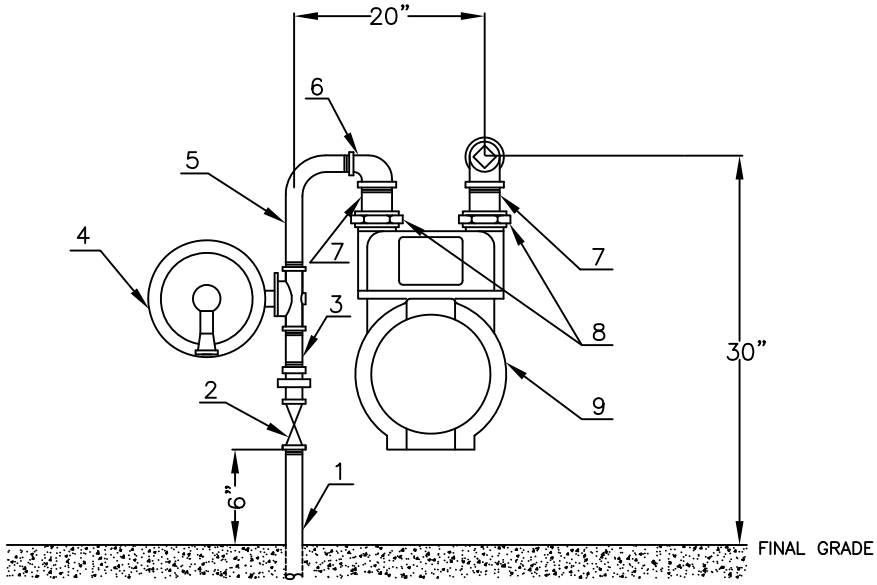


ELEVATION

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-01, 02 APPENDIX C.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" IPS x 1" CTS RISER	43052	1
2	3/4" H-11174 MUELLER	42998	1
	METER VALVE, WITH INSULATED		
	OUTLET, BLK		
3	3/4" x 3-1/2" NIPPLE, BLK	41404	1
4	3/4" REGULATOR	44300	1
5	3/4" SCH. 40 90° BEND	44222	1
	WITH 2" RADIUS		
6	3/4" x 1-1/2" ELBOW RED.	41350	1
7	1 1/2" PIPE SWIVEL, MALE	44203	2
8	#4 SPRAGUE SWIVEL NUT	44209	2
9	250 - 630 SCFH METER		1
10	1-1/2" PLUG, BLK	41603	1
11	1-1/2" TEE, BLK	41803	1

	BY	DATE
DRAWN	A.P.	7/96
CHECKED	RE	12/09
REVIEWED	RE	12/09

250-800 SCFH METER
RESIDENTIAL ASSEMBLY STANDARD

CITY OF PALO ALTO, CALIFORNIA

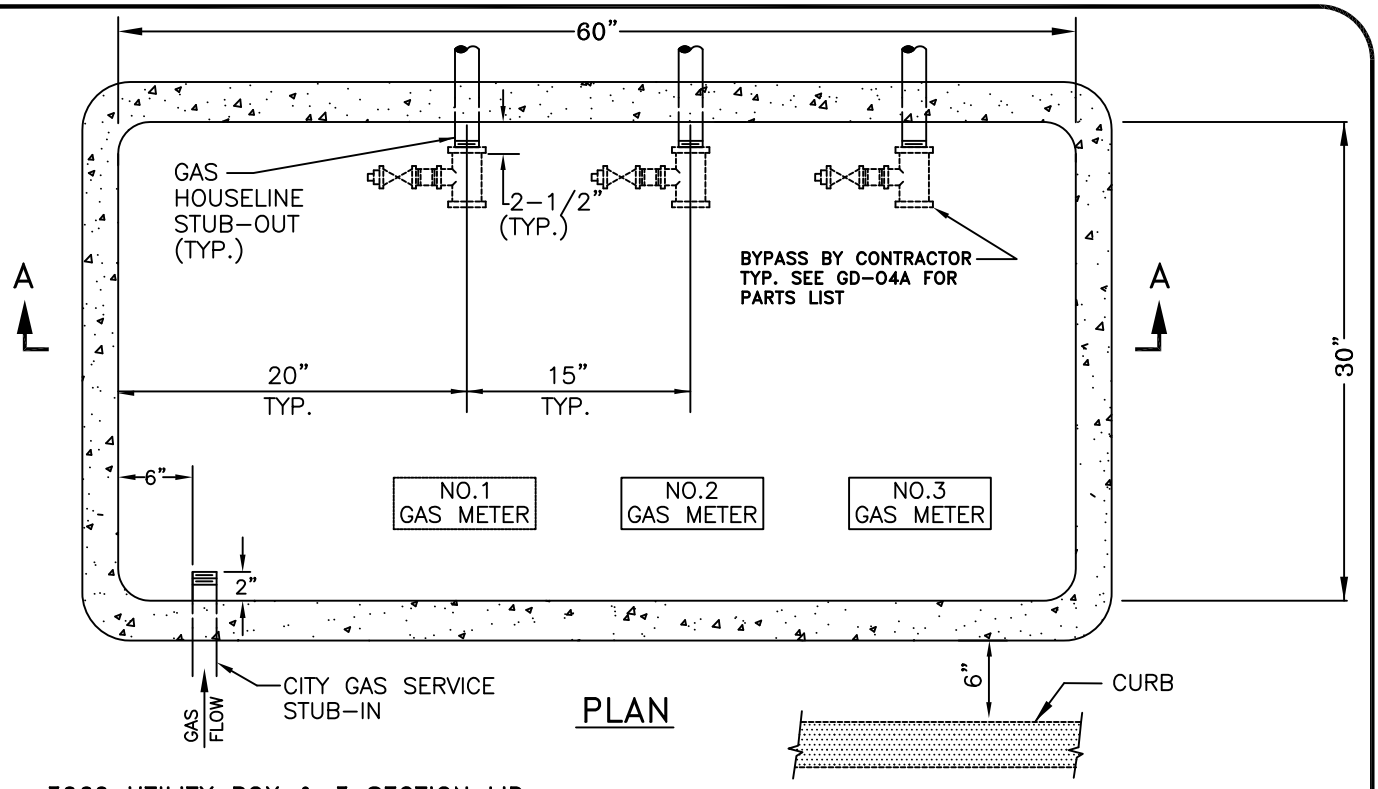
APPROVED:
JANUARY, 31 2013
52944 R.E. NO.
EDWARD WU
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

SCALE: 1"=1'-0"

DWG. NO. STD. GD-05

APPENDIX C



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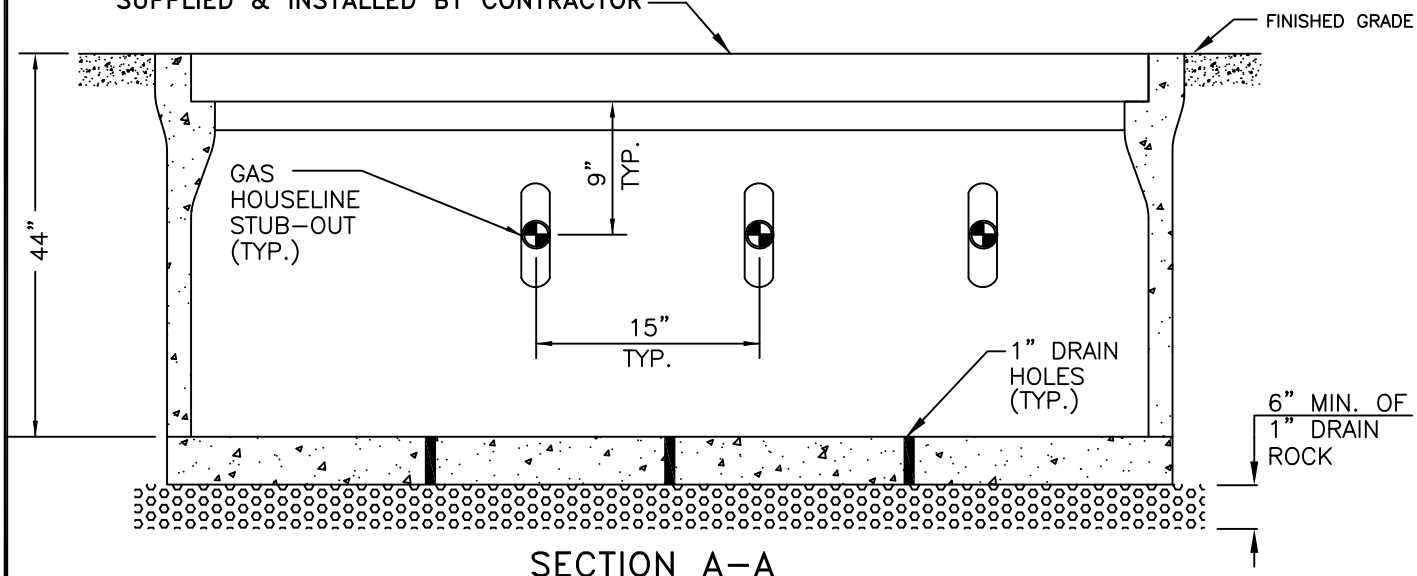
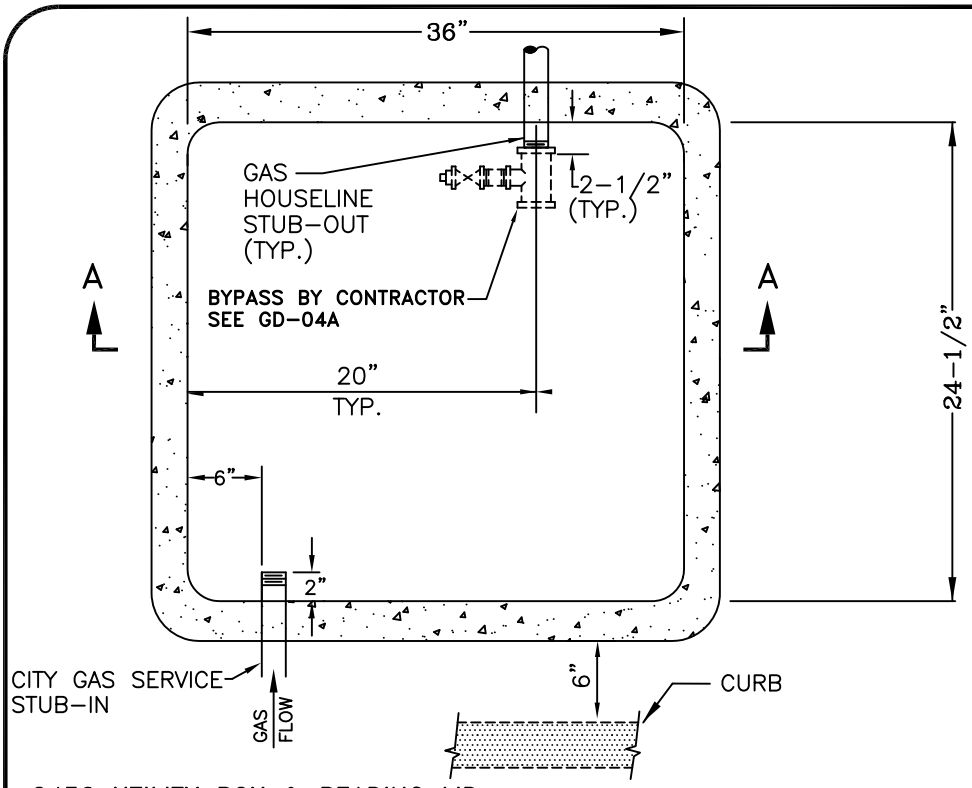


SECTION A–A

NOTES:

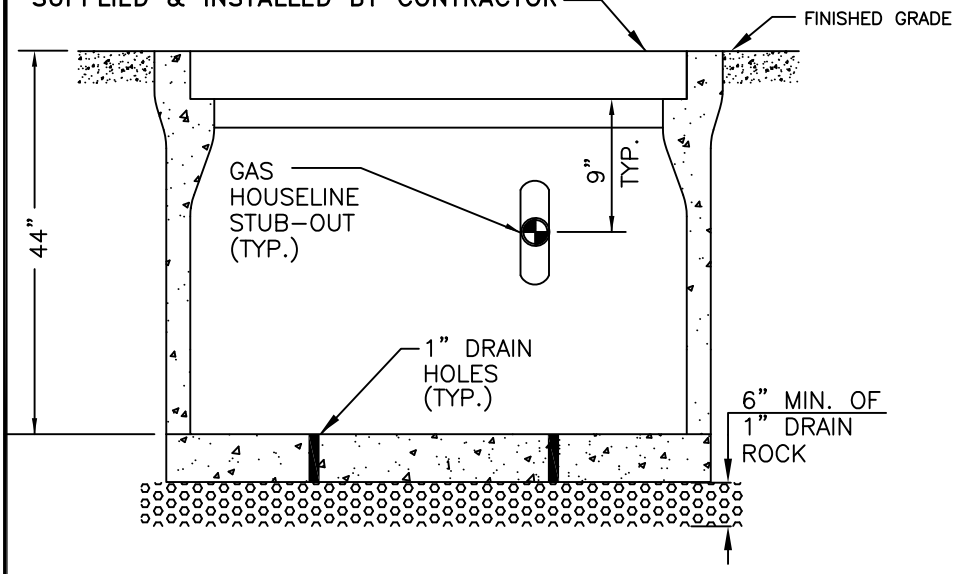
1. CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT.
2. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY–PASS.
3. CURB METER BOXES MUST NOT BE LOCATED IN VEHICULAR TRAFFIC AREAS.
4. CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
5. GAS SERVICE LINE, CONNECTION TO MAIN AND METER INSTALLATION BY CITY OF PALO ALTO.
6. C.P.A. WILL NOT SET METERS UNTIL THE SPECIFICATIONS ARE MET.
6. METER BOX AND LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW & PLANTING STRIP APPLICATIONS AND MIN. TIER 22 FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

BY	DATE	MULTIPLE CURB GAS METERS FOR 250 – 630 CFH STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DRAWN A.P.	8/96		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. GD–06
CHECKED RE	12/09			
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



PLAN

2436 UTILITY BOX & READING LID
SUPPLIED & INSTALLED BY CONTRACTOR

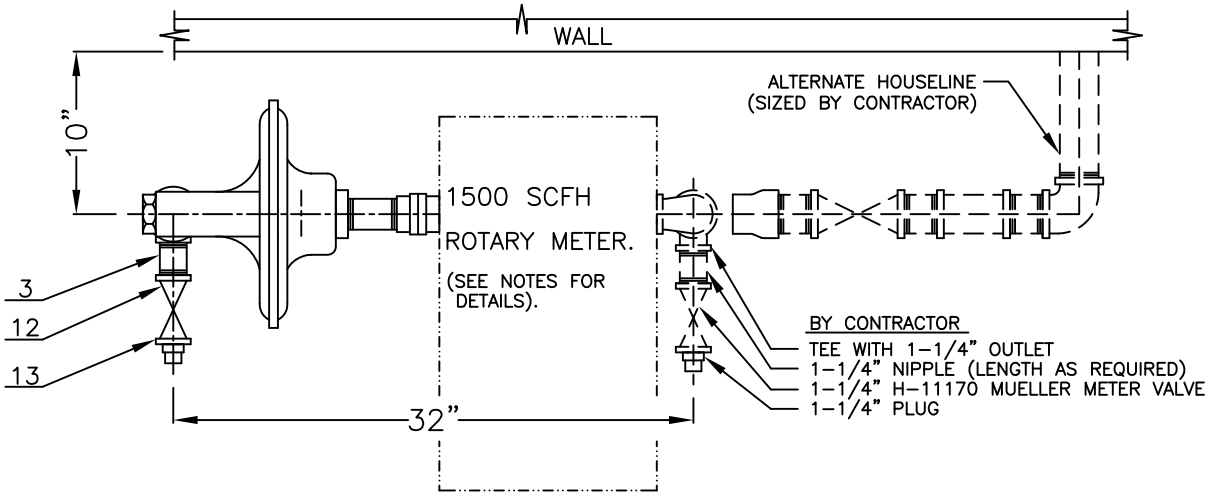


SECTION A–A

NOTES:

1. CURB METER BOX, INSTALLATION AND LOCATION SHALL BE APPROVED BY THE UTILITIES DEPARTMENT.
2. CONTRACTOR SHALL FURNISH AND INSTALL METER BOX, LID, HOUSELINE & BY–PASS.
3. CURB METER BOXES MUST NOT BE LOCATED IN VEHICULAR TRAFFIC AREAS.
4. CURB METER BOXES SHALL NOT BE INSTALLED IN AREAS PRONE TO FLOODING (RAINFALL, SURFACE WATER FLOW, IRRIGATION, ETC.)
5. GAS SERVICE LINE, CONNECTION TO MAIN AND METER INSTALLATION BY CITY OF PALO ALTO.
6. C.P.A. WILL NOT SET METERS UNTIL THE SPECIFICATIONS ARE MET.
6. METER BOX AND LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW & PLANTING STRIP APPLICATIONS AND MIN. TIER 22 FOR DRIVEWAY AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

BY	DATE	CURB GAS METER FOR 250 – 630 CFH STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NTS
DRAWN A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD–07
CHECKED RE	12/09			
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



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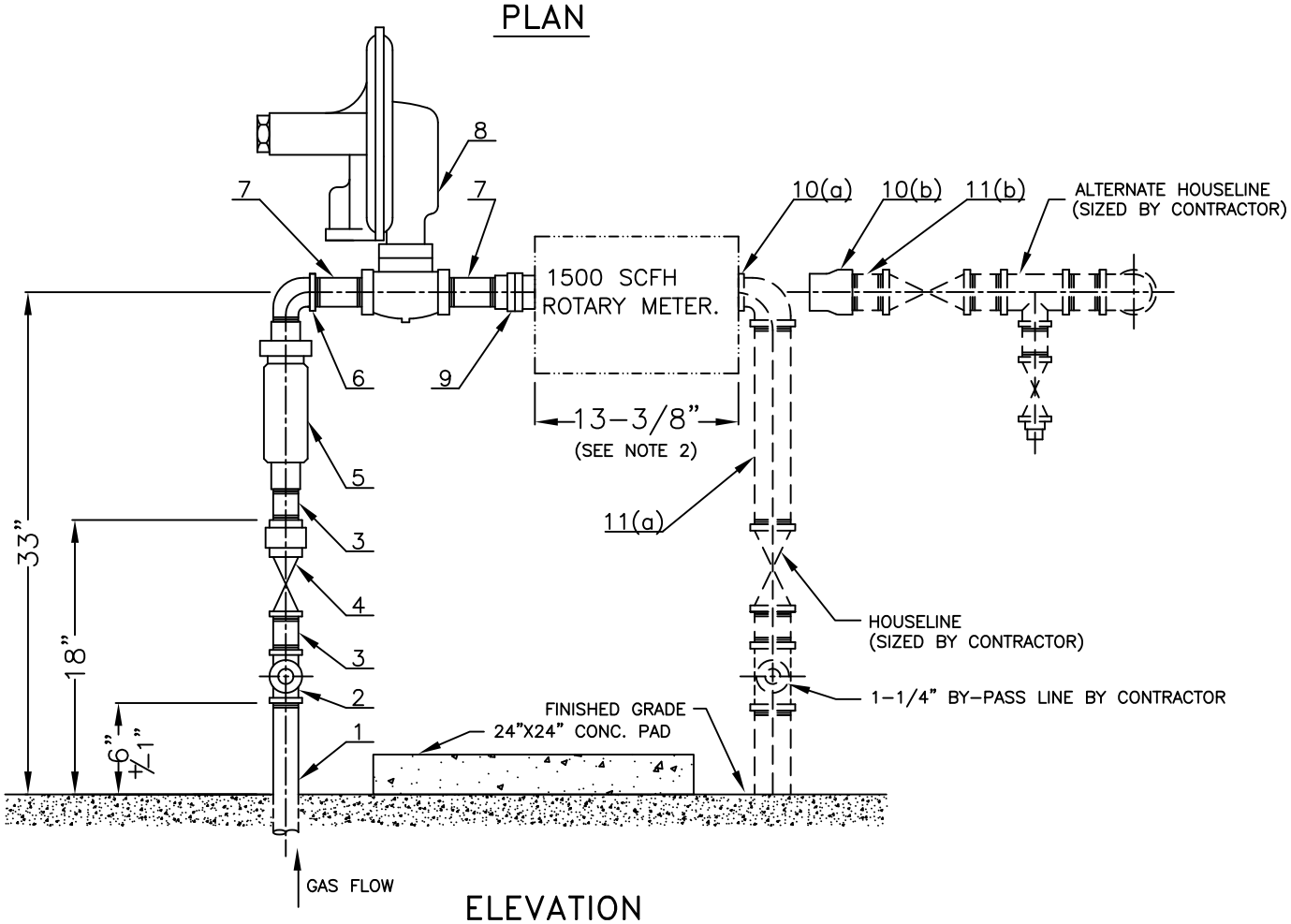


ELEVATION

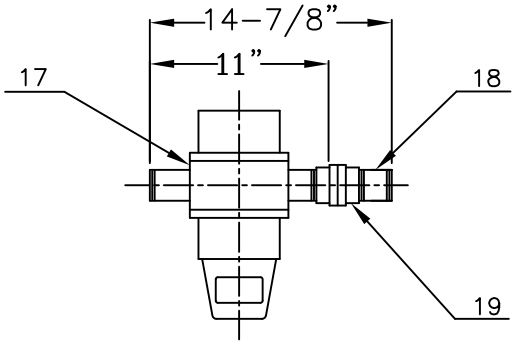
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-02 APPENDIX C.
2. SPACE SCREWED FITTINGS 13-3/8" APART FOR INSTALLATION OF METER. THIS DIMENSION WILL ALLOW THE 14-7/8" METER ASSEMBLY TO BE INSTALLED WITH AN ALLOWANCE OF 3/4" ON EACH SIDE TO ACCOUNT FOR THREAD ENGAGEMENT DEPTH. SEE DWG. STD. GD-15 AND GD-16 APPENDIX C FOR DETAILS.
3. LIST OF MATERIALS SEE ON DWG. STD. GD-17 AND GD-18 APPENDIX C.
4. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

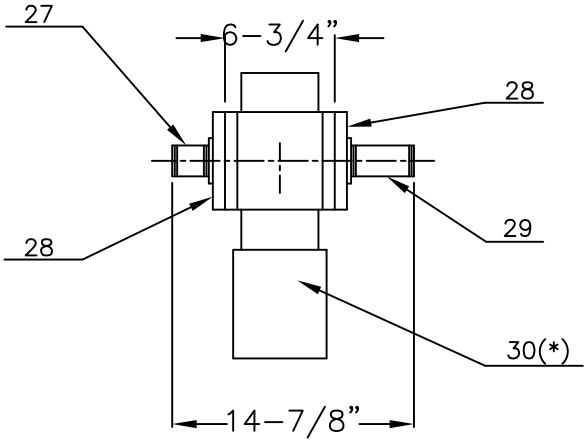
BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1500 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-14
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

1500 SCFH 175 PSI ROTARY GAS METER INSTALLATION DETAILS.

ROOTS 1.5M (1–1/2" THREADED CONNECTIONS)



ROOTS TQM 15C (2" FLANGED CONNECTIONS)



PLANS

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1500 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		EDWARD WU WGW ENGINEERING MANAGER 52944 R.E. NO.	DWG. NO. STD. GD–15
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	1–1/4" IPS x 1" CTS RISER, PREBENT	43050	1
2	1–1/4" TEE, BLK	41802	1
3	1–1/4" x 3–1/2" NIPPLE, BLK	41434	3
4	1–1/4" H–11174 MUELLER METER VALVE WITH	43001	1
	INSULATED OUTLET, BLK		
5	1–1/4" FILTER, PHILPOTT MODEL 125–S,	44315	1
	THREADED CONNECTIONS, ASTM A48–64, CLASS 30		
6	1–1/4" MALE x 1–1/2" FEMALE 90° REDUCING	41361	1
	STREET ELBOW, BLK		
7	1–1/2" x 4–1/2" NIPPLE, BLK	41446	2
8	1–1/2" REGULATOR WITH	44324	1
	INTERNAL RELIEF VALVE, 1/2" ORIFICE		
	SIZE, 10° VALVE ANGLE; THREADED CONNECTIONS;		
9	1–1/2" UNION, GRD JOINT, BLK	41903	1
10(a)	2" x 1–1/2" 90° REDUCING ELBOW, BLK	41356	1
10(b)	2" x 1–1/2" REDUCER, BLK	41711	1
11(a)	2" x 14–1/2" NIPPLE, BLK	41487	1
11(b)	2" x 3–1/2" NIPPLE, BLK	41453	1
12	1–1/4" METER VALVE, BLK	43002	1
13	1–1/4" PLUG, BLK	41602	1

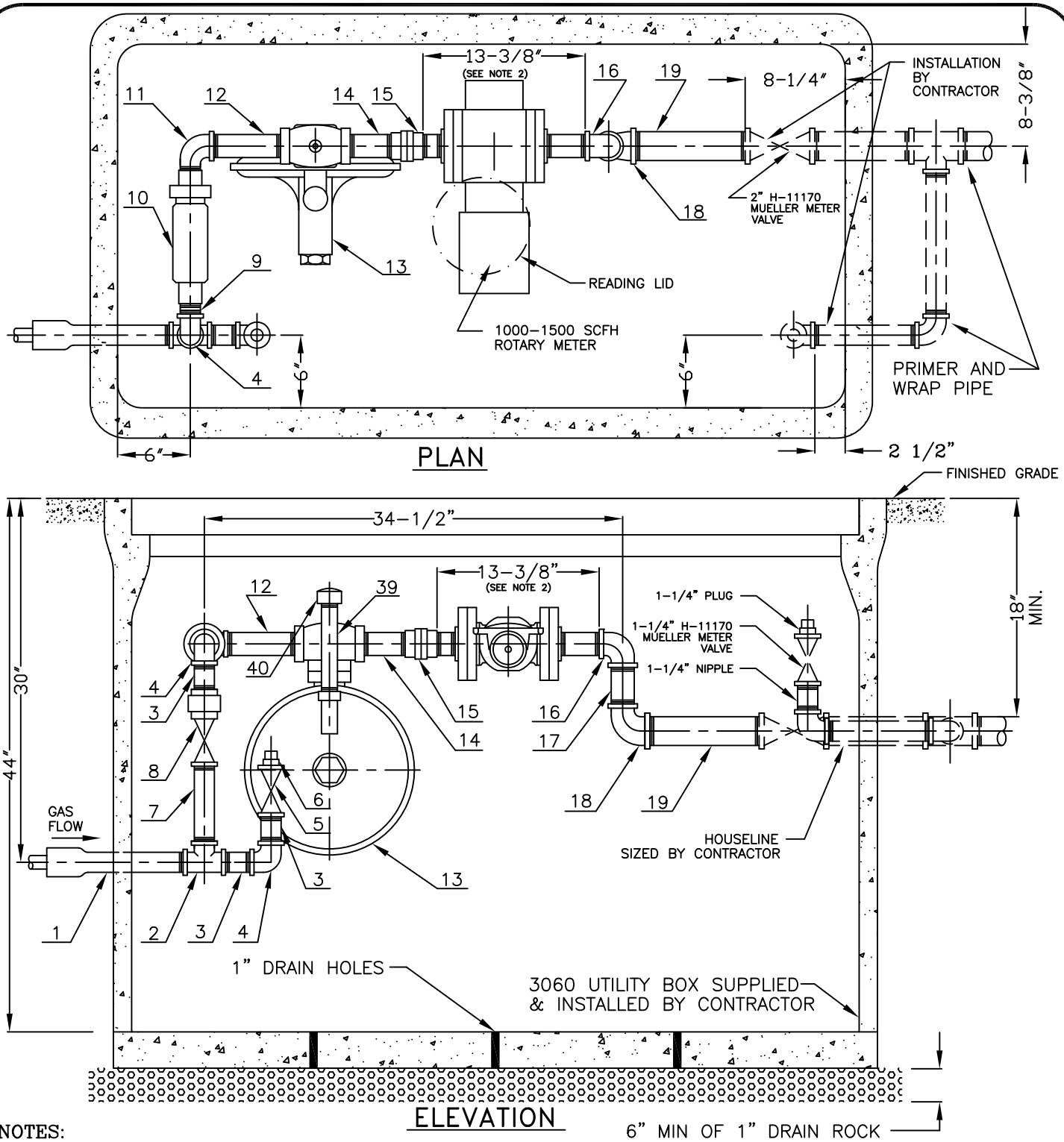
ROOTS 1.5M (1–1/2" THREADED CONNECTIONS):

NO.	DESCRIPTION	STOCK NO.	QUANTITY
17	ROOTS 1.5M (1500 SCFH) 175 PSI ROTARY GAS	NOT STOCKED	1
	METER, 1–1/2" THREADED CONNECTIONS		
18	1–1/2" x 3" NIPPLE, BLK	41443	1
19	1– 1/2" UNION, GRD JOINT, BLK	41903	1

ROOTS TQM 15C (2" FLANGED CONNECTIONS):

NO.	DESCRIPTION	STOCK NO.	QUANTITY
27	1–1/2" x 3" NIPPLE, BLK	41443	1
28	2" x 1–1/2" 150 PSI REDUCING FLANGE, FLAT	43320	2
	FACE, THREADED, A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	2
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 1–1/2" HEX CAP SCREW, SAE GRADE 5	43312	8
29	1–1/2" x 4–1/2" NIPPLE, BLK	41446	1
30(B)	ROOTS TQM 15C (1500 SCFH) 175 PSI ROTARY GAS	44125	1
	METER, 2" FLANGED CONNECTIONS		

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1500 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: NTS
DESIGNED A.P.	8/96		Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD–17
REVIEWED RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



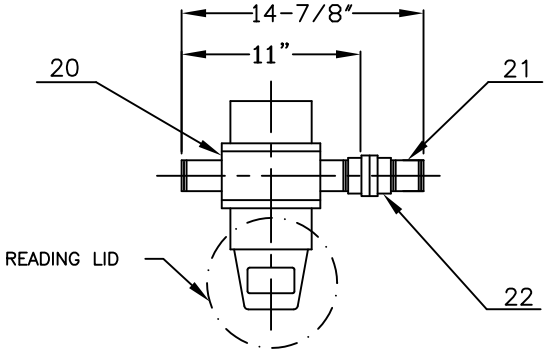
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-06 APPENDIX C.
2. SPACE SCREWED FITTINGS 13-3/8" APART FOR INSTALLATION OF METER. THIS DIMENSION WILL ALLOW THE 14-7/8" METER ASSEMBLY TO BE INSTALLED WITH AN ALLOWANCE OF 3/4" ON EACH SIDE TO ACCOUNT FOR THREAD ENGAGEMENT DEPTH. SEE DWG. STD. GD-20 AND GD-21 APPENDIX C FOR DETAILS.
3. LIST OF MATERIALS SEE ON DWG. STD. GD-20 AND GD-21 APPENDIX C.
4. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
5. METER BOX AND LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS AND MIN. TIER 22 FOR DRIVEWAY AND AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

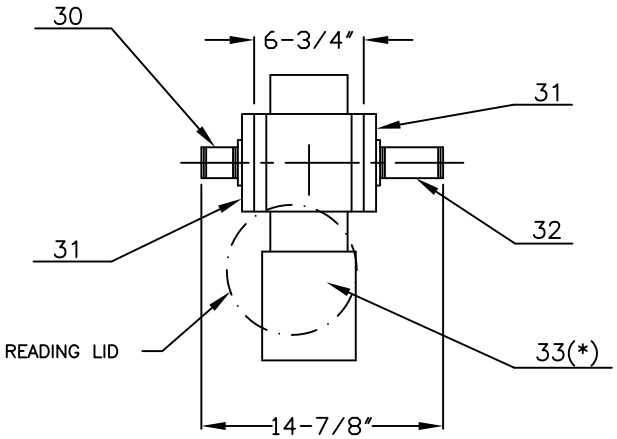
BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1000-1500 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-19
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

1000–1500 SCFH 175 PSI ROTARY GAS METER INSTALLATION DETAILS.

ROOTS 1.5M (1–1/2" THREADED CONNECTIONS)



ROOTS TQM 11C/15C (2" FLANGED CONNECTIONS)



NOTE: 33(*) – SIZE OF METER:

33(A) – TQM 11C
33(B) – TQM 15C

PLANS

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1000–1500 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD–20
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	1–1/4" TRANSITION FITTING, THREADED END	45598	1
2	1–1/4" TEE, BLK	41802	1
3	1–1/4" x 3–1/2" NIPPLE, BLK	41434	3
4	1–1/4" 90° ELBOW, BLK	41312	2
5	1–1/4" METER VALVE, BLK	43002	1
6	1–1/4" PLUG, BLK	41602	1
7	1–1/4" x 7–1/2" NIPPLE, BLK	41472	1
8	1–1/4" H–11174 MUELLER METER VALVE WITH	43001	1
	INSULATED OUTLET, BLK		
9	1–1/4" x 2–1/2" NIPPLE, BLK	41432	1
10	1–1/4" FILTER, PHILPOTT MODEL 125–S,	44315	1
	THREADED CONNECTIONS, ASTM A48–64, CLASS 30		
11	1–1/4" MALE x 1–1/2" FEMALE 90° REDUCING	41361	1
	STREET ELBOW		
12	1–1/2" x 7" NIPPLE, BLK	41480	1
13	1–1/2" REGULATOR WITH	44324	1
	INTERNAL RELIEF VALVE,		
	THREADED CONNECTIONS;		
14	1–1/2" x 5" NIPPLE, BLK	41447	1
15	1–1/2" UNION GRD JOINT, BLK	41903	1
16	1–1/2" x 90° ELBOW, BLK	41313	1
17	1–1/2" x 4–1/2" NIPPLE, BLK	41446	1
18	2" x 1–1/2" 90° REDUCING ELBOW, BLK	41356	1
19	2" x 10–1/2" NIPPLE, BLK	41485	1

ROOTS 1.5M (1–1/2" THREADED CONNECTIONS):

NO.	DESCRIPTION	STOCK NO.	QUANTITY
20	ROOTS 1.5M (1500 SCFH) 175 PSI ROTARY GAS	NOT STOCKED	1
	METER, 1–1/2" THREADED CONNECTIONS		
21	1–1/2" x 3" NIPPLE, BLK	41443	1
22	1–1/2" UNION GRD JOINT, BLK	41903	1

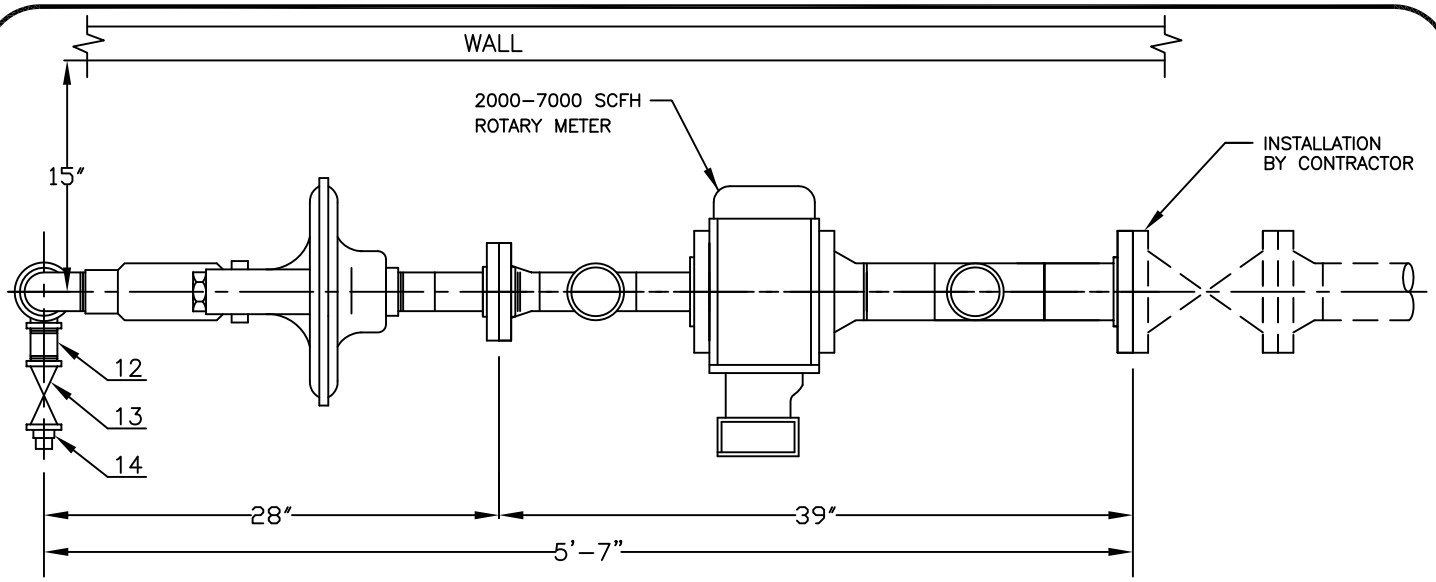
ROOTS TQM 11C/15C (2" FLANGED CONNECTIONS):

NO.	DESCRIPTION	STOCK NO.	QUANTITY
30	1–1/2" x 3" NIPPLE, BLK	41443	1
31	2" x 1–1/2" 150 PSI REDUCING FLANGE, FLAT	43320	2
	FACE, THREADED, A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	2
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 1–1/2" HEX CAP SCREW, SAE GRADE 5	43312	8
32	1–1/2" x 4–1/2" NIPPLE, BLK	41446	1
33(A)	ROOTS TQM 11C (1100 SCFH) 175 PSI ROTARY GAS	44123	1
	METER, 2" FLANGED CONNECTIONS		
33(B)	ROOTS TQM 15C (1500 SCFH) 175 PSI ROTARY GAS	44125	1
	METER, 2" FLANGED CONNECTIONS		

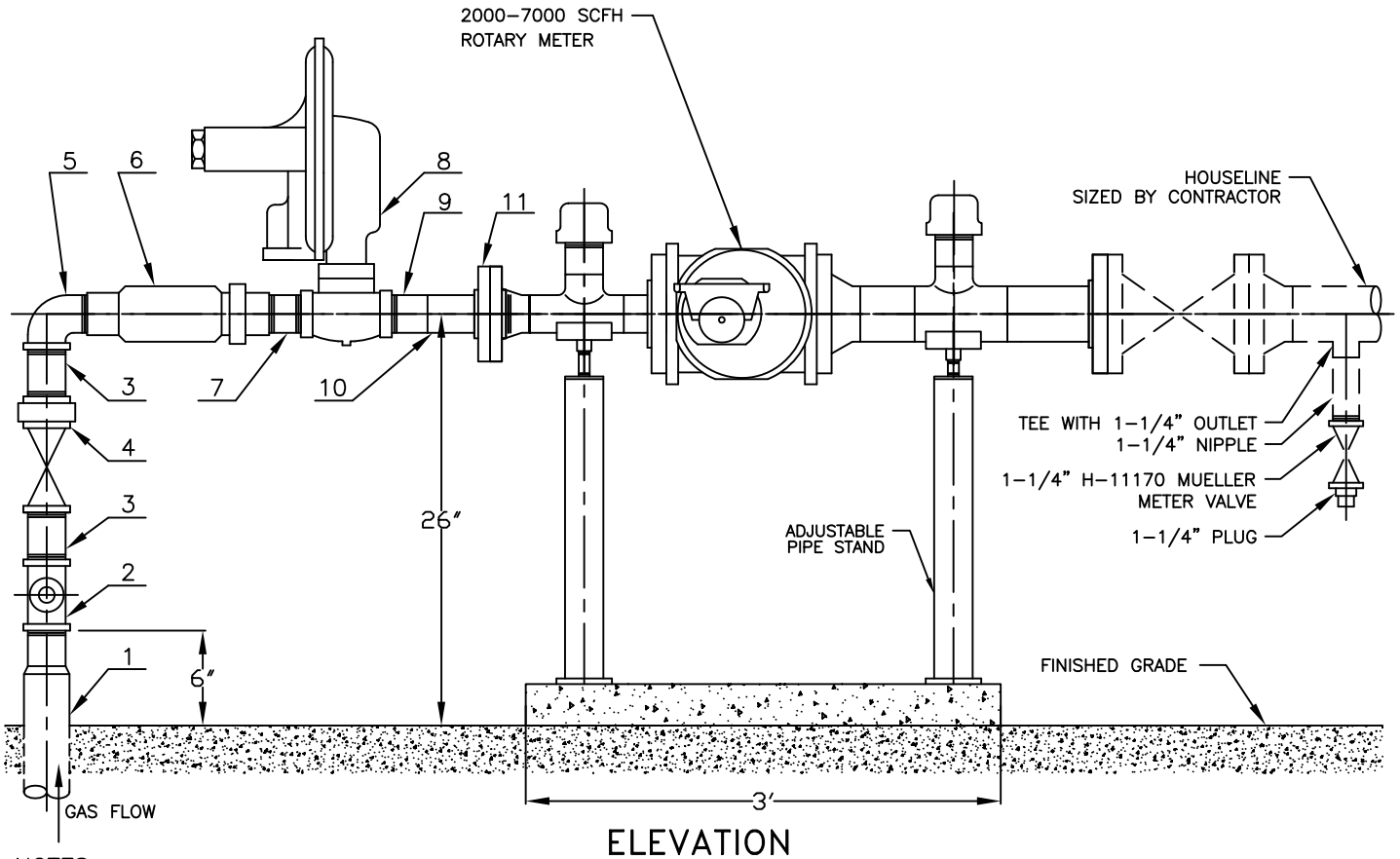
VENT INSTALLATION:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
39	1" x 9" NIPPLE, BLK	41470	1
40	1" FEMALE TYPE 975 VERTICAL VENT	44311	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 1000–1500 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		EDWARD WU WGW ENGINEERING MANAGER 52944 R.E. NO.	DWG. NO. STD. GD–21
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



PLAN



ELEVATION

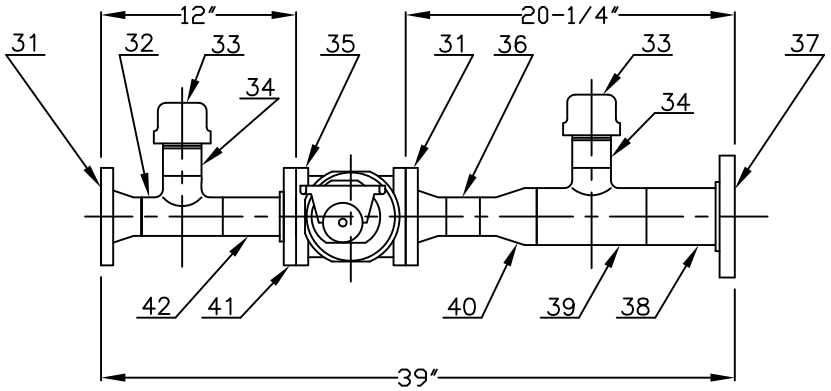
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD–02 APPENDIX C.
2. 2000–7000 SCFH ROTARY METER INSTALLATION DETAILS SEE ON DWG. STD. GD–26 APPENDIX C.
3. LIST OF MATERIALS SEE ON DWG. STD. GD–26, GD–27, AND GD–28 APPENDIX C.
4. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

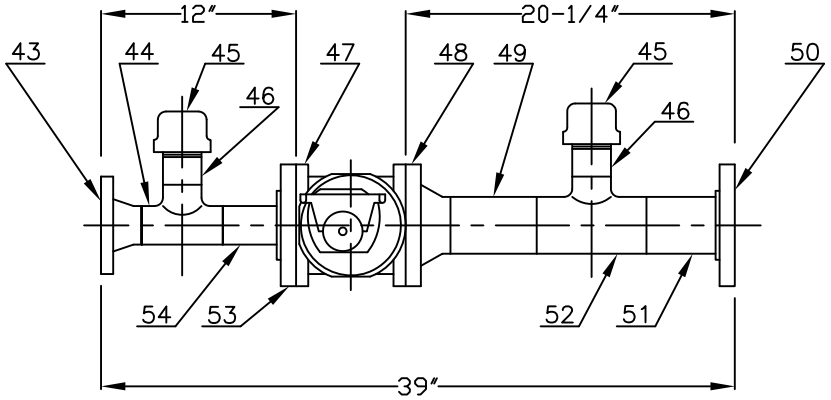
BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000–7000 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		EDWARD WU, WGW ENGINEERING MANAGER, 52944 R.E. NO.	DWG. NO. STD. GD–24
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

2000–7000 SCFH 175 PSI ROTARY GAS METER INSTALLATION DETAILS

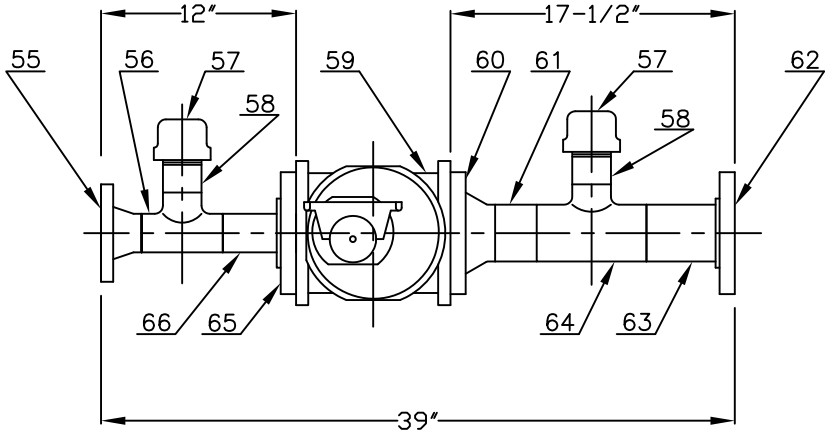
2000/3000 SCFH



5000 SCFH



7000 SCFH



ELEVATION

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000–7000 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1″=1′–0″
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD–26
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	2" IPS x 2" IPS ANODELESS RISER, PREBENT	43057	1
2	2" x 2" x 1-1/4" TEE, BLK	41810	1
3	2" x 4-1/2" NIPPLE, BLK	41455	2
4	2" H-11174 MUELLER METER VALVE WITH	43005	1
	INSULATED OUTLET		
5	2" MALE x 2" FEMALE 90° STREET ELBOW, BLK	41365	1
6	2" FILTER, PHILPOTT MODEL 200-S,	44317	1
	THREADED CONNECTIONS, ASTM A48-64, CLASS 30		
7	2" x 3-1/2" NIPPLE, BLK	41453	1
8	2" 243-12-2 EQUIMETER REGULATOR WITH	44330	1
	INTERNAL RELIEF VALVE, BLUE SPRING, 3/4" ORIFICE		
	SIZE, 30° VALVE ANGLE; THREADED CONNECTIONS;		
	POSITION C-4-Z		
9	2" x 3" NIPPLE, THREADED ON ONE END	41490	1
10	2" 150 ANSI STUB END	43340	1
11	2" 150 ANSI LAP-JOINT FLANGE, A 105	43325	1
	2" IPS 1/16" THICK, RING GASKET FOR 150 ANSI	43355	1
	LAP-JOINT FLANGE		
	5/8"-11 x 2-3/4" HEX CAP SCREW, SAE GRADE 5	43314	4
	5/8"-11 HEX NUT	43317	4
12	1-1/4" x 3-1/2" NIPPLE, BLK	41434	1
13	1-1/4" METER VALVE, BLK	43002	1
14	1-1/4" PLUG, BLK	41602	1

2000/3000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
31	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43320	2
	A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-1/2" HEX CAP SCREW, SAE GRADE 5	43312	4
32	2" x 2" x 2" TEE SCH. 40, BUTT-WELD ENDS	41811	1
33	2" CAP, BLK	41104	2
34	2" x 3" NIPPLE, THREADED ON ONE END	41490	2
35			
A	2" 2000 SCFH 175 PSI ROTARY GAS METER	44126	1
B	2" 3000 SCFH 175 PSI ROTARY GAS METER	44127	1
36	2" x 2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1
37	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1
38	3" 150 ANSI STUB END	43341	1
39	3" x 3" x 2" TEE SCH. 40, BUTT-WELD ENDS	41812	1
40	3" x 2" REDUCER, CONC., BUTT-WELD ENDS	41375	1
41	2" 150 ANSI SLIP-ON FLANGE, FLAT FACE A 105	43335	1
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-1/2" HEX CAP SCREW, SAE GRADE 5	43312	4
42	2" x 4-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000-7000 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		EDWARD WU WGW ENGINEERING MANAGER 52944 R.E. NO.	DWG. NO. STD. GD-27
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

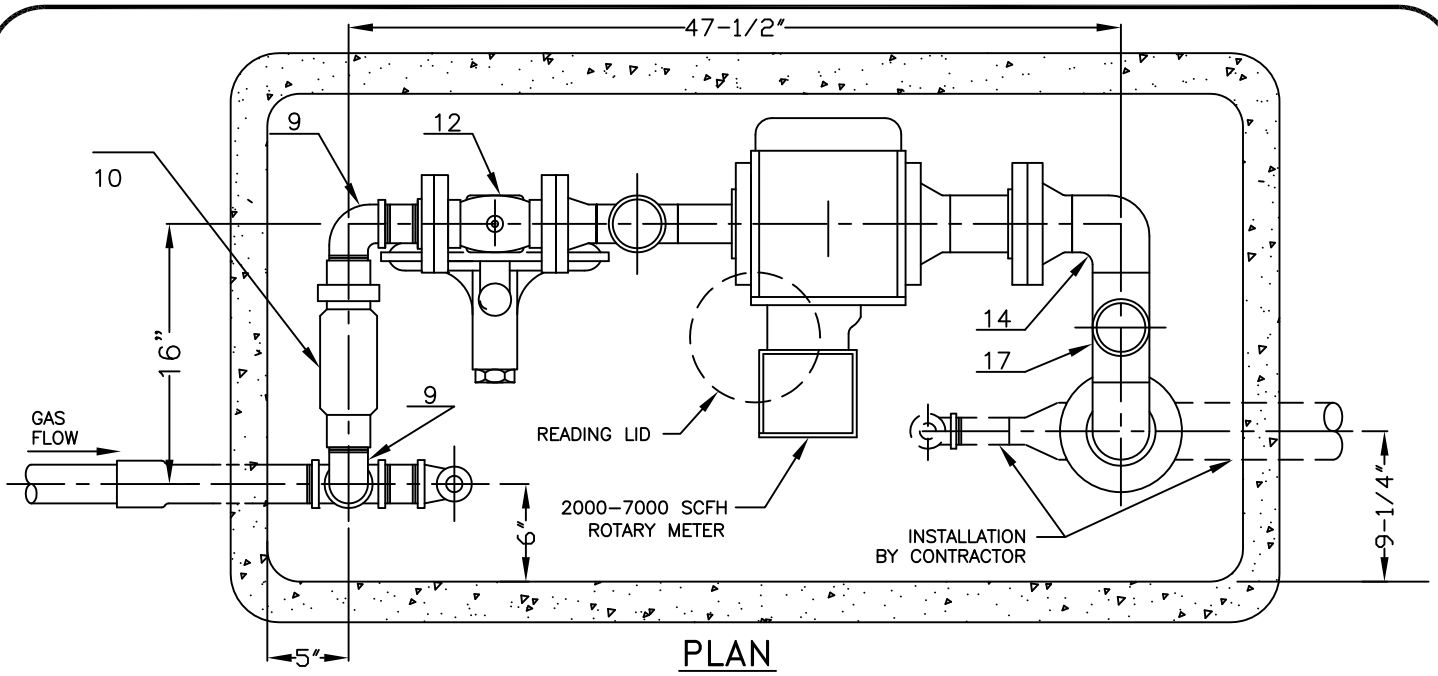
5000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
43	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
44	2" x 2" x 2" TEE SCH. 40, BUTT-WELD ENDS	41811	1
45	2" CAP, BLK	41104	2
46	2" x 3" NIPPLE, THREADED ON ONE END	41490	2
47	3" 5000 SCFH 175 PSI ROTARY GAS METER	44128	1
48	3" 150 ANSI WELD NECK FLANGE, FLAT FACE	43331	1
	A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
49	3" x 5-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41518	1
50	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1
51	3" 150 ANSI STUB END	43341	1
52	3" x 3" x 2" TEE SCH. 40, BUTT-WELD ENDS	41812	1
53	3 x 2" 150 ANSI REDUCING FLANGE, FLAT FACE,	43322	1
	SLIP-ON, A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
54	2" x 4-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1

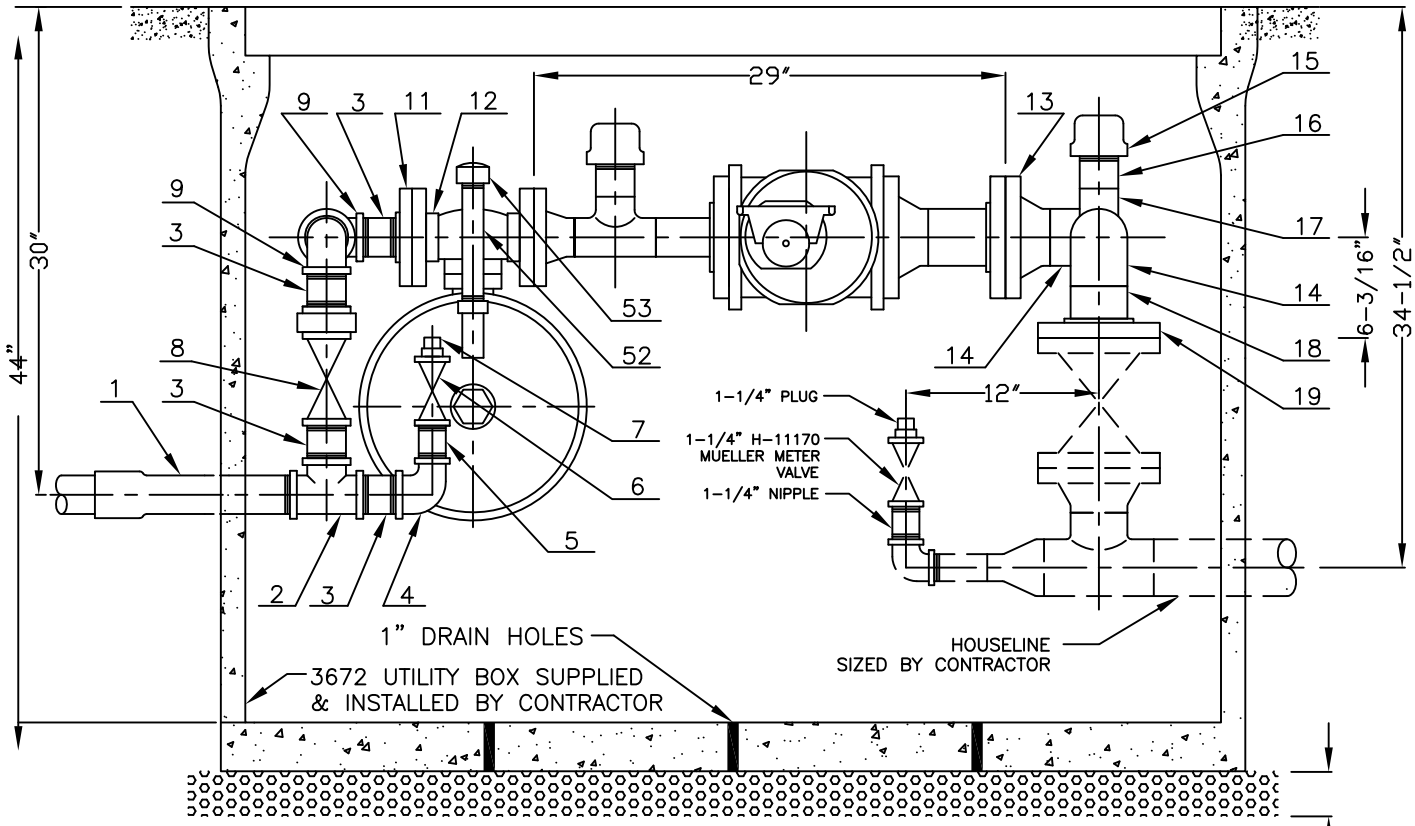
7000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
55	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
56	2" x 2" x 2" TEE SCH. 40, BUTT-WELD ENDS	41811	1
57	2" CAP, BLK	41104	2
58	2" x 3" NIPPLE, THREADED ON ONE END	41490	2
59	3" 7000 SCFH 175 PSI ROTARY GAS METER	44129	1
60	3" 150 ANSI WELD NECK FLANGE, FLAT FACE	43331	1
	A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
61	3" x 2-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41518	1
62	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1
63	3" 150 ANSI STUB END	43341	1
64	3" x 3" x 2" TEE SCH. 40, BUTT-WELD ENDS	41812	1
65	3 x 2" 150 ANSI REDUCING FLANGE, FLAT FACE,	43322	1
	SLIP-ON, A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
66	2" x 4-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000-7000 SCFH ROTARY METER ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. GD-28
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



PLAN



ELEVATION

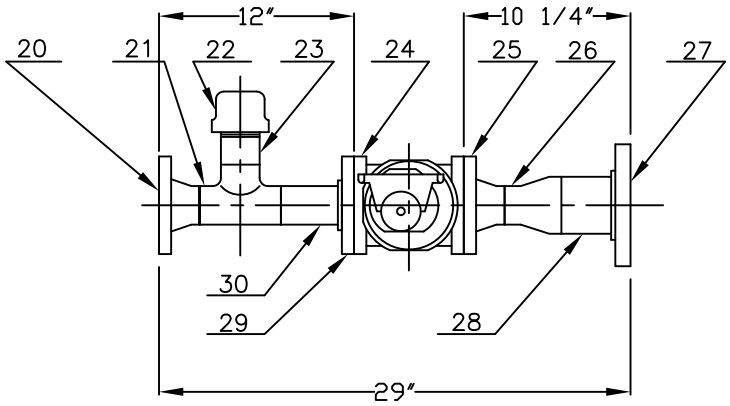
NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-06 APPENDIX C.
2. 2000-7000 SCFH ROTARY METER INSTALLATION DETAILS SEE ON DWG. STD. GD-31 APPENDIX C.
3. LIST OF MATERIALS SEE ON DWG. STD. GD-32, GD-33, AND GD-34 APPENDIX C.
4. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.
5. METER BOX AND LIDS SHALL HAVE MIN. TIER 5 RATING FOR SW AND PLANTING STRIP APPLICATIONS AND MIN. TIER 22 FOR DRIVEWAY AND AND PARKING LOT APPLICATIONS. NOT TO BE INSTALLED IN STREET

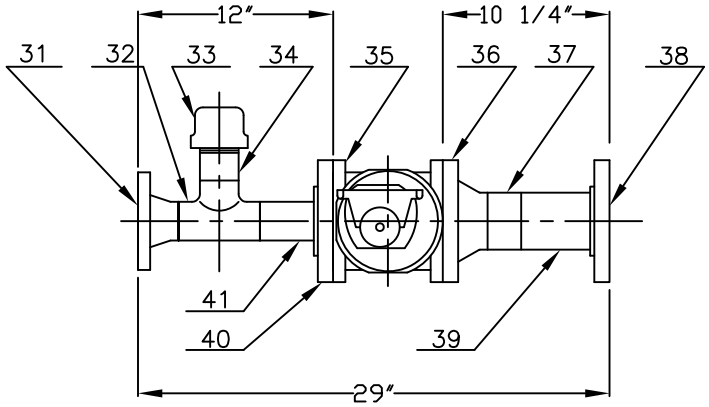
BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000-7000 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-30
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

2000–7000 SCFH 175 PSI ROTARY GAS METER INSTALLATION DETAILS.

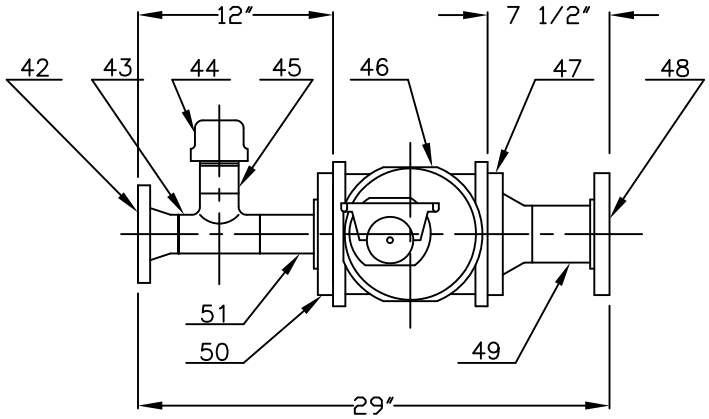
2000/3000 SCFH



5000 SCFH



7000 SCFH



ELEVATIONS

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000–7000 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. GD–31
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	2" IPS TRANSITION FITTING, THREADED END	45599	1
2	2" TEE, BLK	41804	1
3	2" x 3-1/2" NIPPLE, BLK	41453	4
4	2" x 1-1/4" 90° REDUCING ELBOW, BLK	41355	1
5	1-1/4" x 3-1/2" NIPPLE, BLK	41434	1
6	1-1/4" METER VALVE, BLK	43002	1
7	1-1/4" PLUG, BLK	41602	1
8	2" H-11174 MUELLER METER VALVE WITH	43005	1
	INSULATED OUTLET		
9	2" MALE x 2" FEMALE STREET ELBOW, BLK	41365	2
10	2" FILTER, PHILPOTT MODEL 200-S,	44317	1
	THREADED CONNECTIONS, ASTM A48-64, CLASS 30		
11	2" 150 ANSI FLAT FACE FLANGE, THREADED A 105	43321	1
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 2-3/4" HEX CAP SCREW, SAE GRADE 5	43314	4
	5/8"-11 HEX NUT	43317	4
12	2" 125 ANSI FLAT FACE FLANGE CONNECTIONS	44328	1
	REGULATOR WITH INTERNAL RELIEF VALVE.		
13	3" 150 ANSI WELD NECK FLANGE, FLAT FACE	43331	1
	A 105		
	3" IPS 1/16" THICK, RING GASKET FOR 150 ANSI	43356	1
	LAP-JOINT FLANGE		
	5/8"-11 x 3" HEX CAP SCREW, SAE GRADE 5	43316	4
	5/8"-11 HEX NUT	43317	4
14	3" 90° ELBOW SCH. 40, BUTT-WELD ENDS,	41368	2
	SHORT RADIUS		
15	2" CAP, BLK	41104	1
16	2" x 3" NIPPLE, THREADED ON ONE END	41490	1
17	3" x 3" x 2" TEE SCH. 40, BUTT-WELD ENDS	41812	1
18	3" 150 ANSI STUB END	43341	1
19	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000-7000 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		Edward Wu 52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. GD-32
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

2000/3000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
20	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 2–3/4" HEX CAP SCREW, SAE GRADE 5	43314	4
	5/8"–11 HEX NUT	43317	4
21	2" x 2" x 2" TEE SCH. 40, BUTT–WELD ENDS	41811	1
22	2" CAP, BLK	41104	1
23	2" x 3" NIPPLE, THREADED ON ONE END	41490	1
24			
A	2" 2000 SCFH 175 PSI ROTARY GAS METER	44126	1
B	2" 3000 SCFH 175 PSI ROTARY GAS METER	44127	1
25	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 1–1/2" HEX CAP SCREW, SAE GRADE 5	43312	4
26	3" x 2" REDUCER, CONC., BUTT–WELD ENDS	41375	1
27	3" 150 ANSI LAP–JOINT FLANGE, A 105	43326	1
28	3" 150 ANSI STUB END	43341	1
29	2" 150 ANSI SLIP–ON FLANGE, FLAT FACE A 105	43335	1
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 1–1/2" HEX CAP SCREW, SAE GRADE 5	43312	4
30	2" x 4–1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1

5000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
31	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 2–3/4" HEX CAP SCREW, SAE GRADE 5	43314	4
	5/8"–11 HEX NUT	43317	4
32	2" x 2" x 2" TEE SCH. 40, BUTT–WELD ENDS	41811	1
33	2" CAP, BLK	41104	1
34	2" x 3" NIPPLE, THREADED ON ONE END	41490	1
35	3" 5000 SCFH 175 PSI ROTARY GAS METER	44128	1
36	3" 150 ANSI WELD NECK FLANGE, FLAT FACE	43331	1
	A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"–11 x 1–3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
37	3" x 2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41518	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000–7000 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'–0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD–33
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

LIST OF MATERIALS

5000 SCFH ROTARY GAS METER ASSEMBLY (CONTD.):

NO.	DESCRIPTION	STOCK NO.	QUANTITY
38	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1
39	3" 150 ANSI STUB END	43341	1
40	3" x 2" 150 ANSI REDUCING FLANGE, FLAT FACE,	43322	1
	SLIP-ON, A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
41	2" x 4-1/2" PIPE, GRADE A, TYPE E, SCH. 40	41516	1

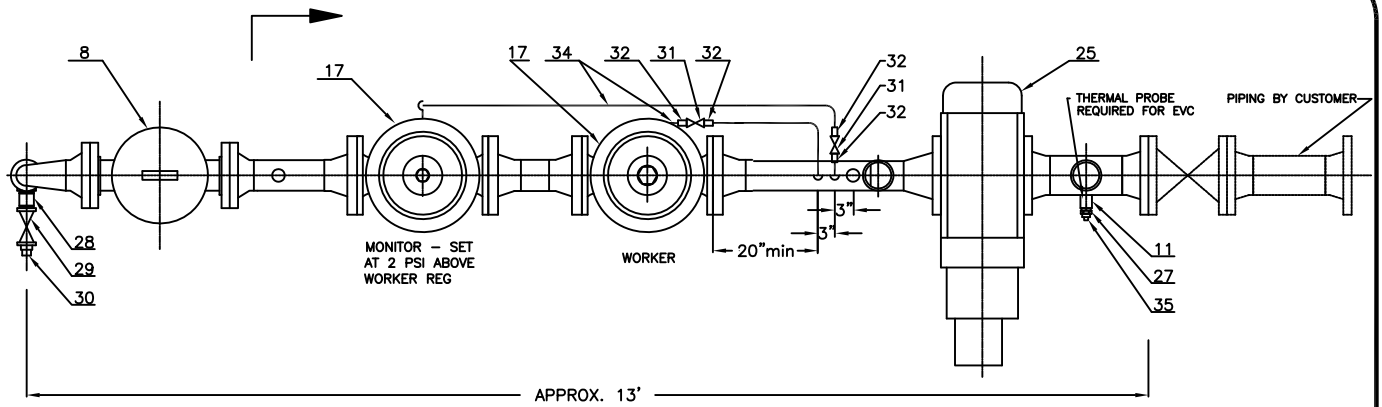
7000 SCFH ROTARY GAS METER ASSEMBLY:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
42	2" 150 ANSI WELD NECK FLANGE, FLAT FACE	43330	1
	A 105		
	2" IPS 1/16" THICK, FULL FACE GASKET FOR	43350	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 2-3/4" HEX CAP SCREW, SAE GRADE 5	43314	4
	5/8"-11 HEX NUT	43317	4
43	2" x 2" x 2" TEE SCH. 40, BUTT-WELD ENDS	41811	1
44	2" CAP, BLK	41104	1
45	2" x 3" NIPPLE, THREADED ON ONE END	41490	1
46	3" 7000 SCFH 175 PSI ROTARY GAS METER	44129	1
47	3" 150 ANSI WELD NECK FLANGE, FLAT FACE	43331	1
	A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
48	3" 150 ANSI LAP-JOINT FLANGE, A 105	43326	1
49	3" 150 ANSI STUB END	43341	1
50	3" x 2" 150 ANSI REDUCING FLANGE, FLAT FACE,	43322	1
	SLIP-ON, A 105		
	3" IPS 1/16" THICK, FULL FACE GASKET FOR	43351	1
	150 ANSI FLAT FACE FLANGE		
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	43313	4
51	2" x 4-1/2" PIPE, A53 GRADE A, TYPE E, SCH. 40	41516	1

VENT INSTALLATION:

NO.	DESCRIPTION	STOCK NO.	QUANTITY
52	1" x 9" NIPPLE, BLK	41470	1
53	1" FEMALE TYPE 975 VERTICAL VENT	44311	1

BY	DATE			
DRAWN A.P.	8/96	COMMERCIAL/INDUSTRIAL 2000-7000 SCFH ROTARY METER ASSEMBLY STANDARD (CURB LOCATION)	APPROVED: JANUARY, 31 2013	SCALE: 1"=1'-0"
DESIGNED A.P.	8/96		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-34
REVIEWED G.S.	8/96	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C



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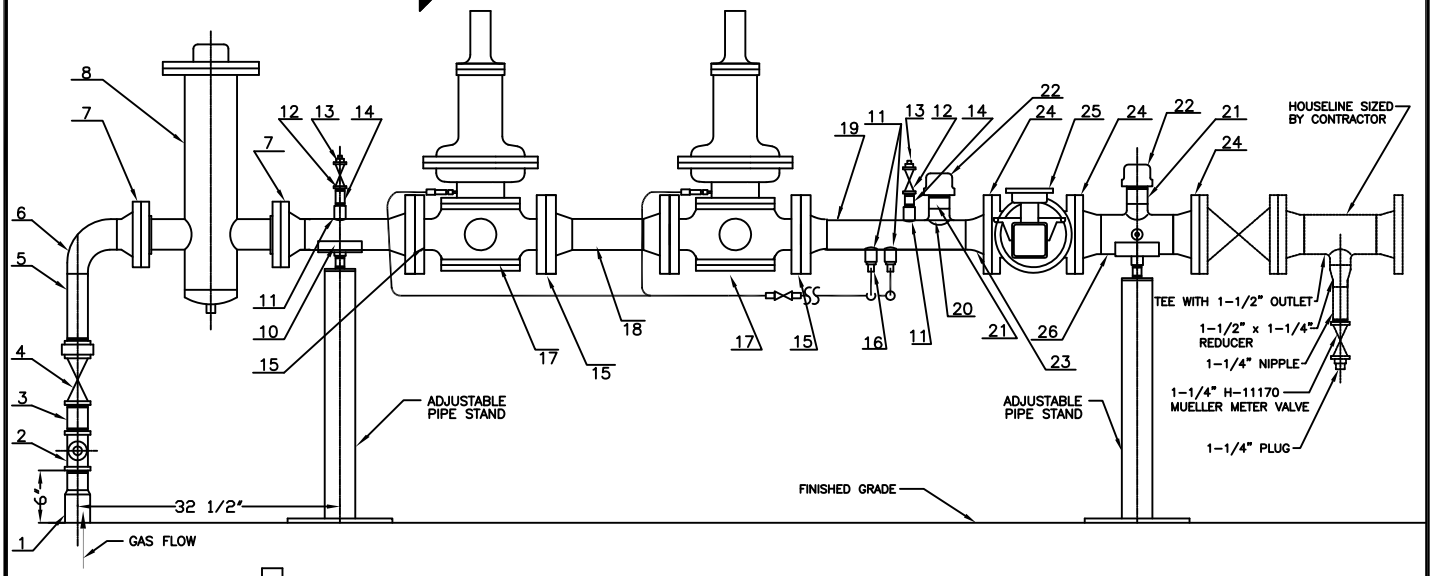
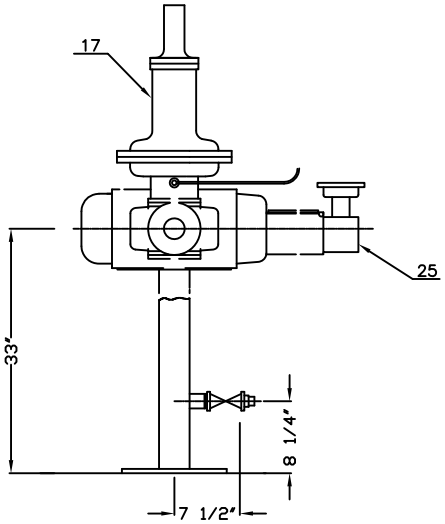




SECTION A/1

ELEVATION

NOTES:

1. FOR PLACEMENT REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-02 NOTES, APPENDIX C.
2. UPON COMPLETION OF METER ASSEMBLY, LEAK TEST ALL CONNECTIONS.

	BY	DATE
DRAWN	A.P.	6/96
CHECKED	A.P.	6/96
REVIEWED	RE	12/09

11,000–23,000 SCFH 5 PSIG
ROTARY METER ASSEMBLY
WITH PILOT-OPERATED REGULATORS
STANDARD

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013
EDWARD WU 52944
WGW ENGINEERING MANAGER R.E. NO.

REVISION:
JAN 31, 2013

SCALE: NONE

DWG. NO. STD. GD-35

APPENDIX C

NO.	DESCRIPTION	STOCK NO.	UNIT	QUANTITY
1	2" IPS x 2" IPS ANODLESS SERVICE RISER, PREBENT	43057	EA.	1
2	2" x 2" x 1-1/4" TEE, BLK	N/A	EA.	1
3	2" x 4-1/2" NIPPLE, BLK	41455	EA.	1
4	2" H-11174 MUELLER METER VALVE WITH	N/A	EA.	1
	INSULATED OUTLET			
5	2" x 8-1/2" NIPPLE, THREADED ON ONE END	N/A	EA.	1
6	2" x 3" 90° REDUCING ELBOW SCH. 40,	N/A	EA.	1
	BUTT-WELDING			
7	3" 150 ANSI WELDING NECK FLANGE, FLAT FACE	N/A	EA.	2
	A105			
	3" 150 ANSI FULL FACE GASKET FOR FLAT FACE	N/A	EA.	2
	FLANGE			
	3", 5/8" x 3-1/2" 150 ANSI STUD BOLT	N/A	EA.	8
	WITH NUTS			
8	3" 180 MAWP, JUNIOR SAFECO NATURAL GAS FILTER,	N/A	EA.	1
	10 MICRON, WITH FLAT FACE FLANGE			
	CONNECTIONS, GFT-JR-03-180-F			
10	3" x 12" PIPE, CARBON STEEL, SEAMLESS, SCH. 40	N/A	EA.	1
11	3/4" 3000 PSI FEMALE NPT STEEL COUPLING,	N/A	EA.	7
	BUTT-WELDING			
12	3/4" VALVE METER, BLK	43000	EA.	2
13	3/4" PLUG, BLK	41600	EA.	2
14	3/4" x 3" NIPPLE, BLK	41403	EA.	2
15	3" 150 ANSI WELDING NECK FLANGE, FLAT FACE	N/A	EA.	4
	A105			
	3" 150 ANSI FULL FACE GASKET FOR FLAT FACE	N/A	EA.	4
	FLANGE			
	3", 5/8" x 3" 150 ANSI STUD BOLT WITH NUTS	N/A	EA.	16
16	3/4" MALE NPT FOR 3/8" TUBE CONNECTOR	N/A	EA.	4
	SS-600-1-12			
17	3" SENSUS MODEL 441-57S 1-1/2" REDUCED	N/A	EA.	2
	VALVE REGULATOR WITH 125 ANSI FLAT FACE			
	FLANGE CONNECTIONS AND YELLOW SPRING			
18	3" x 9" PIPE, CARBON STEEL, SEAMLESS, SCH. 40	N/A	EA.	1
19	3" PIPE, CARBON STEEL, SEAMLESS, SCH. 40	N/A	L.F.	D.I.F.
20	2" TEE, BUTT-WELDING	N/A	EA.	1
21	2" x 3" NIPPLE, THREADED ON ONE END	N/A	EA.	2
22	2" CAP	41104	EA.	2
23	4" x 3" REDUCER SCH. 40, BUTT-WELDING	N/A	EA.	1
24	4" 150 ANSI WELDING NECK FLANGE, FLAT FACE	N/A	EA.	3
	A105			
	4" 150 ANSI FULL FACE GASKET FOR FLAT FACE	N/A	EA.	2
	FLANGE			
	5/8"-11 x 1-3/4" HEX CAP SCREW, SAE GRADE 5	N/A	EA.	16
25		N/A	EA.	1
A	4" 175 MAOP 11000 SCFH ROTARY GAS METER			
	WITH A STANDARD INSTRUMENT DRIVE (ID)			
B	4" 175 MAOP 16000 SCFH ROTARY GAS METER			
	WITH A STANDARD INSTRUMENT DRIVE (ID)			
C	4" 232 MAOP 23000 SCFH ROTARY GAS METER			
	WITH A STANDARD INSTRUMENT DRIVE (ID)			
26	4" x 4" x 2" TEE SCH. 40, BUTT-WELDING	N/A	EA.	1
27	3/4" MALE x 1/4" FEMALE REDUCING BUSHING,	N/A	EA.	1
	THREADED			
28	1-1/4" x 3-1/2" NIPPLE, BLK	41434	EA.	1
29	1-1/4" VALVE METER, BLK	43002	EA.	1
30	1-1/4" PLUG, BLK	41602	EA.	1
31	1/4" FEMALE NPT-18 PLUG VALVE SS-4P4T4	N/A	EA.	4
32	1/4" MALE NPT-18 FOR 3/8" TUBE CONNECTOR	N/A	EA.	10
	SS-600-1-4			
33	1/2" MALE NPT-14 FOR 3/8" TUBE CONNECTOR	N/A	EA.	2
	SS-600-1-8			
34	3/8" x 0.035" TUBE 316 STAINLESS STEEL	N/A	L.F.	D.I.F.
	ASTM A-269			
35	1/4" PLUG, BLK	N/A	EA.	1

	BY	DATE
DRAWN	A.P.	4/97
CHECKED	A.P.	4/97
REVIEWED	G.S.	5/97

11,000-23,000 SCFH 5 PSIG
ROTARY METER ASSEMBLY
WITH PILOT-OPERATED REGULATORS
STANDARD

CITY OF PALO ALTO, CALIFORNIA

APPROVED:
JANUARY, 31 2013

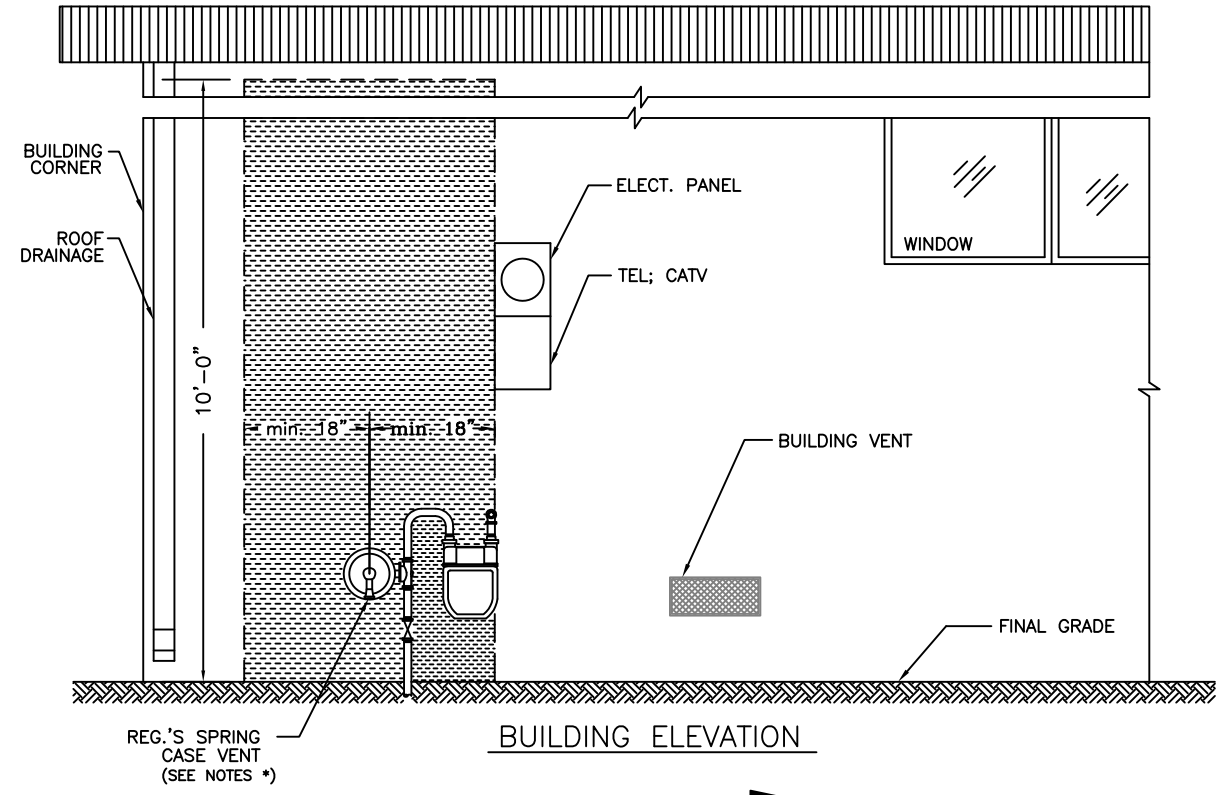
Edward Wu 52944
EDWARD WU R.E. NO.
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

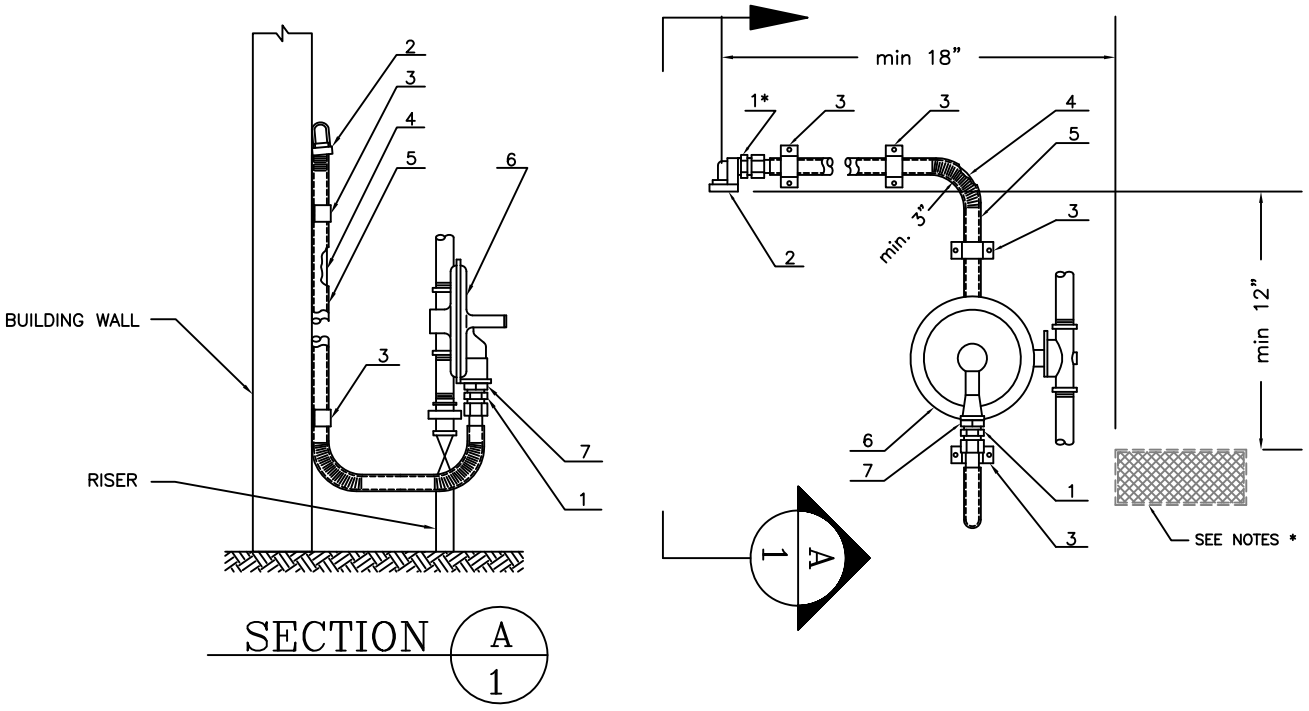
SCALE:
NONE

DWG. NO.
STD. GD-36

APPENDIX C



BUILDING ELEVATION



SECTION A/1

REGULATOR VENT EXTENSION DETAIL

*** NOTES AND LIST OF MATERIALS SEE ON DWG. STD. GD-38 APPENDIX C.**

BY	DATE			
DRAWN A.P.	4/97	GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: NONE
DESIGNED A.P.	4/97		EDWARD WU, WGW ENGINEERING MANAGER, 52944 R.E. NO.	DWG. NO. STD. GD-37
REVIEWED G.S.	5/97	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

NOTES:

1. IF WINDOWS, BUILDING VENTS, CATV, TEL., ELECTRIC PANELS, OR OTHER SOURCES OF IGNITION ARE WITHIN 18" HORIZONTALLY OR 10' VERTICALLY FROM THE GAS REGULATOR SPRING CASE VENT, OR THE REGULATOR IS INSTALLED IN AN ENCLOSURE A REGULATOR VENT EXTENSION IS REQUIRED.
2. FOR GAS METER INSTALLATION REQUIREMENTS REFER TO UTILITY STANDARDS FOR WATER, GAS, AND WASTEWATER DWG. STD. GD-02, APPENDIX C.
3. RECOMMENDED SPACING OF SUPPORT CLAMPS IS 12".

LIST OF MATERIALS

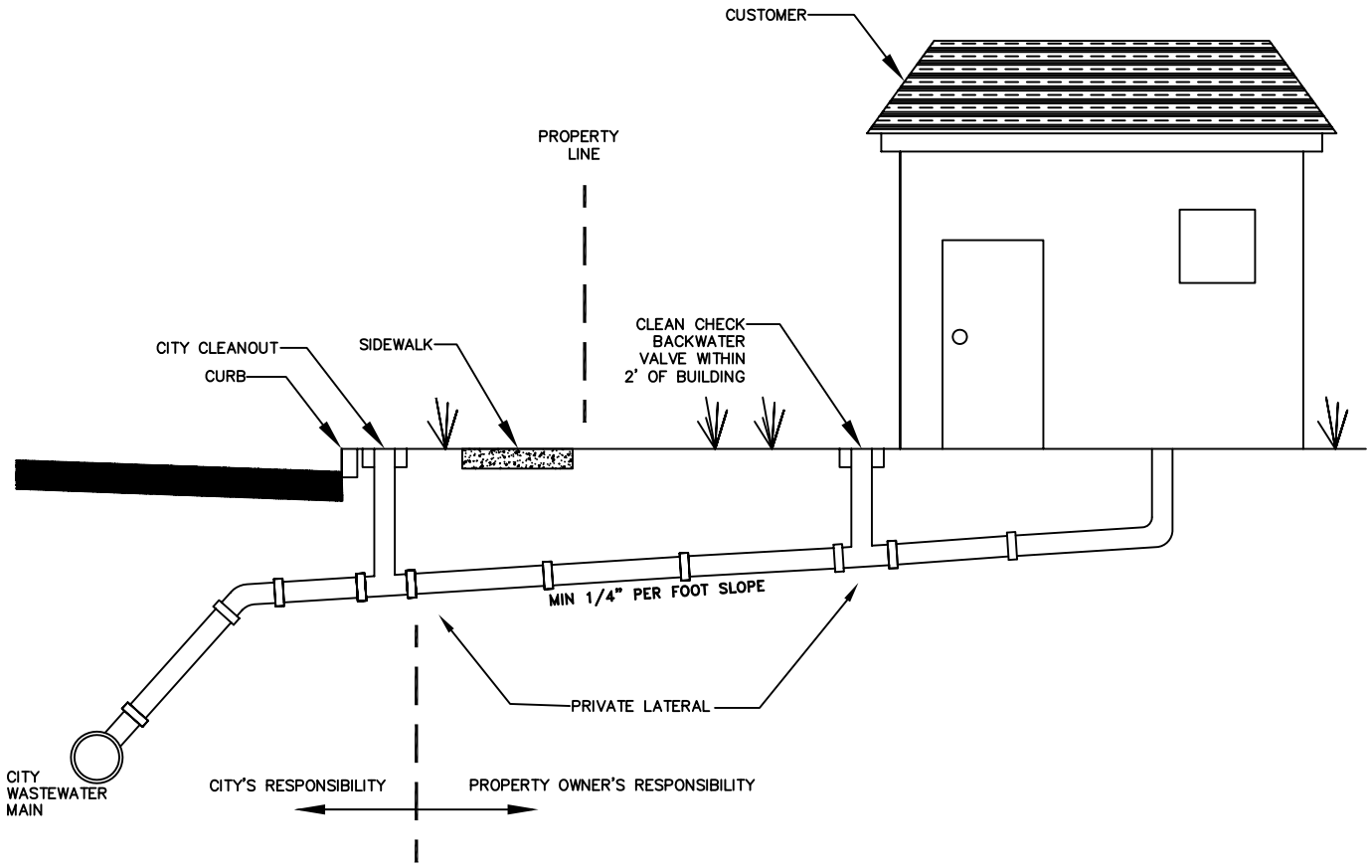
NO.	DESCRIPTION	STOCK NO.	QUANTITY
1	3/4" MECHANICAL ADAPTER (3/4" TUBING BY	N/A	2
	3/4" MIPT)		
2	3/4" ELBOW VENT WITH BUG SCREEN	N/A	1
3	SUPPORT CLAMP	N/A	D.I.F.
4	3/4" PVC OR CSST TUBING	N/A	LENGTH D.I.F.
5	1-1/4" PROTECTIVE STEEL CONDUIT	N/A	LENGTH D.I.F.
6	3/4" REGULATOR		1
7	1" MALE x 3/4" FEMALE NPT BRASS BUSHING	22020	1
	(IF REQUIRED)		

BY	DATE			
DRAWN A.P.	4/97	GAS SERVICE REGULATOR VENT EXTENSION ASSEMBLY STANDARD	APPROVED: JANUARY, 31 2013	SCALE: NONE
DESIGNED A.P.	4/97		Edward Wu 52944 EDWARD WU R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. GD-38
REVIEWED G.S.	5/97	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX C

APPENDIX D.

Wastewater Standard Details

STANDARD DETAIL DESCRIPTION	STANDARD DETAIL NO.
Sanitary Sewer Standard Lateral Detail	WWD-01
Sanitary Sewer Cleanout Type 1	WWD-02A
Sanitary Sewer Cleanout Type 2	WWD-02B
Two-Way Sewer Cleanout Type 2	WWD-02C
SS Cleanout Box - Type 1 (Foot Traffic Areas)	WWD-03
SS Cleanout Box - Type 2 (Traffic Areas)	WWD-04
Sewer Lateral Connection	WWD-05
Lateral Connection to VCP Main - Type 1 & 2	WWD-06
Lateral Connection to RCP Main - Type 3	WWD-07
Strap on Lateral Connection to HDPE, PVC or CIPP - Type 4	WWD-08
Lateral Connection to VCP Main -Type 5	WWD-09
Strap on Multiple Lateral Connections to Polyethylene Sewer Pipe	WWD-10
Sanitary Sewer Manhole (For Sewers Up to 30" in Dia. & > 6' Depth)	WWD-11
Sanitary Sewer Manhole (For Sewers 31" to 42" in Dia.)	WWD-12
Outside Sanitary Sewer Manhole Drop Standard	WWD-13
Sanitary Sewer Manhole (For Sewers Up to 30" in Dia. & $\leq$ 6' Depth)	WWD-14
Sanitary Sewer Manhole Frame and Cover Standard	WWD-15

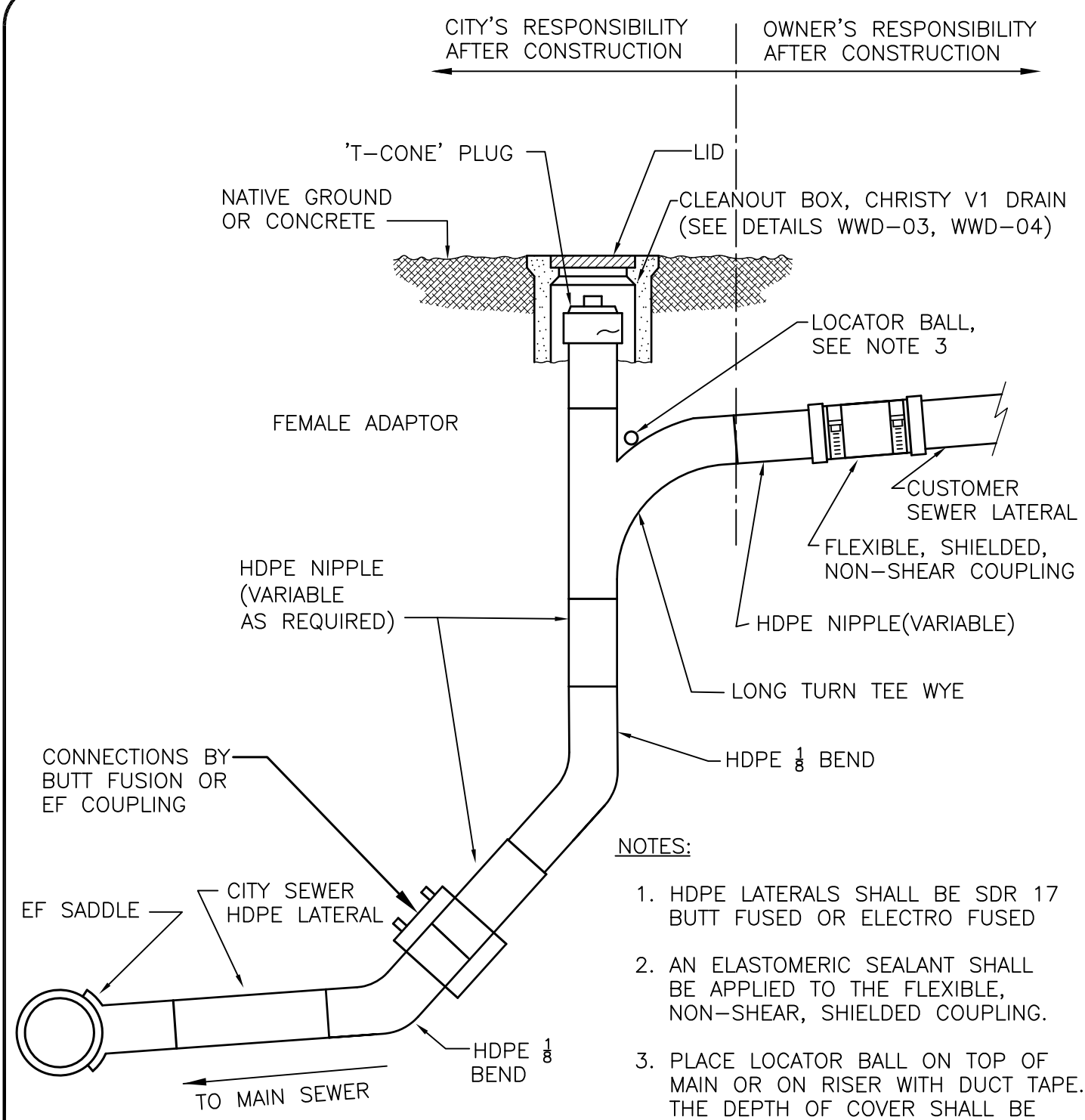


NOTES:

1. THE BACKWATER VALVE SHALL BE RECTORSEAL CLEAN CHECK BACKWATER VALVE OR APPROVED EQUAL

2. LATERALS IN AN EASEMENT WILL BE PRIVATE AND NOT MAINTAINED BY THE CITY

BY	DATE	SANITARY SEWER STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
DRAWN JN	3/98		EDWARD WU 52944 R.E. NO. WGW ENGINEERING MANAGER	DWG. NO. STD. WWD-01
CHECKED EW	3/98			
REVIEWED EW	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX D



NOTES:

1. HDPE LATERALS SHALL BE SDR 17 BUTT FUSED OR ELECTRO FUSED
2. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, NON-SHEAR, SHIELDED COUPLING.
3. PLACE LOCATOR BALL ON TOP OF MAIN OR ON RISER WITH DUCT TAPE. THE DEPTH OF COVER SHALL BE 2 FEET AND NOT EXCEED 5 FEET.
4. LATERALS IN AN EASEMENT WILL BE PRIVATE AND NOT MAINTAINED BY THE CITY

	BY	DATE
DRAWN	RF	3/98
CHECKED	EW	3/98
REVIEWED	RE	12/09

SANITARY SEWER LATERAL TYPE 1 CLEAN OUT STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

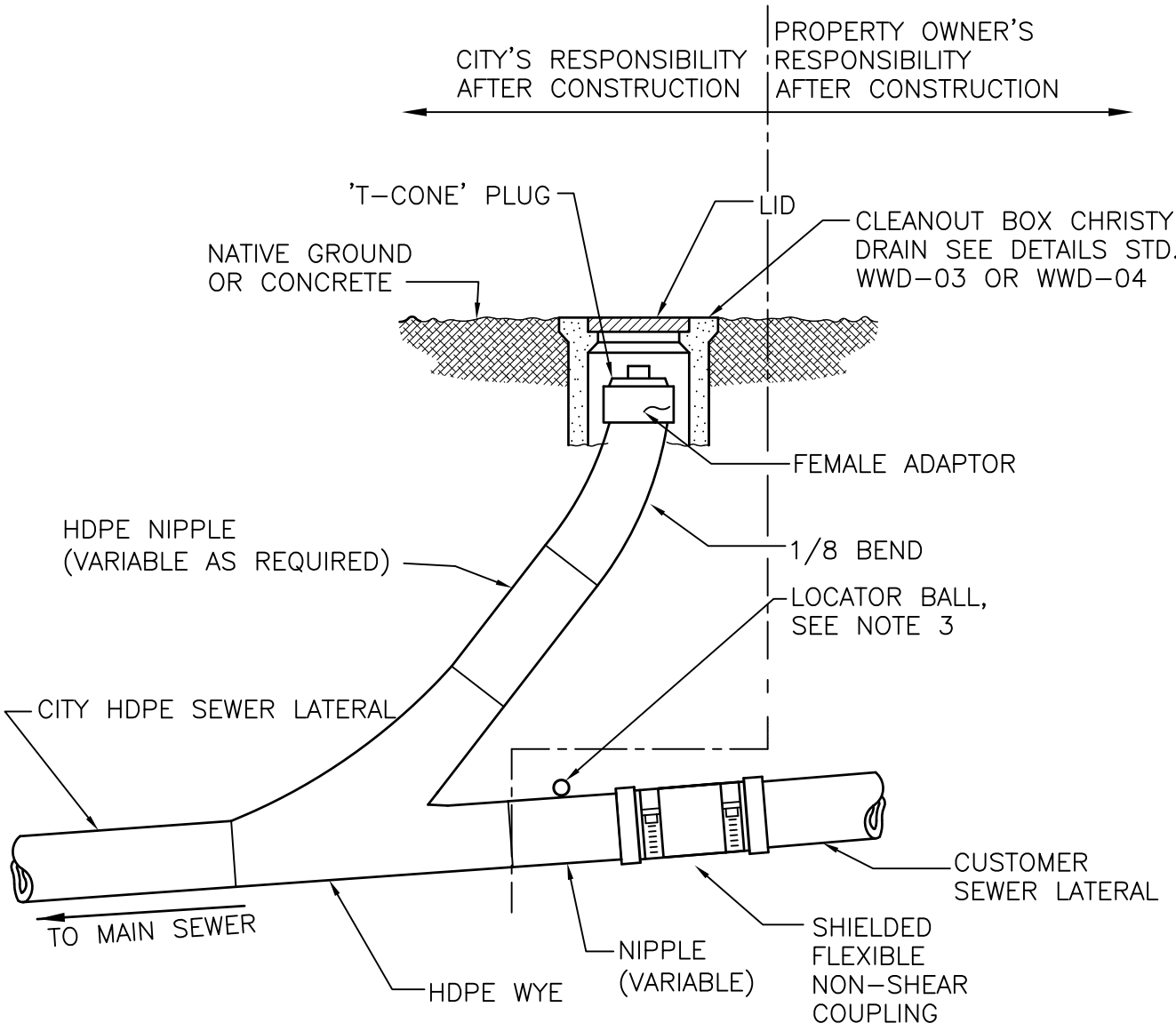
EDWARD WU 52944 R.E. NO.
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WWD-2A

APPENDIX D



NOTES:

1. HDPE LATERALS SHALL BE SDR 17 BUTT FUSED OR ELECTRO FUSED

2. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, NON-SHEAR, SHIELDED COUPLING.

3. PLACE LOCATOR BALL ON TOP OF MAIN OR ON RISER WITH DUCT TAPE. THE DEPTH OF COVER SHALL BE 2 FEET AND NOT EXCEED 5 FEET.

4. LATERALS IN AN EASEMENT WILL BE PRIVATE AND NOT MAINTAINED BY THE CITY

	BY	DATE
DRAWN	JN	3/98
CHECKED	EW	3/98
REVIEWED	EW	12/09

SANITARY SEWER CLEANOUT TYPE 2 STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

Edward Wu 52944

EDWARD WU R.E. NO.

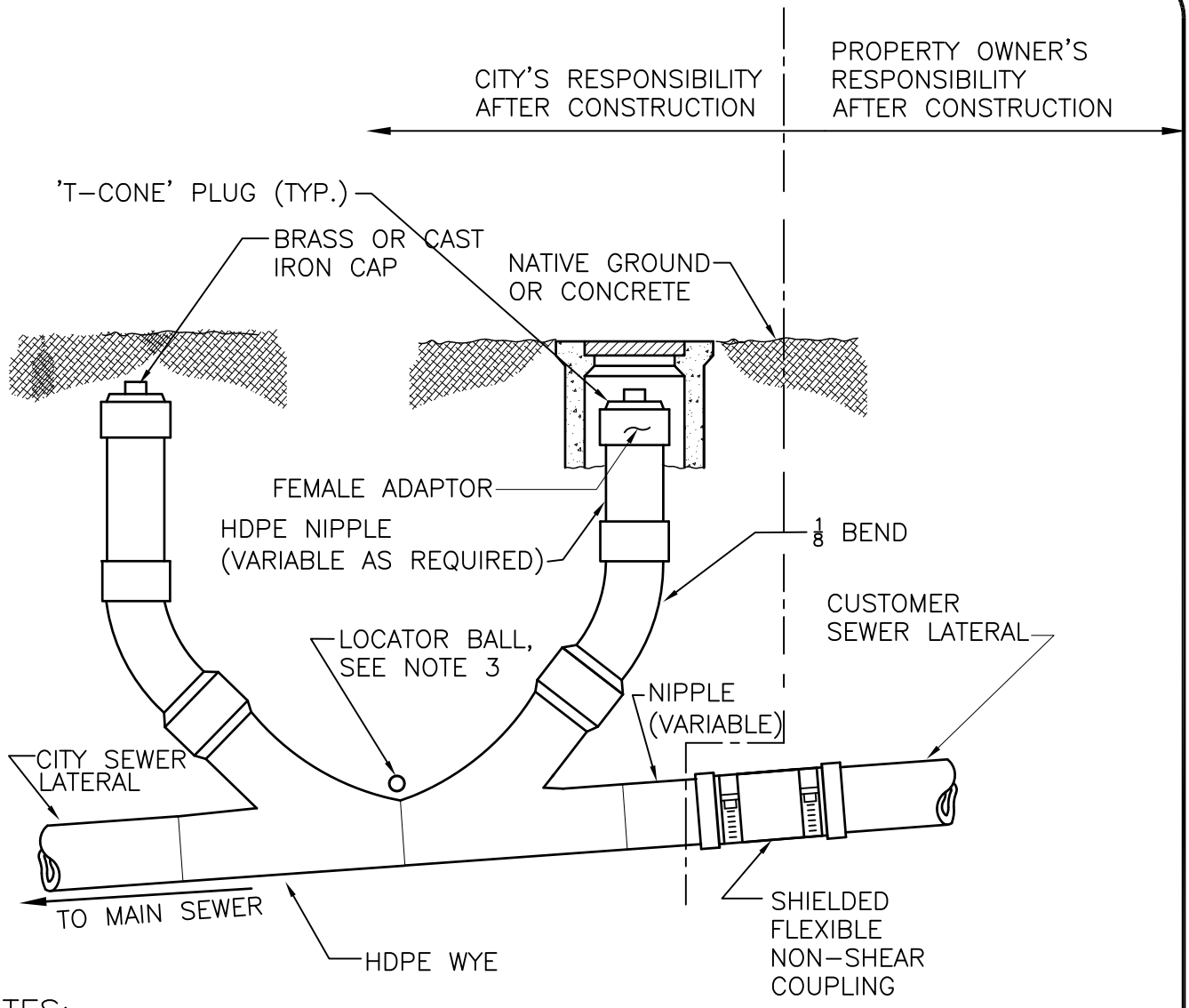
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WWD-02B

APPENDIX D



NOTES:

1. HDPE LATERALS SHALL BE SDR 17 BUTT FUSED OR ELECTRO FUSED.
2. AN ELASTOMERIC SEALANT SHALL BE APPLIED TO THE FLEXIBLE, NON-SHEAR, SHIELDED COUPLING.
3. PLACE LOCATOR BALL ON TOP OF MAIN OR ON RISER WITH DUCT TAPE. THE DEPTH OF COVER SHALL BE 2 FEET AND NOT EXCEED 5 FEET.
4. LATERALS IN AN EASEMENT WILL BE PRIVATE AND NOT MAINTAINED BY THE CITY
5. TWO-WAY CLEANOUTS MAY ONLY BE USED WITH PRIOR APPROVAL.

	BY	DATE
DRAWN	ME	3/98
CHECKED	RI	3/98
REVIEWED	RE	12/09

TWO-WAY SANITARY SEWER CLEANOUT TYPE 2 STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

52944 R.E. NO.

EDWARD WU
WGW ENGINEERING MANAGER

REVISION: JAN 31, 2013

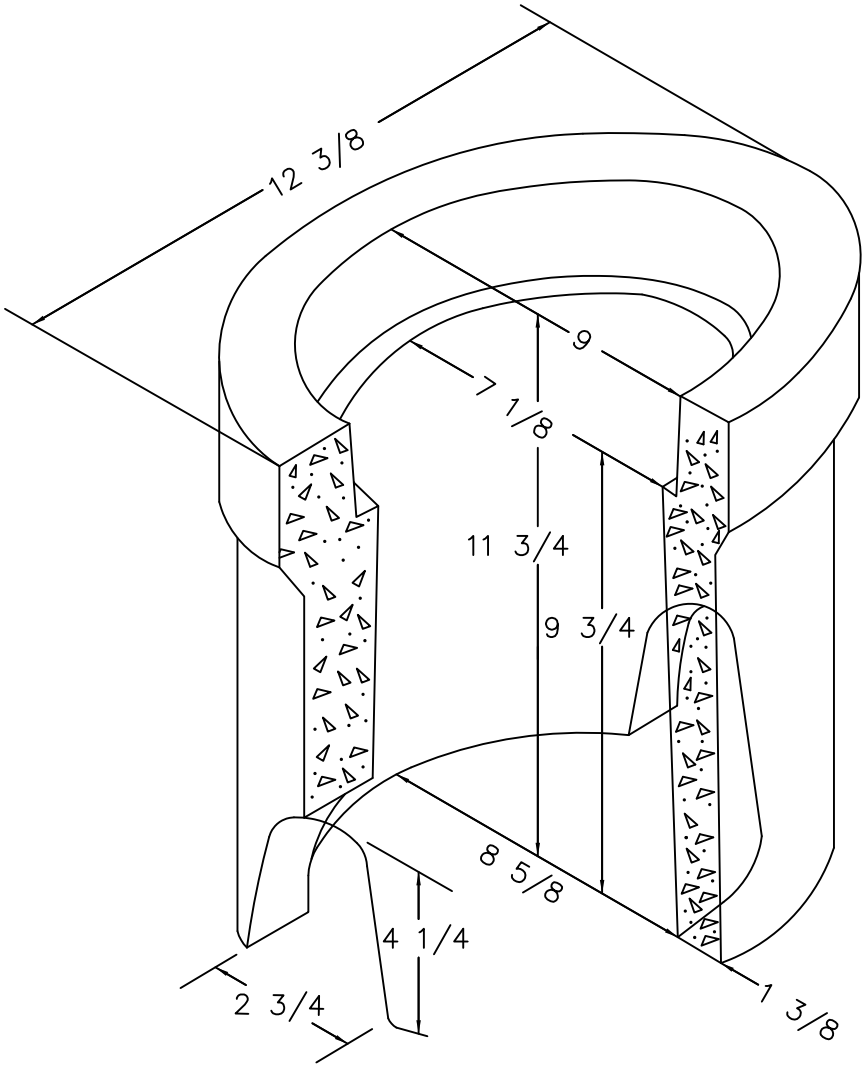
SCALE: NONE

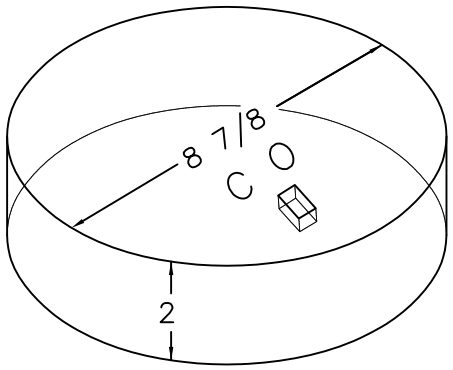
DWG. NO. STD. WWD-2C

APPENDIX D

"CHRISTY" VI DRAIN BOX

"CHRISTY" F8C CAST IRON
LID OR APPROVED EQUAL



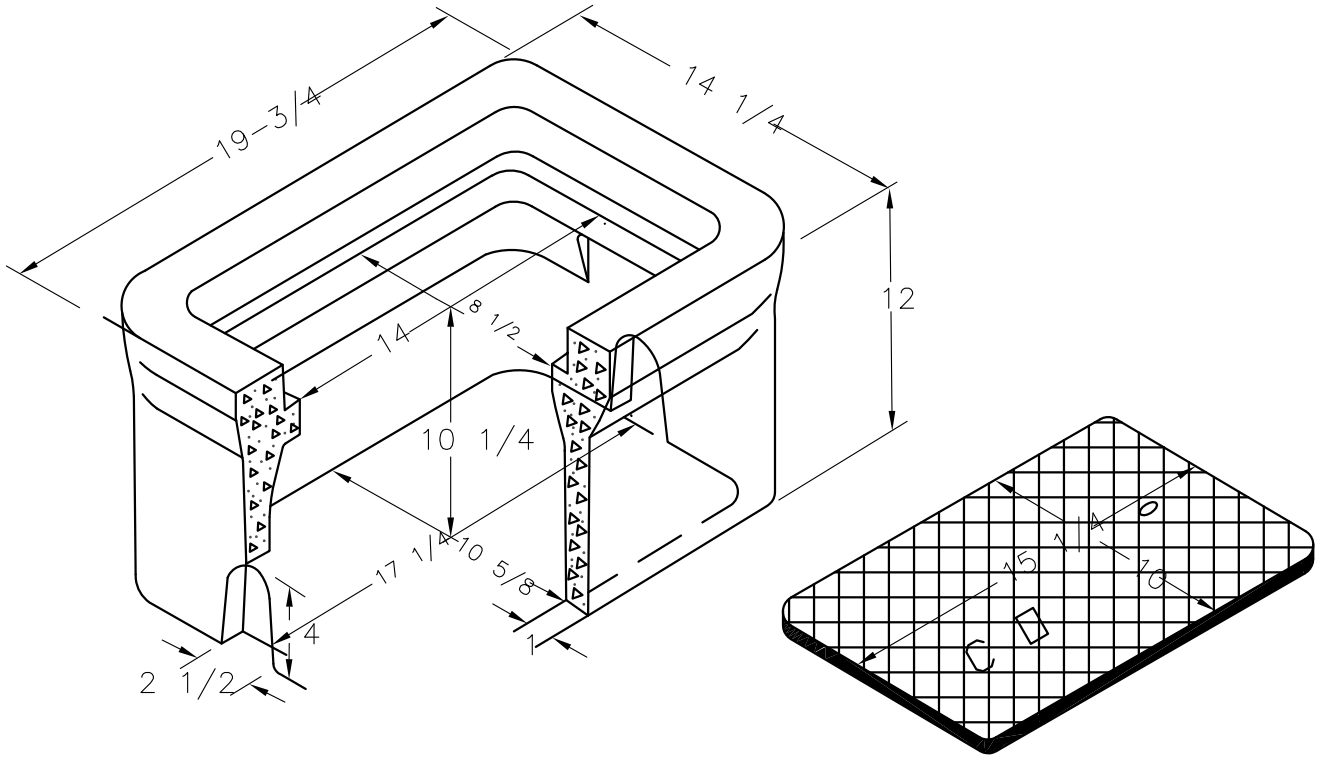


NOTE:

CLEANOUT BOX SHALL BE MARKED ON THE LID
WITH THE LETTERS "CO" OR "SEWER"

BY	DATE			
DRAWN J.N.	4/98	SS CLEANOUT BOX – TYPE 1 STANDARD DETAIL	APPROVED: SEPTEMBER 1, 2004 Roger Cwiak 34533 ROGER CWIAK R.E. NO. CHIEF ENGINEER	SCALE: NONE
CHECKED E.W.	4/98			DWG. NO. STD. WWD–03
REVIEWED R.C.	4/98	CITY OF PALO ALTO, CALIFORNIA	REVISION: OCTOBER 27, 2005	APPENDIX D

"CHRISTY" B9-61D UTILITY BOX
WITH STEEL CHECKER PLATE
COVER



NOTES:

1. CLEANOUT BOX SHALL BE MARKED ON THE COVER WITH LETTERS "CO" OR "SEWER".
2. TO BE USED WITH 45° RISER, IF APPROVED BY THE ENGINEER.

	BY	DATE			
DRAWN	R.F.	5/92	SS CLEANOUT BOX – TYPE 2 STANDARD DETAIL	APPROVED: OCTOBER 30 1992 Roger Cwiak 34533 ROGER CWIAK CHIEF ENGINEER R.E. NO.	SCALE: NONE
CHECKED	E.W.	5/92			DWG. NO. STD. WWD-04
REVIEWED	R.C.	5/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: OCTOBER 27, 2005	APPENDIX D

I. Connections for new laterals to existing mains:

Type of Connection	*Connection Method*	*Standard Detail #*
New SDR26 lateral to existing VCP main	VCP wye*	WWD-06 Detail A
New HDPE lateral to existing VCP main	VCP wye*	WWD-06 Detail A
New SDR26 lateral to existing C900 PVC main	strapped rubber saddle*	WWD-06 Detail B
New HDPE lateral to existing C900 PVC main	strapped rubber saddle*	WWD-06 Detail B
New SDR26 lateral to existing SDR26 PVC main	PVC wye*	WWD-06 Detail D
New HDPE lateral to existing SDR26 PVC main	PVC wye*	WWD-06 Detail D
New SDR26 lateral to existing HDPE main	electrofusion saddle	WWD-06 Detail C
New HDPE lateral to existing HDPE main	electrofusion saddle	WWD-06 Detail C
New SDR26 lateral to existing PCC or RCP main	tap-tite (or approved equal)	WWD-08
New HDPE lateral to existing PCC or RCP main	tap-tite (or approved equal)	WWD-08

* tap-tite (or approved equal) connection for pipes larger or equal than 8-inches will only be acceptable upon Engineer's approval.

II. Connections for new laterals to new mains:

Type of Connection	*Connection Method*	*Standard Detail #*
New SDR26 lateral to new HDPE main	electrofusion saddle	WWD-06 Detail C
New HDPE lateral to new HDPE main	electrofusion saddle	WWD-06 Detail C
New SDR26 lateral to new PVC main	PVC wye	WWD-06 Detail D
New HDPE lateral to new PVC main	PVC wye	WWD-06 Detail D

III. Connections for existing laterals to new mains:

Type of Connection	*Connection Method*	*Standard Detail #*
Existing SDR26 lateral to new VCP main	VCP wye	WWD-07 Detail E
Existing HDPE lateral to new VCP main	VCP wye	WWD-07 Detail E
Existing ABS lateral to new VCP main	VCP wye	WWD-07 Detail E
Existing SDR26 lateral to new SDR26 PVC main	PVC wye	WWD-07 Detail E
Existing HDPE lateral to new SDR26 PVC main	PVC wye	WWD-07 Detail E
Existing ABS lateral to new SDR26 PVC main	PVC wye	WWD-07 Detail E
Existing SDR26 lateral to new HDPE main	electrofusion saddle	WWD-07 Detail F
Existing HDPE lateral to new HDPE main	electrofusion saddle	WWD-07 Detail F
Existing ABS lateral to new HDPE main	electrofusion saddle	WWD-07 Detail F
Existing SDR26 lateral to new PCC or RCP main	tap-tite (or approved equal)	WWD-08
Existing HDPE lateral to new PCC or RCP main	tap-tite (or approved equal)	WWD-08
Existing ABS lateral to new PCC or RCP main	tap-tite (or approved equal)	WWD-08

	BY	DATE
DRAWN	M.E.	3/05
CHECKED	R.I.	3/05
REVIEWED	R.C.	3/05

SS LATERAL CONNECTIONS TABLE

CITY OF PALO ALTO, CALIFORNIA

APPROVED: APRIL 7 2005

Roger Cwiak 34533

ROGER CWIAK R.E. NO.

CHIEF ENGINEER

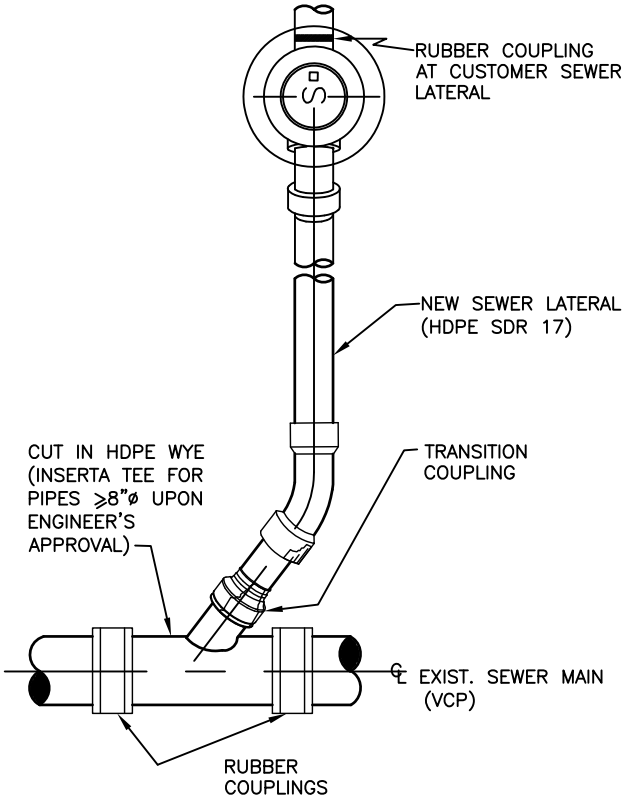
REVISION: OCTOBER 27, 2005

SCALE: NONE

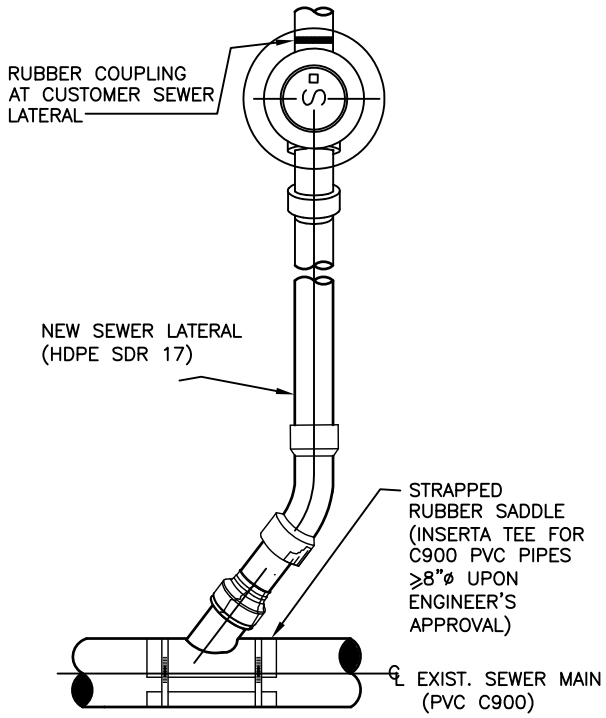
DWG. NO. STD. WWD-05

APPENDIX D

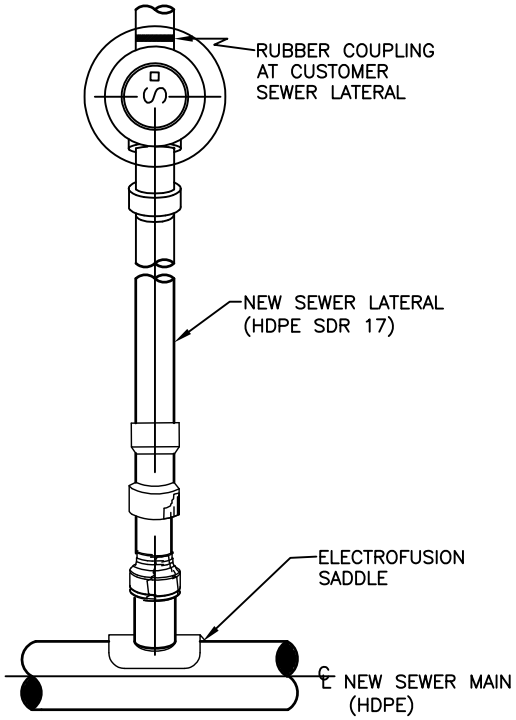
A NEW LATERAL INTO EXIST. VCP MAIN



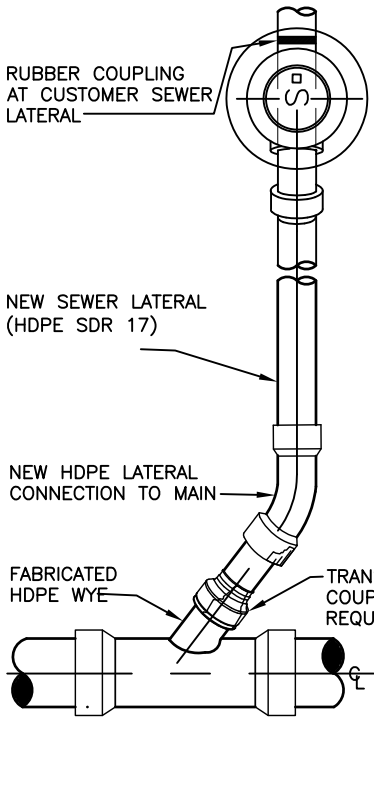
B NEW LATERAL INTO EXIST. PVC C900



C NEW LATERAL INTO NEW OR EXIST. HDPE MAIN



D NEW LATERAL INTO NEW HDPE OR EXIST. PVC SDR26 MAIN



NOTES:

1. RUBBER COUPLINGS SHALL BE NON–SHEAR, SHIELDED TYPE WITH STAINLESS STEEL SERIES 300 BANDSCREW AND HOUSING.
2. RUBBER SADDLES SHALL BE SEALED WITH AN ELASTOMERIC SEALANT. SEE SPECIFICATIONS.
3. CHANGES IN PIPE TYPE AND CONNECTIONS ARE NOTED ON THE DRAWINGS.
4. IF ADDITIONAL COUPLINGS ARE NEEDED TO MAKE A CONNECTION, THE CONTRACTOR SHALL USE ELECTROFUSION COUPLINGS.
5. ELECTROFUSION SADDLES SHALL CONSIST OF A FUSION SADDLE WITH AN INTEGRAL FUSION COUPLER AT ITS OUTLET.

	BY	DATE
DRAWN	ME	3/05
CHECKED	RI	3/05
REVIEWED	RE	12/09

SCHEMATIC SS LATERAL CONNECTIONS – 1 STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

Edward Wu 52944

EDWARD WU R.E. NO.

WGW ENGINEERING MANAGER

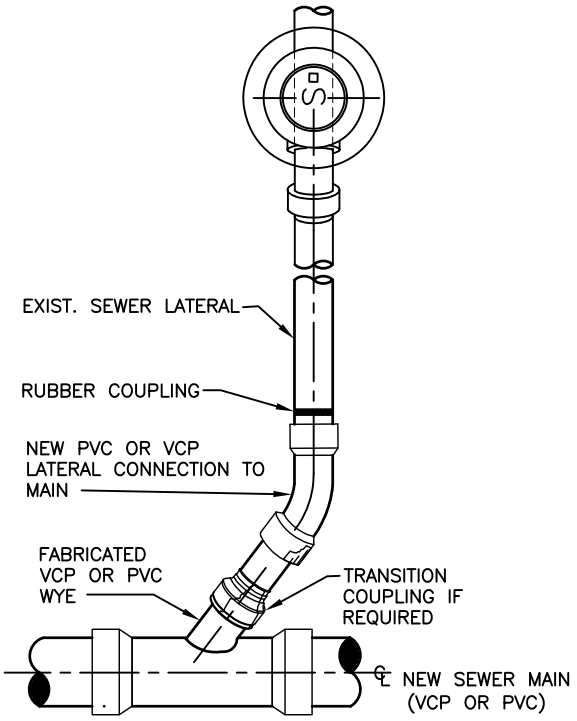
REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WWD–06

APPENDIX D

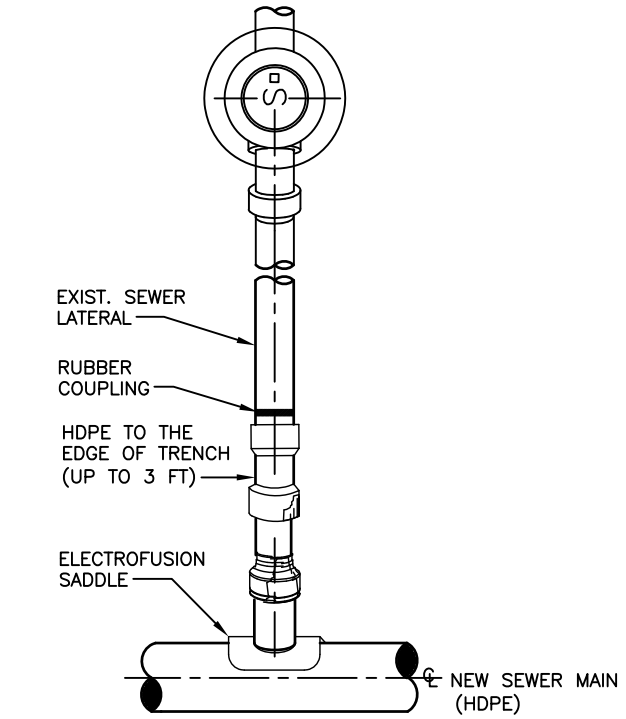
Ⓔ EXIST. LATERAL INTO NEW VCP OR PVC MAIN



NOTES:

1. RUBBER COUPLINGS SHALL BE NON-SHEAR, SHIELDED TYPE WITH STAINLESS STEEL SERIES 300 BANDSCREW AND HOUSING.
2. RUBBER SADDLES SHALL BE SEALED WITH AN ELASTOMERIC SEALANT. SEE SPECIFICATIONS.
3. CHANGES IN PIPE TYPE AND CONNECTIONS ARE NOTED ON THE DRAWINGS.
4. IF ADDITIONAL COUPLINGS ARE NEEDED TO MAKE A CONNECTION, THE CONTRACTOR SHALL USE ELECTROFUSION COUPLINGS.
5. ELECTROFUSION SADDLES SHALL CONSIST OF A FUSION SADDLE WITH AN INTEGRAL FUSION COUPLER AT ITS OUTLET.

Ⓕ EXIST. LATERAL INTO NEW HDPE MAIN



	BY	DATE
DRAWN	ME	3/05
CHECKED	RI	3/05
REVIEWED	RE	12/09

SCHEMATIC SS LATERAL CONNECTIONS – 2 STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

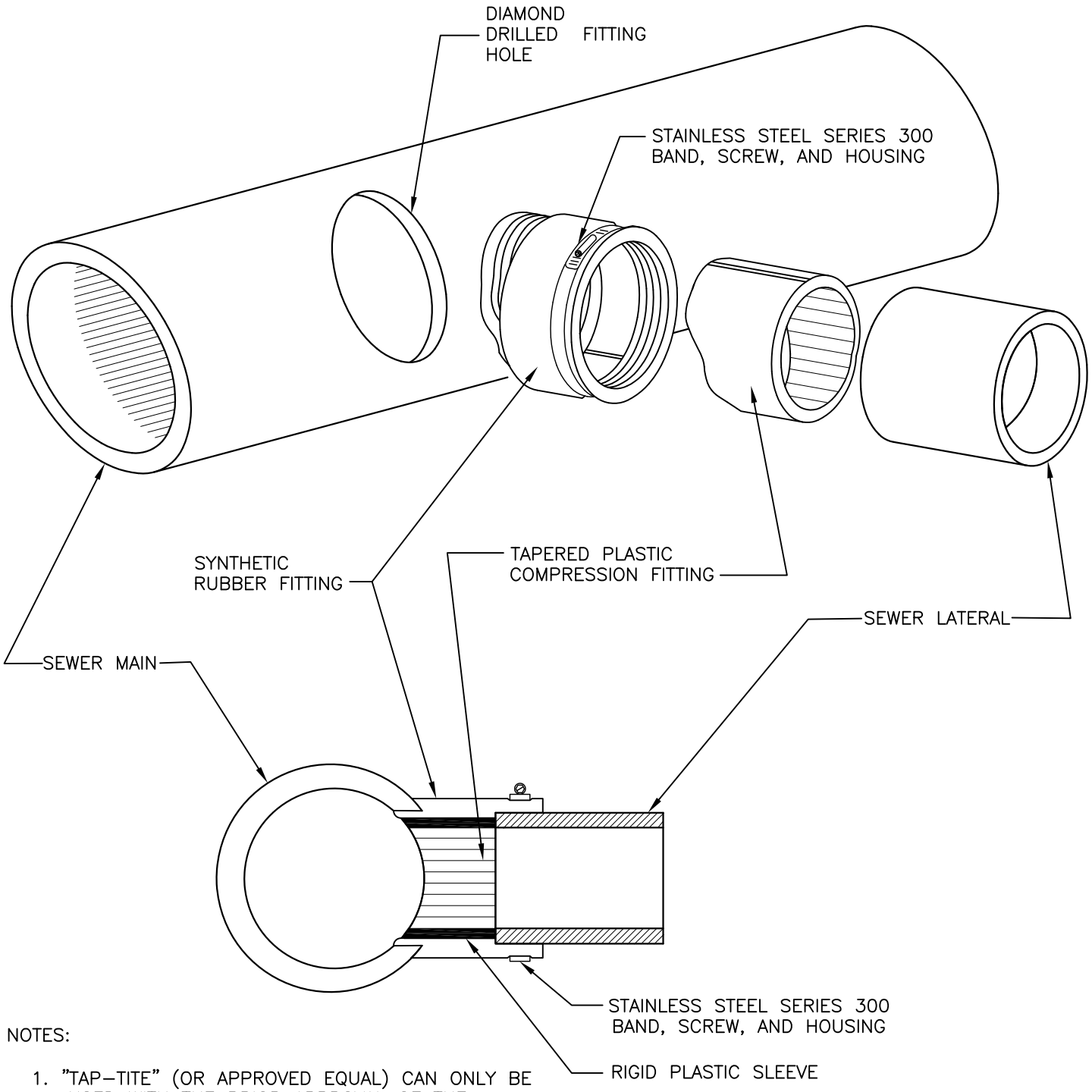
APPROVED:
JANUARY, 31 2013
52944 R.E. NO.
EDWARD WU
WGW ENGINEERING MANAGER

REVISION:
JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WWD-07

APPENDIX D



NOTES:

1. "TAP–TITE" (OR APPROVED EQUAL) CAN ONLY BE USED WITH THE PRIOR APPROVAL OF THE WASTEWATER SENIOR ENGINEER.
2. AN ELASTOMERIC SEALANT SHALL BE APPLIED BETWEEN THE SEWER MAIN AND THE FLEXIBLE SADDLE TO ENSURE AN AIR TIGHT CONNECTION.
3. COUPON SHALL BE REMOVED AND GIVEN TO THE CITY INSPECTOR.

	BY	DATE
DRAWN	A.L.	4/98
CHECKED	E.W.	4/98
REVIEWED	R.C.	4/98

LATERAL CONNECTION FOR TAP–TITE OR EQUAL STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

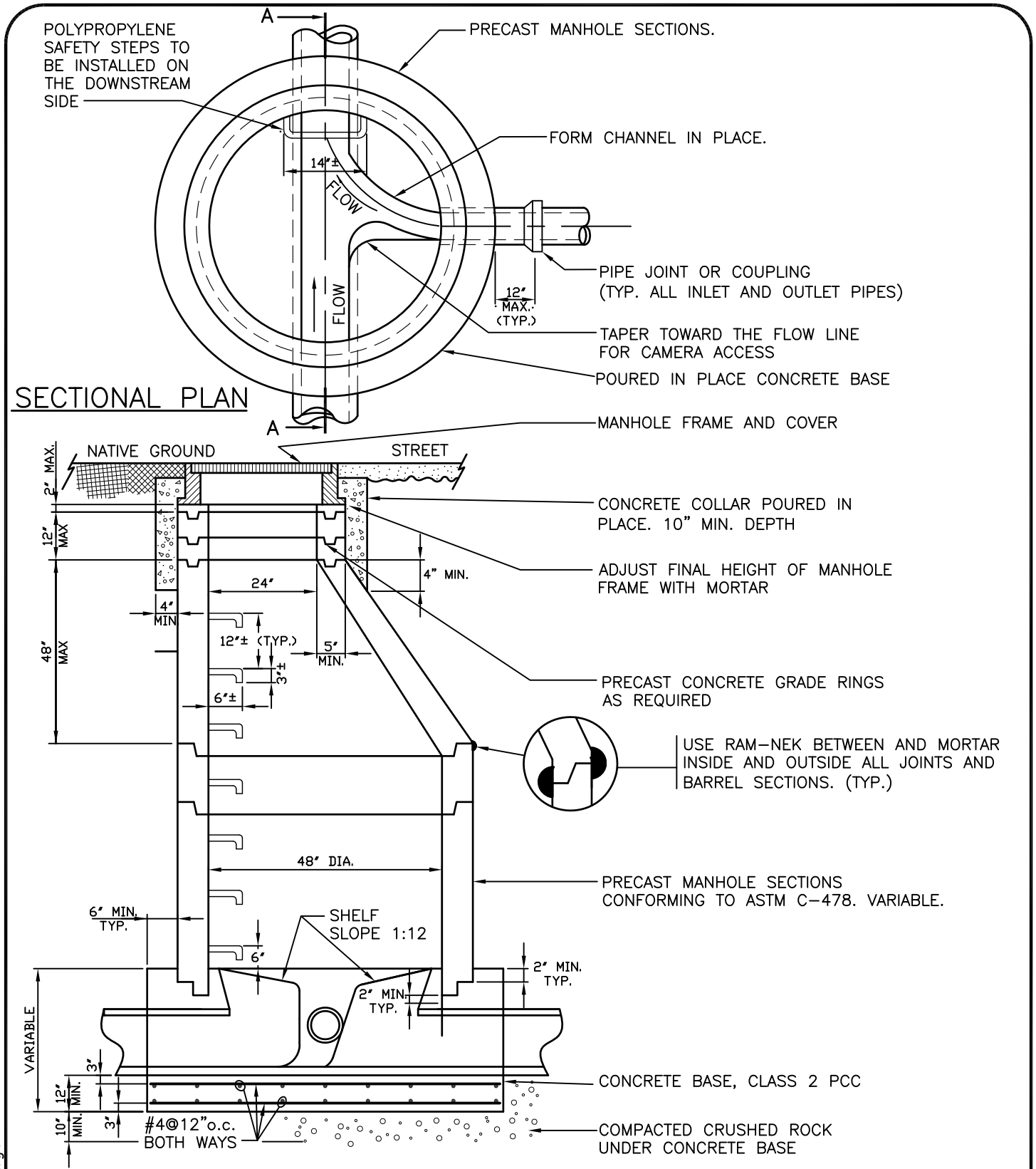
APPROVED: SEPTEMBER 1, 2004
Roger Cwiak 34533
ROGER CWIAK R.E. NO.
CHIEF ENGINEER

REVISION: OCTOBER 27, 2005

SCALE: NONE

DWG. NO. STD. WWD–08

APPENDIX D



NOTE: REBAR SHALL HAVE A MIN. CLEARANCE OF 3", WHEN CONCRETE IS NOT FORMED.

	BY	DATE
DRAWN	R.F.	4/98
CHECKED	E.W.	4/98
REVIEWED	R.C.	4/98

SANITARY SEWER MANHOLE (FOR PIPES UP TO 30" DIA.) STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: SEPTEMBER 1, 2004

Roger Cwiak 34533

ROGER CWIAK CHIEF ENGINEER — R.E. NO.

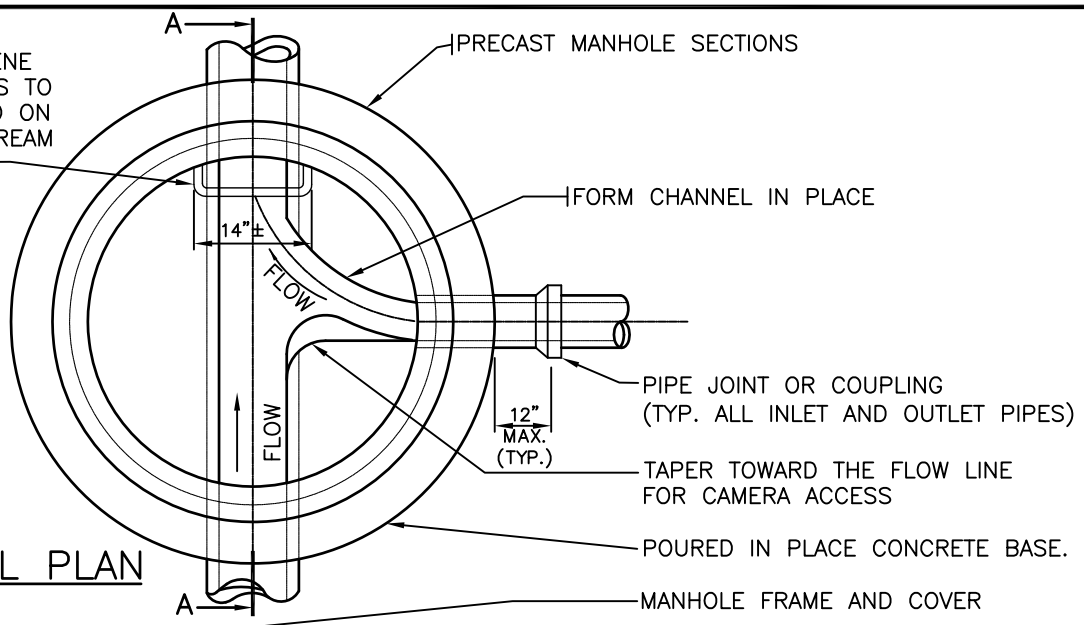
REVISION: OCTOBER 27, 2005

SCALE: NONE

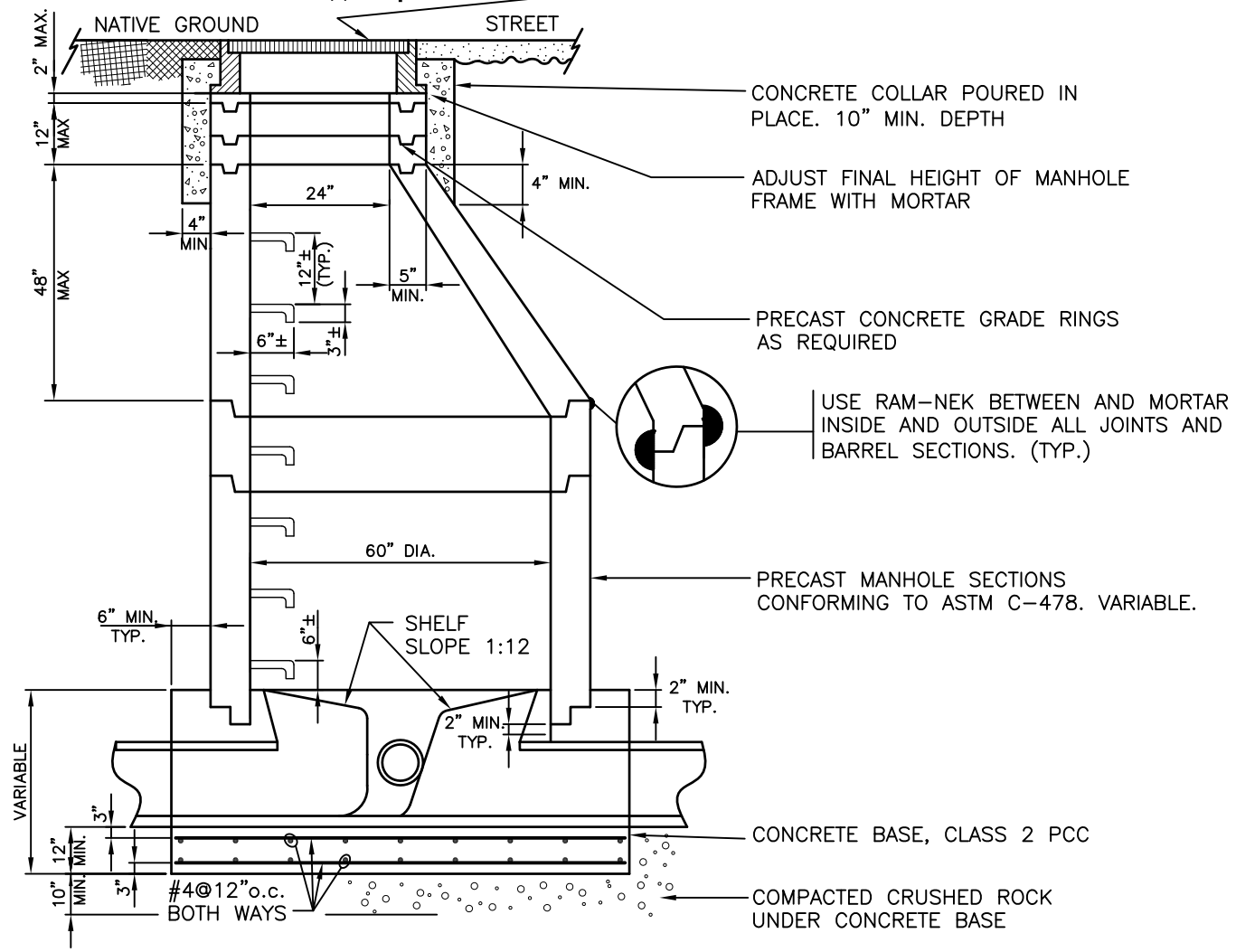
DWG. NO. STD. WWD-09

APPENDIX D

O:/STANDARD/Stddwg1



SECTIONAL PLAN



SECTION A-A

NOTE: REBAR SHALL HAVE A MIN. CLEARANCE OF 3", WHEN CONCRETE IS NOT FORMED.

	BY	DATE
DRAWN	R.F.	5/92
CHECKED	E.W.	6/92
REVIEWED	R.C.	6/92

SANITARY SEWER MANHOLE (FOR PIPES 31" TO 42" DIA.) STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: SEPTEMBER 1, 2004

Roger Cwiak 34533

ROGER CWIAK CHIEF ENGINEER — R.E. NO.

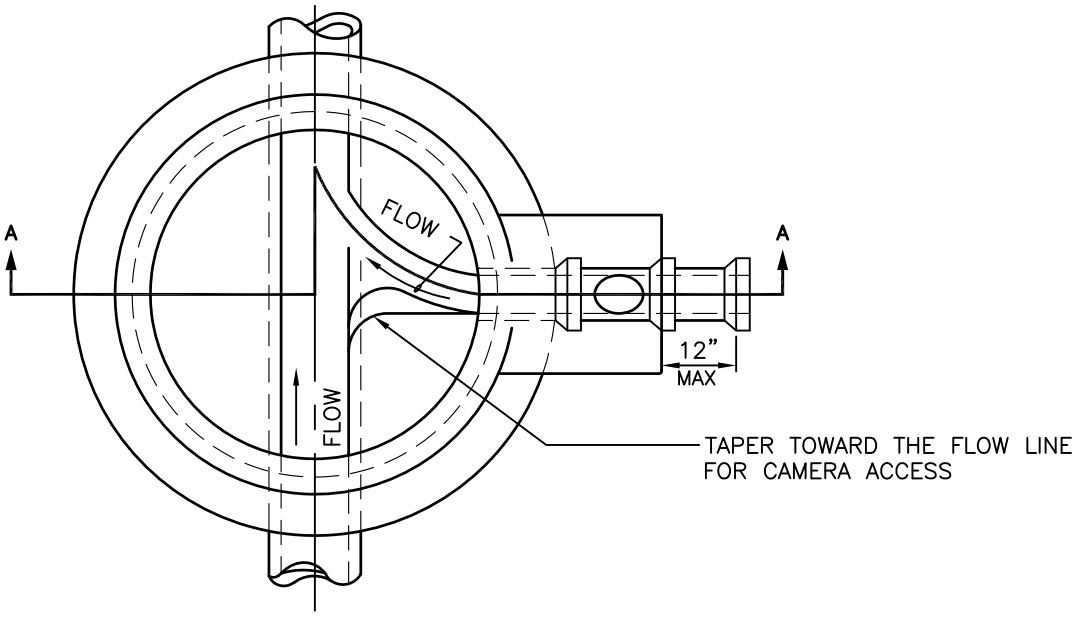
REVISION: OCTOBER 27, 2005

SCALE: NONE

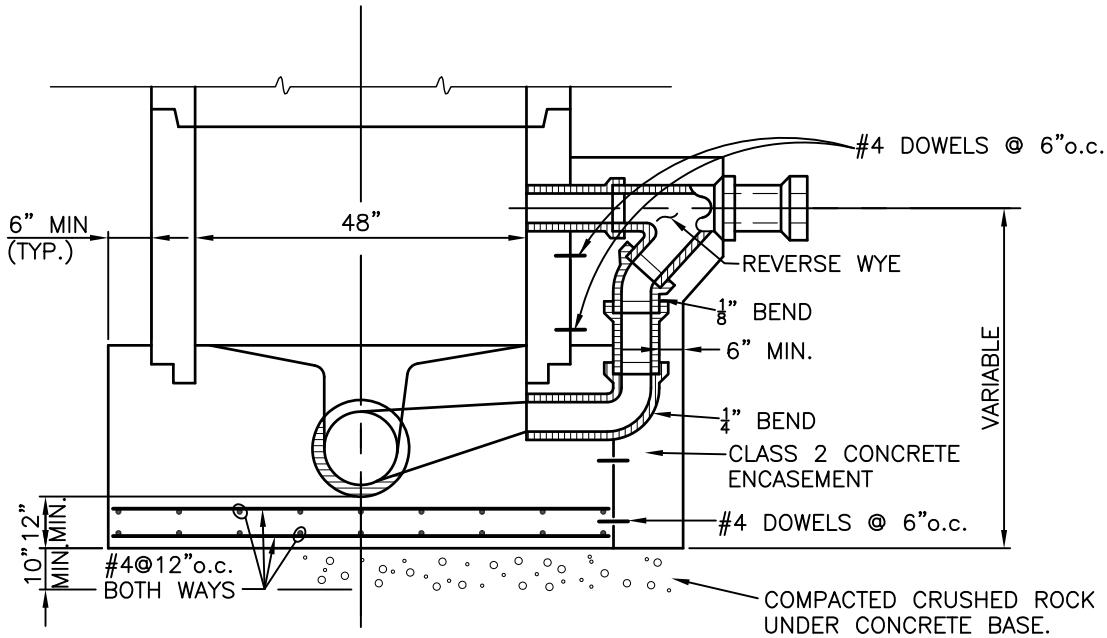
DWG. NO. STD. WWD-10

APPENDIX D

O:/STANDARD/Stddwg1

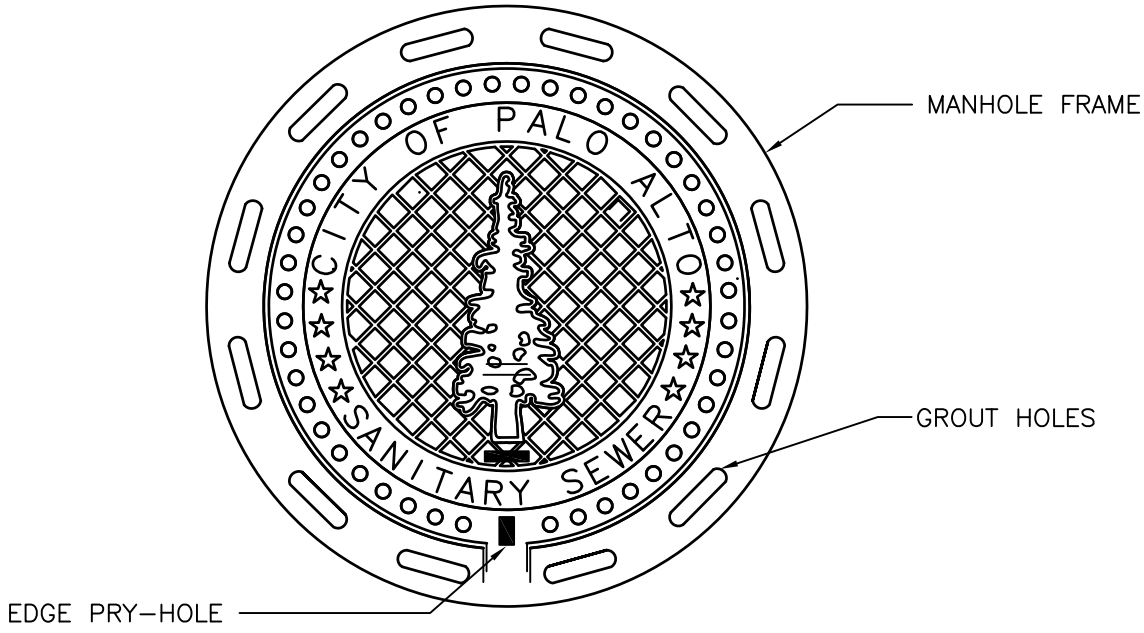


SECTIONAL PLAN



SECTION A–A

BY	DATE			
DRAWN R.F.	5/92	OUTSIDE DROP STANDARD DETAIL	APPROVED: SEPTEMBER 1, 2004 Roger Cwiak 34533 ROGER CWIAK CHIEF ENGINEER R.E. NO.	SCALE: NONE
CHECKED E.W.	6/92			DWG. NO. STD. WWD–11
REVIEWED R.C.	6/92	CITY OF PALO ALTO, CALIFORNIA	REVISION: OCTOBER 27, 2005	APPENDIX D



NOTE: CERTAINTEED PAMREX 24" DUCTILE IRON MANHOLE FRAME AND COVER AS MADE BY CF MANUFACTURING, LLC P.O. BOX 164 BRADFORD WOODS, PA 15015 PH – 724–473–1044 CALIFORNIA REP – FAMCON 805–485–4350

	BY	DATE
DRAWN	JN	2/95
CHECKED	RE	3/13
REVIEWED	RE	3/13

SANITARY SEWER MANHOLE FRAME AND COVER STANDARD DETAIL

CITY OF PALO ALTO, CALIFORNIA

APPROVED: JANUARY, 31 2013

EDWARD WU
WGW ENGINEERING MANAGER

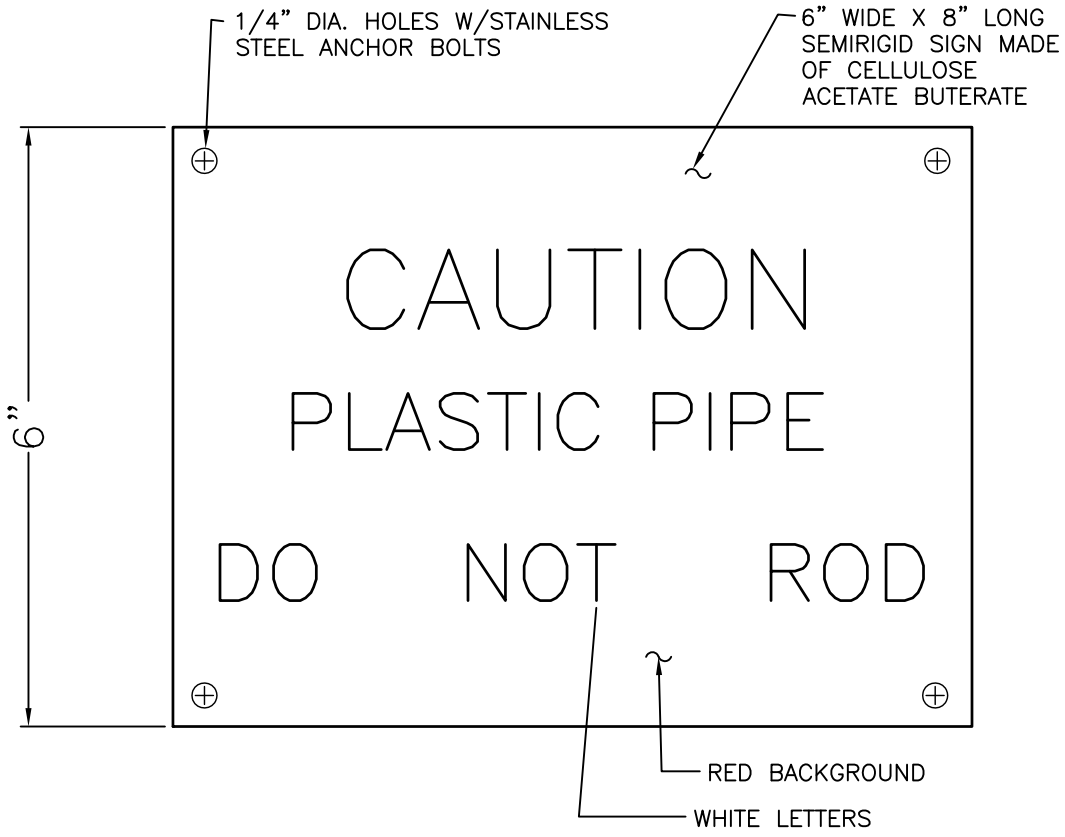
52944 R.E. NO.

REVISION: JAN 31, 2013

SCALE: NONE

DWG. NO. STD. WWD–12

APPENDIX D

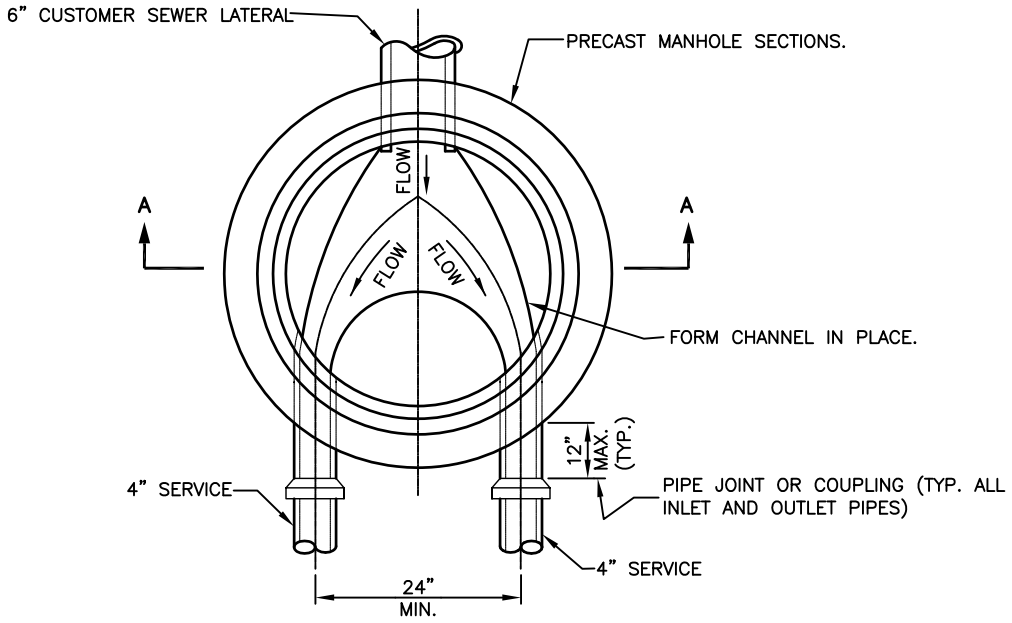


NOTES:

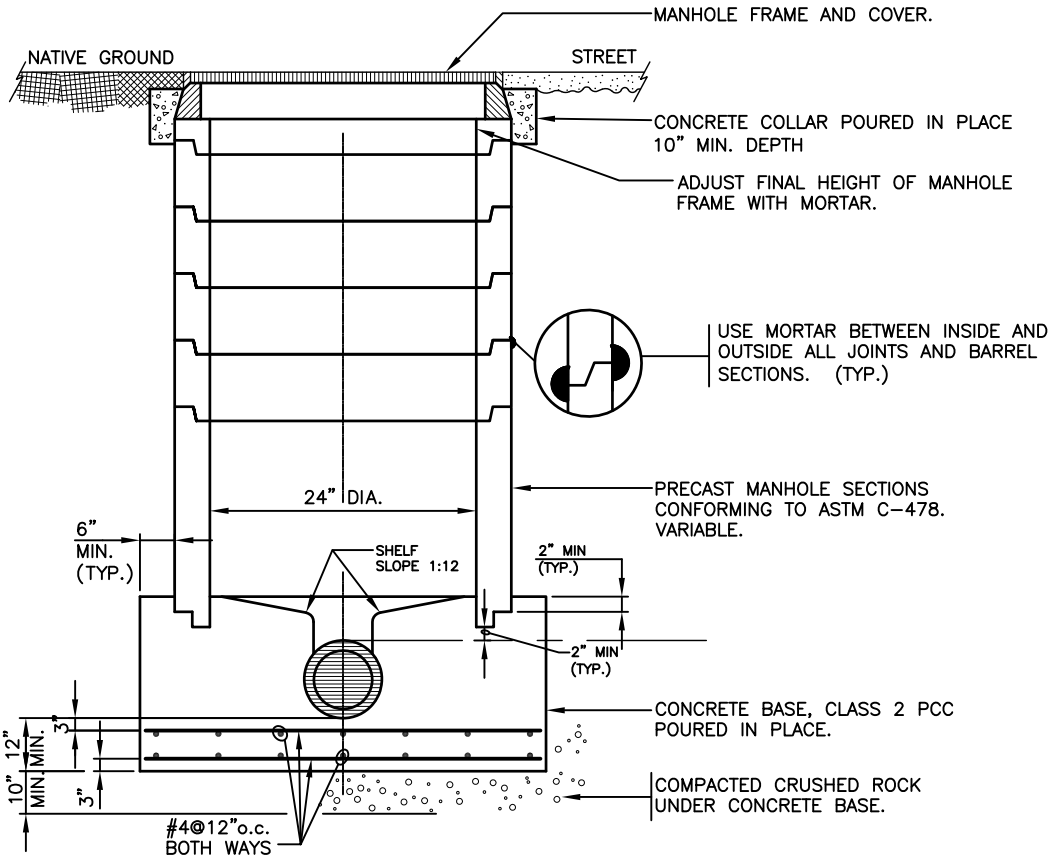
1. CAUTION SIGN MUST BE INSTALLED INSIDE SANITARY SEWER MANHOLE WHEN PLASTIC PIPE IS USED AND SHALL BE LOCATED AT 12" BELOW THE MANHOLE GRADE RING.

2. EPOXY ANCHOR BOLTS 1" PENETRATION MINIMUM. BOLT HEAD SHALL BE FLUSH ON THE SIGN.

	BY	DATE			
DRAWN	JN	11/97	PLASTIC PIPE MANHOLE SIGN STANDARD DETAIL	APPROVED: JANUARY, 31 2013	SCALE: NONE
CHECKED	EW	11/97		52944 R.E. NO. EDWARD WU WGW ENGINEERING MANAGER	DWG. NO. STD. WWD-13
REVIEWED	RE	12/09	CITY OF PALO ALTO, CALIFORNIA	REVISION: JAN 31, 2013	APPENDIX D

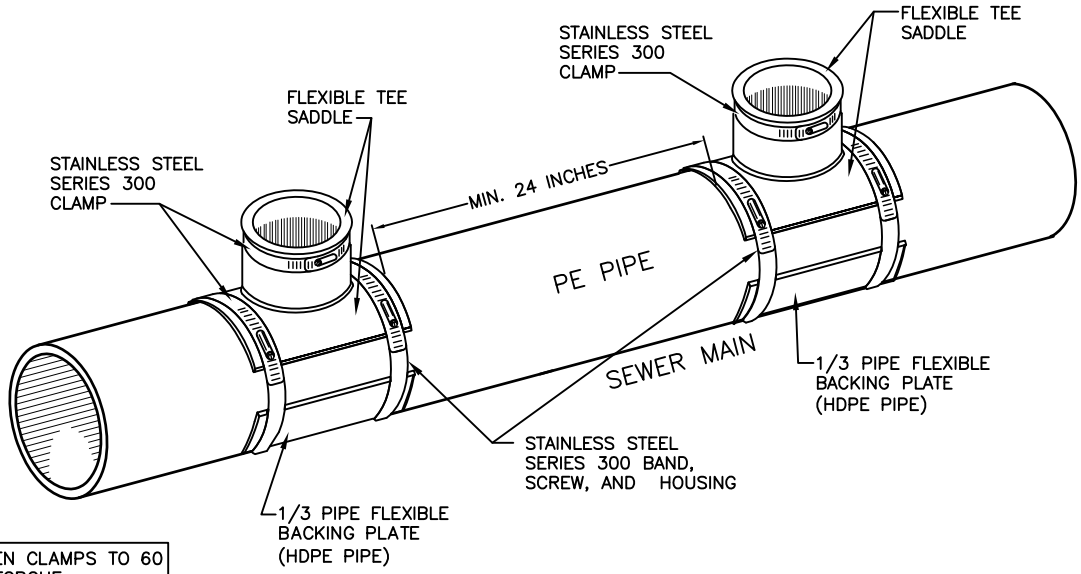


SECTIONAL PLAN

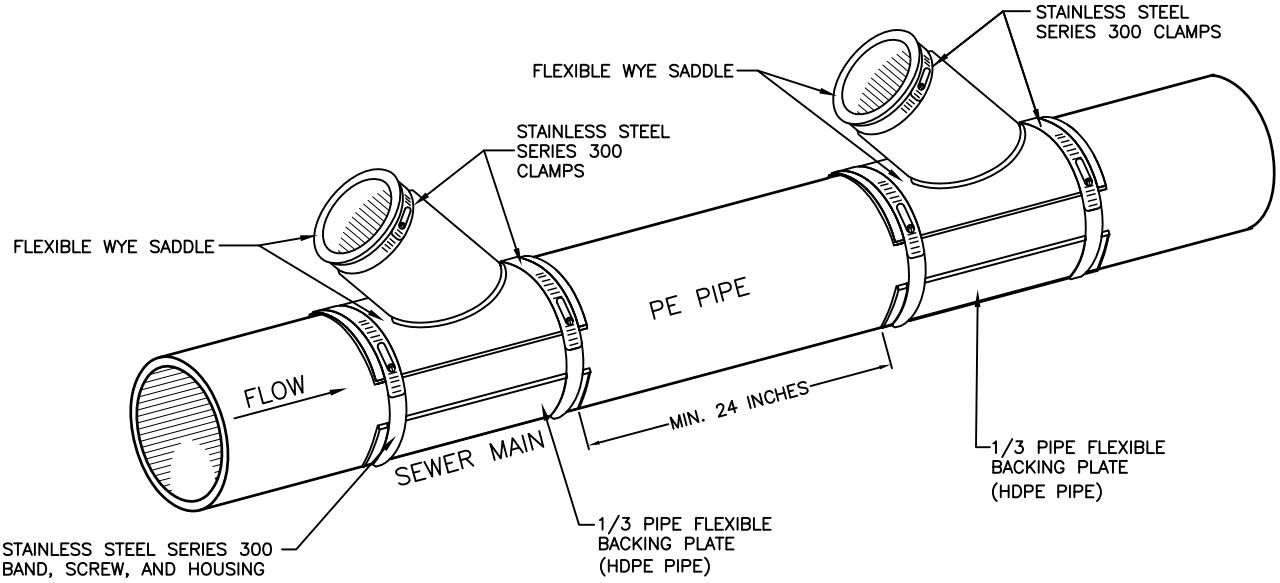


SECTION A–A

	BY	DATE			
DRAWN	J.N.	4/98	SANITARY SEWER MANHOLE CONVERT ONE 6" LATERAL TO TWO 4" LATERALS	APPROVED: SEPTEMBER 1, 2004 Roger Cwiak 34533 ROGER CWIAK R.E. NO. CHIEF ENGINEER	SCALE: NONE
CHECKED	E.W.	4/98			DWG. NO. STD. WWD–14
REVIEWED	R.C.	4/98	CITY OF PALO ALTO, CALIFORNIA	REVISION: OCTOBER 27, 2005	APPENDIX D



NOTE: TIGHTEN CLAMPS TO 60 LBS. TORQUE.



NOTE: AN ELASTOMERIC SEALANT SHALL BE APPLIED BETWEEN THE SEWER MAIN AND THE FLEXIBLE SADDLE TO ENSURE AN AIR TIGHT CONNECTION.

SLURRY BACKFILL IN BEDDING AND PIPE ZONE.

NOTE:
THIS DETAIL IS USED W/ DETAIL WWD-14.

	BY	DATE			
DRAWN	J.N.	3/98	STRAP ON MULTIPLE LATERAL CONNECTIONS TO SEWER PIPE STANDARD DETAILS	APPROVED: MAY 1, 1998 Roger Cwiak 34533 ROGER CWIAK CHIEF ENGINEER R.E. NO.	SCALE: NONE
CHECKED	E.W.	3/98			DWG. NO. STD. WWD-15
REVIEWED	R.C.	3/98	CITY OF PALO ALTO, CALIFORNIA	REVISION: OCTOBER 27, 2005	APPENDIX D

Polyethylene Pipe Fusion Training Procedures and Certification

Revised 3/21/13

TABLE OF CONTENTS

CITY OF PALO ALTO: Polyethylene Pipe Fusion Training Procedures

It is responsibility of a fuser to verify that polyethylene pipe and fittings are in conformance with the specifications requirements and no older than 6 months from the date of manufacture to the date of shipment to CPA.

A) **HEAT FUSION TOOLS**

1) BUTT FUSION

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions.

I) Heating Iron

The heating irons are NOT EXPLOSION PROOF and shall not be used in any area with gas present while still connected to a power source.

An electrically resistive coil in the heating iron maintains the temperature at a level sufficient for fusion. The irons operate on 110 volts A.C. with power requirements ranging from 1200 watts McElroy No. 14 to 1750 watts McElroy No. 28 Auto Mac. Teflon coated faces are utilized on both sides of the iron. Extreme care must be exercised to avoid scratching the faces; only cotton cloths should be used for cleaning. The faces are either an integral part of the iron or are detachable and must be recoated when scratched. A dial type thermometer is placed next to the handle. The iron temperature can be adjusted by changing the calibration set screw. The heating iron for the Auto Mac must be connected to the proper outlet on the butt fusion machine, DO NOT attach the iron to any other source as it does not self regulate and it will be burned out.

II) Butt Fusion Machine

The butt fusion machine consists of mobile and stationary alignment clamps that hold the pipe ends during the fusion process. These clamps transfer the force and associated pressure required to fuse the pipe.

III) Alignment Clamp Inserts

Two sizes of inserts are supplied for the 4" machines (2" and 3" IPS). The No. 28 machine also has two inserts (4" and 6" IPS).

IV) Facer

Either manual or electrical facers are provided for the butt fusion machines. The electrical facers are NOT EXPLOSION PROOF and shall not be used in any area with gas present.

2) ELECTRO FUSION

NOTE: The manufacturer's operating instructions must be adhered to insure acceptable fusions.

I) Universal Control Box

This unit controls the fusion process. It processes information received from the optical wand that is used to determine the fitting manufacturer and appropriate fusion times. It also stores fusion related information, which can be downloaded for record information.

II) Optical Wand

This device reads the uniform product code UPC sticker on the fitting.

III) Couplings

A resistant wire embedded in the coupling provides the energy required for fusion.

a) Alignment Clamps

Only required for 2" and larger sizes. These devices align and immobilize the pipe ends and coupling during the fusion and cool down periods.

b) Pipe Scrapers

Three types of scrapers are used to remove oxidation and contaminants from the outside pipe wall prior to electro fusion coupling installation. A paint scraper may be used on 1/2" and 1" CTS sizes only. Virax type or interior anchored pipe scraper can be used on 1/2" CTS - 6" IPS sizes. Additionally, full encirclement Scrapers can be used on 2" - 16" pipe sizes.

IV) Tapping Tees

The tees also have a resistant wire coil that provides the energy for fusion. They require either a back up under saddle or a ratchet operated clamp to fix the tee to the main during fusion. A threaded cutter is included for tapping the main.

a) Service Line Alignment Clamp

When applying the service line to the outlet of a tapping tee an alignment clamp shall be used to insure that the outlet and the service line are straight. This unit also immobilizes the coupling during the fusion and cool down periods.

b) Ratchet Clamp

All pipe sizes require the use of a hold down clamp or backing plate to secure the tapping tee onto the main during fusion.

3) MISCELLANEOUS TOOLS

I) Pipe Cutters

a) "Plier" type cutters for use on 1/2" CTS - 2" IPS sizes.

b) A guillotine type cutter shall be used on 3" and larger sizes.

II) Pipe Squeeze Off Tools

a) Manual squeeze off tools are provided for 1/2" CTS - 2" IPS sizes. These

tools are equipped with stops for each pipe size that prevent over squeezing of the pipe.

b) Hydraulic squeeze off tools are necessary for the larger pipe sizes, 3" - 8". These tools are also equipped with stops for each pipe size.

III) Pyrometer

The pyrometer is used to check the surface temperature of the heating irons. It consists of a hand held display unit and an attached surface probe.

B) **MANUAL BUTT FUSION PROCEDURES**

1) Energize the heating iron. Once the heater has reached maximum temperature, generator cycles off, check the thermometer for 425° ± 25°F.

At the start of each day, the reading of the dial thermometer shall be checked against the surface temperature by use of the pyrometer and the heating iron calibration set screw adjusted accordingly (manual machines only).

Note: DO NOT adjust the heating iron for the AutoMac unit as it is regulated (controlled) by the microprocessor.

2) Install the proper size alignment clamp inserts if required.

3) Inspect the pipe and/or fitting ends and cut off any damaged or flattened portions.

4) Clean each pipe/fitting end with a clean cotton cloth and place them in the alignment clamps. Pipe ends should overlap the alignment clamps by approximately 1".

5) Place the manual or the motorized facer on the guide rods and bring the pipe ends in contact with it. Turn the manual facer in the direction of the arrow or turn the motorized facing unit on and apply light force on the carriage lever to advance the pipe ends. The motorized facer speed will increase when the pipe has bottomed out.

6) Retract the carriage lever and remove the facer. Discard the strips of material from the pipe ends taking care not to touch the clean surfaces. Check the discarded strips to insure that a continuous length from the entire diameter has been removed.

7) Check alignment of the pipe ends and adjust for high-low if necessary. If an adjustment is made or a visible gap exists between the pipe ends, repeat the procedures from Step 4.

8) Wipe heater with a non-synthetic clean dry cloth and place it on the guide rod(s) and bring the pipe ends into contact with it. Maintain a light force on the carriage until a small melt bead forms around the entire circumference of both pipe ends. Relax the force on the carriage but keep both pipe ends in contact with the heater and start the melt time cycle. Refer to Table 1 for proper melt times.

9) After the melt time has been observed snap the carriage back (open) and quickly remove the heater being careful not to hit the melt.

10) Inspect the pipe ends for complete melt. Bring the pipe ends together quickly, DO NOT SLAM, applying only enough pressure to form a double roll back bead. The proper bead thicknesses are shown in Table 1. Over-pressuring the melt will cause the bead to overlap itself resulting in a subquality fusion due to displacement of the melt to the OD and ID of the

joint leaving a cold ring in the center. Under pressuring can result in inadequate fusion due to insufficient contact pressure in the melt area.

11) Maintain the pressure exerted on the fusion area for one minute for 1/2"-4" sizes and for three minutes for 6". Relaxing the pressure prior to expiration of the cooling time can result in porous fusion joints.

12) Allow the joint to cool for additional three to four minutes (see Table 1) prior to removal from the alignment clamps. The pipe can now be handled with care. Complete cooling requires approximately thirty minutes.

13) Check the melt bead for uniformity and size. If the joint exhibits poor characteristics, determine the cause, make the necessary corrections, cut out the suspect joint, and repeat the procedure from Step 4.

14) Clean the heater faces with a clean cotton cloth. DO NOT use synthetic cloths or metal implements.

TABLE 1: Manual Butt Fusion Parameters

Pipe Size	Melt Bead Size	Heating Time (seconds)	Hold Time (seconds)	Cooling Time (minutes)
1/2" CTS	1/16"	3-6	60	3
1" CTS	1/16"	5-9	60	3
2" IPS	1/16"-1/8"	15	60	4
3" IPS	1/8"	20	60	4
4" IPS	3/16”	20	60	4
6" IPS	3/16"	30	180	5

HDPE pipe fusion parameters’ shall be in accordance with manufacturer’s procedures.

C) **AUTOMATED BUTT FUSION PROCEDURES**

Follow the appropriate manufacturer's procedures when producing butt fusion with automatic equipment.

Review Joint Report generated by DataLogger™ to confirm fusion success.

D) **ELECTRO FUSION PROCEDURES**

NOTES: See the Universal Control Box Manufacturer’s literature for fusion information. The manufacturer’s literature must be adhered to insure acceptable fusions.

In the event that the supply voltage varies outside of the stated limits the fusion cycle will be interrupted. A new cycle can be started after a ten-minute cool down period has been observed. The fusion system will automatically adjust the duration of the cycle to compensate for the previously

aborted attempt. A maximum of three attempts may be tried. If the tapping tee has already been tapped, **NO** retries are allowed.

E) **MAIN INSTALLATION PROCEDURES**

1) DIRECT BURIAL

I) Excavate 34" plus pipe diameter deep trench.

II) Make sure trench bottom is level and free of sharp objects, rocks or other materials that may damage pipe.

III) Shade trench with 4" min. sand bed and level sand as needed.

IV) Install a #10 copper tracer wire adjacent to pipe.

V) Install pipe in trench and snake it. Observe pipe during installation for scratches, gouges or others defects. Avoid dragging pipe over rough surfaces and scratching it.

VI) Pressure test pipe with 100 PSIG air for 24 hours.

VII) Backfill to top of pipe and haunch the sides.

VIII) Backfill trench with 12" lifts of sand and compact to 95% compaction.

IX) Purge pipe.

2) INSERTION

I) Two methods may be used to identify possible obstructions in the pipe to be inserted:

- Video inspection of the existing pipe
- Pulling of a proof piece of similar diameter pipe through the section to be inserted and inspection of it for damage.

All obstruction must be removed prior to insertion of a gas main.

II) At the location of all service tees a section of main must be removed prior to insertion to allow installation of a tapping tee.

III) Deburr casing ends, run mechanical brush, and use compressed air to blow debris out of casing. Install a suitable casing cable protector on the casing end to protect the pipe coating from damage.

IV) Attach a #10 copper tracer wire to existing steel pipe casing. If the casing is plastic attach the tracer to the new pipe.

V) Seal end of the pretested pipe to be inserted with an end cap. Insert the pretested pipe into existing casing taking care not to scrape it at the entrance. Pipe shall be extended at least two feet past the casing end and inspected for gouges and scratches. If damaged, replace the pipe and go back to Step I.

VI) Leak test pipe with 100 PSIG air applying water soap mixture to all joints and verify no leakage is present.

VII) Purge pipe.

3) DIRECTIONAL BORING

I) Prospect/expose all existing underground utility services/facilities prior to boring. Additionally, all sewer laterals in public and private right of ways must be potholed to determine exact vertical and horizontal position before boring and video inspected, following the mains/services installation, prior to introduction of natural gas.

II) After establishing the pilot hole, a back reamer/compactor must be used. The back reamer/compactor size shall be as specified in Section 2200 subpart 3.10(B).

III) A commercially available weak link must be used on the pull head to avoid damaging the pipe during pull in.

IV) Attached an end cap and tracer wire to the pipe prior to pull in.

V) Care must be taken to avoid scraping or gouging the pipe during pull in. Rollers shall be used at all bend points in the launching pit and every 15' along the pipe. **Pipe shall not be dragged on street surface.**

VI) After pull in, check continuity of tracer wire.

VII) Install service tees and bore in service lines.

VIII) Care must be exercised, when filling service and sewer pits, to insure proper backfill and support of installed pipe. Fill pits up to the top of pipe and hand tamp backfill around pipe haunch.

F) **SERVICE INSTALLATION PROCEDURES**

1) DIRECT BURIAL

I) Excavate 24" plus pipe diameter deep trench.

II) Make sure trench bottom is level and free of sharp objects, rocks or others materials that may damage pipe.

III) Install a #10 copper tracer wire adjacent to pipe.

IV) Install pipe in trench. Always "snake" the pipe in the trench bottom during installation (This insures that when the pipe contracts at lower temperatures it won't pull out from connections). Observe the pipe during installation for scratches, gouges or others defects.

V) Attach ASR or insert existing riser.

VI) Install tapping tee and connect service line to it, including installation of an excess flow valve.

VII) Pressure test pipe with 100 PSIG air for 15 minutes and check all connections for leaks.

VIII) Tap main and purge pipe.

IX) Backfill pipe and replace the landscape in kind.

2) INSERTION

I) Deburr casing ends and use compressed air to blow debris out of casing. Install a suitable casing cable protector on the casing end to protect the pipe coating from damage.

II) Attach a #10 copper tracer wire to existing steel pipe casing. If the casing is plastic attach the tracer to the new pipe.

III) Seal end of pipe to be inserted with an end cap. Insert pipe into existing casing taking care not to scrape it at the entrance. Pipe shall be extended at least two feet past the casing end and inspected for gouges and scratches. If damaged, replace the pipe and go back to Step I.

IV) Install tapping tee and connect service line to it.

V) Pressure test pipe with 100 PSIG air for 15 minutes and check tapping tee for leaks.

VI) Tap main and purge pipe.

3) BORE

I) Establish a service bore hole with a pneumatic or similar gopher type boring device.

II) Verify depth at meter end of bore hole. If bore hole is less than 24" deep, restart procedure from Step I.

III) Install an end cap and attach a #10 tracer wire to service line.

IV) Insert service line into bore hole.

V) Attach an ASR to the meter end of service line.

VI) Install a service tee and connect the service line to it.

VII) Pressure test pipe with 100 psig air for 15 minutes and check tapping tee for leaks.

VIII) Perform sewer lateral(s) video verification.

IX) Tap main and purge pipe.

G) **ADDITIONAL TOPICS**

1) SQUEEZE OFF

I) Set the pipe stops to the appropriate diameter.

II) Ground the squeeze machine and the pipe end.

III) Take your time while squeezing the pipe, advance the squeeze a little bit each time and then allow the pipe to conform to the new set before continuing the process. Complete shut off may not be achieved in the larger sizes.

IV) Perform the repair.

V) Remove the squeezer, allowing for the pipe to expand in steps during the removal.

2) MAIN REPAIRS

Control the gas or water flow by closing valves or by installing pipe squeezers (for PE gas pipe). Depending on the cause, either install a clamp or cut out the damaged portion and install a short section of PE. If working on PE use two electro fusion couplings to make connections. With materials other than PE use two Maxi Grip Couplings and required stiffeners.

3) SERVICE REPAIRS

If the service piping material is ABS, Copper, ACP, VCP Cast Iron, Galvanized or Tenite replace the entire pipe with PE, including retapping the main with a new service tee. Abandon the old tee at the main.

If the service pipe is PE and the failure is pull out related (either by a third party or temperature contraction) replace the entire line. With dig in situations, control the flow and use either of the approved fusion methods to repair the line.

CITY OF PALO ALTO: Polyethylene Pipe Fusion Certification Procedures

Applicants for fusion certification will be required to attend two hour training session conducted by the City of Palo Alto and pass a written exam prior to be allowed to take fusion qualification tests.

Name:_____ Date:_____

Title:_____

Individual should be tested on all procedures he/she is to be certified under. (Unmarked boxes constitute failure in that type procedure)

☐ **BUTT FUSION MANUAL**

☐1. Pipe ends were faced properly.
☐2. Removed cuttings from interior of pipe.
☐3. Aligned pipe ends and adjusted for "high-low".
☐4. Verified heating iron temperature.
☐5. Observed recommended melt bead prior to timing.
☐6. Observed recommended melt time.
☐7. Maintained pressure on fusion during recommended cool down period.
☐8. Allowed joint to cool in machine for recommended period.

☐ **BUTT FUSION AUTOMATIC**

☐1. Observed fusion machine manufacturer's recommended procedures.
Review Joint Report generated by DataLogger™ to confirm fusion success.

☐ **ELECTRO FUSION**

☐ **COUPLINGS**

☐1. Pipe ends were cut square and even.
☐2. Cleaned pipe inside and out.
☐3. Measured and marked pipe ends.
☐4. Scraped pipe ends.
☐5. Took proper precautions to avoid contamination of pipe ends.
☐6. Cleaned fitting and pipe ends with alcohol.
☐7. Properly installed pipe in alignment tool.
☐8. Centered fitting between marks.
☐9. Connected control box to proper 110 volt A.C. power source in correct sequence.
☐10. Verified the operation of sensor switches. (If Innogaz System)
☐11. Had thorough understanding of operation sequence and warning light functions.
☐12. Swiped fitting UPC with optical wand.
☐13. Noted time that FUSION START BUTTON was depressed.
☐14. Marked time of day on pipe at end of fusion.
☐15. Removed leads from fitting 30 seconds or longer after fusion was over.
☐16 Verified presence of plastic flow into both wells. (If Innogaz System)
☐17. Allowed fitting to cool in secured position for recommended time.

□ **TAPPING TEES**

□1. Cleaned pipe around fusion zone.
□2. Scraped entire pipe surface that will fall under tee.
□3. Took proper precautions to avoid contamination of scraped pipe.
□4. Cleaned fitting and scraped area with alcohol.
□5. Placed tee on scraped area.
□6. Properly installed under-saddle/hold-down clamp.
□7. Connected control box to proper 110 volt A.C. power source in correct sequence.
□8. Verified the operation of sensor switches.
□9. Had thorough understanding of operation sequence and warning light functions.
□10. Swiped fitting UPC with optical wand.
□11. Noted time that FUSION START BUTTON was depressed.
□12. Marked time of day on pipe at end of fusion.
□13. Removed leads from fitting 30 seconds or longer after fusion was over.
□14. Verified presence of plastic flow into both wells.
□15. Allowed fitting to cool in secured position for recommended time.
□16. Outlet Connection:
  □a. Pipe end had square cut.
  □b. Cleaned pipe end and outlet.
  □c. Measured and marked pipe end.
  □d. Scraped pipe and outlet end.
  □e. Cleaned fitting and scraped areas with alcohol.
  □f. Installed fitting properly.
  □g. Followed proper fusion procedure.
  □h. Immobilized pipe during fusion and cool down periods.

JOINT EVALUATION

Visual Examination (During and after assembly. Compare to Photograph or sample of acceptable joint.)

Procedure/Joint Appearance

PROCEDURE		JOINT APPEARANCE		ADDITIONAL INSTRUCTION REQUIRED IN
		PASS	FAIL	
BUTT FUSION				
ELECTRO FUSION	COUPLING			
	TAPPING TEE			

DEFORMATION TEST

□ Specimen cut into longitudinal straps. (Joint should be free of voids or unbonded areas on surface.)

Joint Evaluation (Visual)

PROCEDURE		JOINT APPEARANCE		APPARENT CAUSE OF FAILURE
		PASS	FAIL	
BUTT FUSION				
ELECTRO FUSION	COUPLING			
	TAPPING			

Joint Evaluation (Deform joint by bending or compression.)

PROCEDURE		JOINT APPEARANCE		APPARENT CAUSE OF FAILURE
		PASS	FAIL	
BUTT FUSION				
ELECTRO FUSION	COUPLING			
	TAPPING			

Inspector_____

Individual demonstrated the ability to follow the recommended procedures and produce acceptable fusion joints.

□Yes □No

RECOMMENDATION:

□ Retest Required.
□ Certification Card Issued/Date_____
□ Re-Certification Card Issued/Date_____

Certified in the following application(s):
□ Butt Fusion
□ Couplings
□ Tapping Tees

_____ _____
Authorized Observer/Tester Date