Nominal Pipe Size, in	½	¾	1	1¼	1½	2	3	4
Nominal Diameter, mm	15	20	25	32	40	50	75	100
wall thickness	-12.5%	-12.5%	-12.5%	-12.5%	-12.5%	-12.5%	-12.5%	-12.5%
Weight per meter, kg	1.27-1.34	1.68-1.78	2.50-2.62	3.38-3.55	3.75-4.23	5.00-5.43	10.3-11.3	14.5-16.1
Fittings								
90° Elbow								
Length	28.45	33.27	38.10	44.45	46.74	57.15	78.23	96.27
Weight, kg	0.11	0.18	0.29	0.43	0.56	0.79	2.34	4
45° Elbow								
Length	22.35	24.89	28.45	32.77	36.32	42.67	55.12	66.29
Weight, kg	0.07	0.10	0.15	0.38	0.52	0.77	2.11	3.46
St. Elbow								
Length, ME	40.89	48.01	54.10	61.98	67.82	83.06	114.55	114.27
Length, FE	28.45	33.02	38.10	44.45	49.28	57.15	78.23	96.27
Weight, kg	0.11	0.18	0.29	0.49	0.66	1.06	2.99	4.94
Tee								
Length	28.45	33.27	38.10	44.45	49.28	57.15	78.23	96.27
Weight, kg	0.16	0.25	0.41	0.59	0.78	1.19	3.22	5.12
Cross Tee								
Length	28.45	33.27	38.10	44.45	49.28	57.15	78.23	96.27
Weight, kg	0.20	0.29	0.44	0.72	0.86	1.33	3.7	6.76
Coupling								
Length	34.04	38.61	42.42	49.02	54.61	64.26	80.77	93.73
Weight, kg	0.09	0.13	0.22	0.34	0.45	0.66	1.5	2.56
Union Patente								
Length	43.69	51.31	55.63	57.40	62.74	69.85	89.92	97.79
Weight, kg	0.21	0.26	0.41	0.54	0.74	1.09	2.47	4.31
Thickness, mm	2.54	3.05	3.30	3.56	3.81	4.32	5.84	6.60
Tolerance								
Dimension, CF, mm	±1.50	±1.50	±1.80	±1.80	±2.00	±2.00	±2.50	±3.00
Thickness	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%

Notes: (1) All dimensions are in millimeters except where otherwise shown.
(2) Center-to-Face dimensions apply to elbows, tees & crosses
(3) Face-to-Face dimensions apply to couplings, unions, etc.
(4) ME – Male End, FE – Female End, CF – Center-to-Face

A.3. Cast Iron (CI)

A.3.1. Cast iron pipe shall conform to the requirements of AWWA C106 (Cast Iron Pipe Centrifugally Cast in Metal Molds for Water or other Liquids) or AWWA C108 (Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds for Water or other Liquids) and shall be Class 100 or Class 150 where shown in the Drawing; or ISO Recommendation R-13 (Cast Iron Pipes, Special Castings and Cast Iron Parts for Pressure Main Lines) and shall be Class LA, however, the hydrostatic test pressure shall be 2.45MPa (355 psi) for all sizes.

A.3.2. Pipe shall be furnished with bell and spigot ends with rubber "push-on" joints, flange joints, or flexible coupling.

A.3.3. The pipe shall be lined with cement mortar in accordance with the requirements of AWWA C104 (American Standard for Cement-Mortar Lining for Cast-Iron Pipe and Ductile-Iron Pipe and Fittings for Water)

A.3.4. Cast iron fitting shall conform to the requirements of AWWA C110 (American Standard for Cast Iron and Ductile Iron Fittings, 2-in through 48-in., for Water and Other Liquids) or ISO R13 (Cast Iron Pipes, Special Casting and Cast Iron Parts for Pressure Mainlines).

A.3.5. Fittings are manufactured of ductile iron grade 70-50-05 (minimum tensile strength: 70,000psi; minimum yield strength: 50,000; minimum elongation: 5%) as specified in AWWA C110 or C153.

A.3.6. Fittings shall be furnished with mechanical or flanged joints.

A.3.6.1 Mechanical Joints: All mechanical joint fittings will be Bell and Bell unless otherwise specified. Mechanical joint fittings shall be rated for 350 psi working pressure for sizes 4-in – 24-in.

A.3.6.2 Flanges: All flanges are plain without projections and are furnished smooth or with shallow serrations. The flanges shall conform to ISO 7005 – 2. Flanged fittings shall be rated for 250 psi working pressure for sizes 4-in – 64-in.

A.3.6.3 Bolts, Studs and Nuts: Bolts are hex head machine bolts with regular or heavy hex nuts as specified. Studs with one hex nut each are required for tapped flanges. Bolts, studs and nuts are low-carbon steel per ASTM A307 Grade B; threads are ANSI B1.1 Coarse Thread Series, Class 2A external and Class 2B internal. Recommended studs are the same length as corresponding bolt length with "tap end" threaded approximately the same length as flange thickness.

A.3.7. All fittings shall be epoxy coated internally and externally in accordance to AWWA C116 (Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service).

B. VALVES

B.1. Air Release and Air/Vacuum Valves

B.1.1. Air release and air/vacuum valves shall conform to the requirements of AWWA C512 (Air Release, Air/Vacuum and Combination Air Valves for Waterworks Service) or the latest revision or its equivalent.

B.1.2. The body shall be single body type with National Pipe Threaded (NPT) inlet and outlet configurations.

B.1.3. Epoxy lining and coatings for valves shall conform to AWWA C550 (Protective Epoxy Interior Coatings for Valves and Hydrants).

B.2. Check Valves

B.2.1. Check valves shall be resilient seated conforming to AWWA C508 (Swing-check Valves for Waterworks Service 2-in through 24-in (50-mm through 600-mm) NPS) or the latest revision or its equivalent.

B.2.2. The valve shall be designed for a minimum water working pressure of 1.0MPa (150psi).

B.2.3. The valve body and cover shall be cast in Ductile Iron and coated with a thermally applied polymeric coating.

B.2.4. The disc shall be encapsulated in EPDM rubber.

B.2.5. The check valve shall be designed so that the disc and body seat may be easily removed without removing the valve from the line.

B.3. The check valve shall be flanged type conforming to ISO 7005 – 2.

B.4. Gate Valves

Cast Iron (CI)

B.4.1. All valves shall conform to the AWWA Specifications C509 (Standard for Resilient Seated Gate Valves) or the latest revision or its equivalent. Component parts are constructed of heavy, rugged proportions for extra strength to withstand pipe strain and possible shifting in underground service. Gate valves shall be designed for minimum water working pressure of 1.0 MPa (150 psi).

B.4.2. The gate valve shall be flanged and mechanical joint. Flanges and drilling shall conform to ISO 7005 – 2.

B.4.3. All resilient gate valves have a full bore with same nominal diameter as the pipeline. The full bore ensures minimum pressure loss, as the valve does not cause any reduction in the flow path, other great advantages are that the full bore allows drilling and facilitates pipe pigging to ensure high quality potable water.

B.4.4. The ductile iron core is fully vulcanized with EPDM rubber internally and externally. No iron parts are exposed to the medium and the excellent rubber vulcanization prevents creeping corrosion underneath the rubber.

B.4.5. The fixed integral wedge nut reduces the number of moveable valve parts and risk of malfunction.

B.4.6. The valve shall be encapsulated and shall be non-rising stem with a minimum two "O" ring seals (at least one above the stem collar).

B.4.7. The valve shall have 50mm (2 in) square operating nut with cast arrow showing direction in which the nut is to be turned open the valve.

B.4.8. The body and cover bolts and nuts shall meet specifications of ASTM A-307 (rust proofed).

B.4.9. All valve casting to be shot blasted prior to epoxy coating. Epoxy coating shall conform to AWWA C550 (Protective Epoxy Interior Coatings for Valves and Hydrants) specifications. Body and bonnet are coated internally and externally. Layer thickness shall be 250-400 microns on flat and pressurized parts and 150-300 microns on convex outer edge.

Table 3. CI Gate Valve Dimensions

Nominal Pipe Size, in	2	3	4	6	8	10	12
Nominal Diameter, mm	50	75	100	150	200	250	300
Length (Face to Face), mm	178 – 180	203 – 205	221 – 229	267 – 268	292 – 295	330 – 335	356 – 365
Height (above CL), mm	241 – 326	297 – 378	334 – 430	443 – 549	544 – 646	627 – 750	785 – 835
Weight, kg	13 – 18	20 – 23	26 – 33	51 – 53	75 – 83	125 – 133	174 - 193

Brass

B.4.10. Brass valves shall be full port, screwed-in bonnet and non-rising stem.

B.4.11. The valve body, bonnet and solid wedge disc shall be brass conforming to ASTM B584 Alloy C84400-1996 or the latest revision or its equivalent. The minimum pressure rating shall be 125psi saturated steam pressure and 200psi non-shock water, oil or gas.

B.4.12. The valve shall be threaded end conforming to ASME B1.20.1 (NPT)

Table 4. Brass Gate Valve Dimensions

Nominal Pipe Size, in	½	¾	1	1¼	1 ½	2
Nominal Diameter, mm	15	20	25	32	40	50
Length, mm	35 – 43	39 – 45	43 – 54	48 – 61	54 – 63	58 – 72
Height, mm	71 – 72	77 – 84	88 – 98	103 – 116	114 – 125	134 – 153

Handwheel Diameter, mm	54 – 55	54 – 55	60 – 61	72 – 77	72 – 77	80 – 83

C. FIRE HYDRANTS

C.1.1. Fire hydrants heads shall be cast iron body conforming to the requirements of AWWA C503 (Wet-Barrel Fire Hydrants) or the latest revision or its equivalent, with bronze working parts.

C.1.2. Fire hydrants shall be designed for a minimum pressure of 1.0MPa (150 psi) and have a 100mm (4-in) flanged inlet and two (2) 63mm (2½-in) fire hose outlet.

C.1.3. The outlets shall have National Standard Hose Threads with hose caps and chains.

C.1.4. The stem shall be provided with at least two (2) O-rings.

C.1.5. Hydrant valves shall open counter clockwise.

C.1.6. Breakable piece and extension elbow shall be provided.

C.1.7. Epoxy lining and coatings for valves shall conform to AWWA C550 (Protective Epoxy Interior Coatings for Valves and Hydrants).

D. STRAINER

D.1.1. The strainer should be designed for minimum weight and pressure loss.

D.1.2. The screen shall be made of perforated stainless steel plate and shaped to give maximum rigidity against the flow stream forces.

D.1.3. The effective straining area shall be at least double that of the meter main case inlets.

D.1.4. An access cover plate shall be provided.

D.1.5. Strainers shall be furnished with dual round-type flanged connections which are faced and drilled. Bolt circle, length and diameters shall be compatible with meter connection dimensions in conformance to ISO 7005 – 2. Sufficient flange bolts; nuts and gaskets shall be furnished.

D.1.6. The housing and cover shall be cast iron. Raised letters indicating the flow direction will be clearly visible.

D.1.7. Casing bolts, nuts, screws and washers shall be made of a copper alloy containing not less than 57 percent copper or stainless steel.

E. MANHOLE FRAME AND COVER

E.1.1. The manhole frame and cover shall be round manufactured from cast iron or ductile iron conforming to ASTM A-126, Class B or ASTM A-536-80, Class 400 respectively.

E.1.2. The frame depth shall not exceed 200mm and four (4) bolt holes shall be provided for anchoring purposes.

E.1.3. The cover shall be 575mm – 625mm in diameter. The face of the cover shall include the name and/or logo of Calamba Water District. The name/logo shall be cast into the cover during manufacture.

E.1.4. The cover shall be connected to the frame with a hinged. A locking mechanism shall be included to prevent unauthorized access.

E.1.5. The cover shall be one-man operable and shall be designed for a maximum highway loading.

F. CONCRETE

Portland Cement-cement shall conform to the standard specification for concrete.

Aggregates- all aggregates used for concreting shall conform to ASTM-33 and shall be checked daily for any variances in moisture content.

Coarse Aggregates-shall be uniformly and evenly graded for each application in accordance to ACI 318 Unless otherwise approved aggregate shall be sound,crushed, angular grantic stone , smooth or rounded stone(river rock) shall not be acceptable.

Fine aggregates shall consist of natural sand, manufactured sand or a combination thereof.

G. RANDOM TESTING

G.1. For every size, two (2) sample pipes representing each lot of one hundred (100) pieces or less shall be tested for compliance with this specification. Any visible defect or failure to meet the quality standards herein will be grounds for rejecting the entire order.

H. CERTIFICATION

H.1. The manufacturer shall furnish a sworn statement that the inspection, *mill certificate or equivalent*, metallurgical test result (if applicable) and pressure tests have been results thereof comply with the requirements of the applicable Standard(s) herein specified. A copy of the Certification shall be submitted to Calamba Water District.

----------*End of Scope of Works and Specifications*----------