SOUTH MESA WATER COMPANY

STANDARD SPECIFICATIONS

FOR THE FURNISHING OF MATERIALS AND THE
CONSTRUCTION OF WATER FACILITIES
FEBRUARY 1, 2014

SOUTH MESA WATER COMPANY
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SECTION I
GENERAL REQUIREMENTS

1-01 DEFINITIONS

The word “Water Company" shall mean the South Mesa Water Company.

The word "Board" or words "Board of Directors" shall mean the Board of Directors of the Water Company.

The words "General Manager'' shall mean the Manager in charge of operations appointed by the Board of Directors acting directly, or indirectly through his properly authorized agents, engineers, assistants, inspectors and superintendents.

The word "Contractor'' shall mean the person, persons, partnership or corporation duly licensed as such in the State of California to enter into a contract for the performance of the work required.

The word "Applicant" used herein shall mean the person or persons and duly authorized representatives of the party or parties requesting an extension or an addition to the Water Company’s water system.

The word "Plates" shall refer to the Water System Construction Plans that have been prepared by the Applicant's engineer and approved by the Water Company.

1-02 CONDITIONS

On all questions relating to the acceptability of the material, machinery or plant equipment, classifications of material or work, the proper execution, progress or sequence of the work, quantities and the interpretation of the specifications or drawings, the decision of the Water Company shall be final.

The Contractor shall obtain copies of and comply with all applicable current statutes, laws, ordinances, rules, regulations and specifications of the United States Government, the State of California, the applicable Counties of either Riverside or San Bernardino, and any other governmental agencies having jurisdiction and shall make application for all required permits and bear cost of same.

Street cut and trench repair permits for the construction of the domestic water system shall be obtained by the Water Company from the appropriate governmental agencies, prior to construction.

In the event of conflict between the requirements of these Specifications and the Requirements of the permits, the requirements of the permits shall govern.

The Contractor shall furnish to the Water Company copies of all required permits and licenses prior to initiation of the work. Upon completion of the work, the Contractor shall supply to the Water Company, a letter of approval from the governing body having jurisdiction that the Contractor has met the requirements and conditions of the permits or licenses.

1-03 SUPERVISION AND INSPECTION

The General Manager shall decide within the provisions of the specifications all questions which may arise concerning the quality or acceptance of materials furnished and work performed by the Contractor.

1-04 CAL-OSHA SAFETY CODE

All work shall be done in a manner that complies with all CAL-OSHA Title 8 Safety Codes.

1-05 DEFECTIVE WORK OR MATERIALS

No work which is defective in its construction or deficient in any of the requirements of these specifications will be considered as accepted in consequence of the failure of any inspector connected with the work to point out said defects or deficiency during construction. The Contractor shall correct any imperfect work, without compensation from the Water Company, before final acceptance of the work by the Water Company.

1-06 MAINTENANCE OF EXISTING IMPROVEMENTS

Unless otherwise indicated in the plans or in these specifications, or unless otherwise cared for by the owner of a public utility or franchise, all water, gas, oil or irrigation lines, structures or house laterals, in place, and other subsurface structures or lines, shall be maintained by the Contractor and shall not be disturbed, disconnected or damaged by him during the progress of the work. Should the Contractor in the performance of the work disturb, disconnect or damage any of the above, all expenses of whatever nature arising from such disturbance or in the replacement or repair thereof shall be borne of the Contractor.

1-07 PROXIMITY TO SEWERS

If the horizontal separation between parallel sewer and water lines must be less than 10 feet, or if the sewer crosses below the water line with less than one foot of separation, special construction as required by the State Department of Health Services and approved by the Water Company is required.

SECTION 2
MATERIALS

2-01 GENERAL

The Contractor shall furnish and install either PVC or Ductile Iron Pipe only. All material in the pipeline work shall be new and unused. All material in the pipeline work shall be of the selected type of pipe. All materials shall be suitable for 150 psi working pressure unless specified otherwise. All pipelines shall have a detectable locating tape laid with the pipe. The tape shall be highly visible and shall be impervious to alkalis, acids, chemical reagents and solvents found in the soil. The metallic core shall have a minimum overall thickness of 5 mils. Tape shall have imprinted continuously over its length, in permanent ink, a message in the form of "CAUTION WATERLINE BURIED BELOW". Maximum imprint length shall be 36 inches per message. Locating tape shall be a minimum of 3 inches wide.

2-02 PLASTIC (PVC) PRESSURE WATER PIPE & FITTINGS

PVC pipe shall be extruded from 12454 A or B compound providing a hydrostatic design basis (HDB) of 4000 p.s.i. in accordance to AWWA C-900 and C-905. Pipe shall have cast iron outside diameters.

All rubber rings shall be furnished by the pipe manufacturer. These rubber rings (elastomeric gaskets) shall be manufactured to conform with the requirements of ASTM F-477.

AWWA C-900 PVC pipe shall be class 150 and AWWA C-905 PVC pipe shall be rated at 235 p.s.i. (DR-18) or as specified on approved drawings. PVC pipe shall not be installed for working pressures exceeding 150 p.s.i. unless specifically approved by the Water Company.

Fittings for PVC pipe shall be flanged or bolted mechanical joint or push-on joint ductile or gray iron fittings and shall conform to ANSI/AWWA C110/A21.10 or C153/A21.53, and ANSI/AWWA C111/A21.11. All fittings shall be cement mortar lined and tar (seal) coated in accordance with ANSI/AWWA CI04/A21.4.

Restrained Joints shall be provided by a clamping ring and an additional ring designed to seat the bell end of the pipe. The rings shall be connected with T-Head bolts or rods. Restraining devices shall provide full (360 degree) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods. Restraining devices shall meet or exceed the requirements of ASTM F-1674 or UNI-Bell B-13 "Recommended Standard Performance Specification for Joint Restrainers for Use with PVC Pipe." Restraining devices shall be UNI-Flange Series 1300 or 1350 or approved equal.

All buried steel parts shall be sand blasted in accordance with the coating manufacturers technical data sheet for "submerged" service and coated with a two coat epoxy. Epoxy shall be Tnemac Series 66 or equal. All bolts and tie rod materials shall be either high strength cast iron containing a minimum of 0.5% copper or high-strength, low alloy steel, as specified in AWWA C-111 for buried mechanical joints.

All service connections to PVC pressure pipe water main shall be constructed with bronze service saddles with CS threads for receiving a brass corporation stop in accordance with standard drawings. Service saddle shall be Jones, Mueller, or approved equal.

All ductile or gray iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be in accordance with ANSI/AWWA C105.

2-03 DUCTILE IRON (DIP) WATER PIPE & FITTINGS

Ductile iron pipe and fittings shall be cement mortar lined. All pipe joints shall be mechanical or push on type.

Applicable sections of the following standards will apply to ductile iron pipe and fittings:

STANDARD	
AWWA C151	DUCTILE IRON PIPE
AWWA C104	CEMENT MORTAR LINING
AWWA C110	FITTINGS
AWWA C1111	RUBBER GASKET JOINTS

2-04 BUTTERFLY VALVES

Butterfly valves will be acceptable for sizes 12 inches to 20 inches. Butterfly valves shall conform to all requirements of A.W.W.A. C504 for buried service. Valves shall be flanged and provided with 0-ring shaft seals and manual operators with an operator nut to open counterclockwise. The dimensions of the operator nut shall be in accordance with Sec. 3.16, "Wrench Nuts and Hand-wheels" of A.W.W.A. C500. Valves shall be as manufactured by Mueller or approved equal.

2-05 RESILIENT WEDGE GATE VALVES

Resilient Wedge Gate Valves 4 inch through 12 inch nominal pipe size shall conform to all requirements of A.W.W.A. C509-80 or latest revision thereof. Valves shall have non-rising stems, opening by turning counter-clockwise. Valves shall be provided with 0-ring shaft seals and operating nuts and hand-wheels in accordance with the applicable sections of the above referenced standard. Valves shall be manufactured by Mueller or approved equal.

2-06 VALVE BOXES

Valve boxes and caps shall be furnished and installed with all buried valves. The valve boxes shall be of the two piece adjustable type with cast iron caps or as directed by the Water Company. The valve boxes shall have walls not less than 10 gauge and the nominal diameter shall not be less than 8 inches. Valve box caps shall have the word "WATER" cast into them.

2-07 FIRE HYDRANTS (FH)

Fire hydrants shall be of the break-off traffic type and shall conform to A.W.W.A. C502 with 6 inches flanged inlet and 5-1 /2 inch valve opening. Nozzle threads shall be American National Standard. Operating nut shall be 1-1/2 inch National Standard pentagon. The main valve shall be equipped with "O" ring seals and shall open when turned left or counter-clockwise. Fire hydrants shall be painted as specified by the Water Company. Hydrants shall be Mueller or an approved equal and shall be equipped with two 2-1 /2 inch hose nozzles and one 4 inch pump nozzle. The drain plug shall be permanently sealed before installation.

2-08 BLOW-OFF (BO)

The hydrant head on the 4-inch Blow-off assembly shall be a model J-344 by James Jones Company or equal with a 4-inch inlet and 2-1 /2 inch hose connection outlet. The Blow-off assembly shown in Std. Dwg. W-7A or W-7B shall be used at all low points along water mains.

2-09 AIR VACUUM VALVE (AV)

Air valve shall be designed to permit automatic escape of large quantities of air from the pipeline when the line is being filled and permit air to enter the pipeline when the line is being emptied. It shall also allow accumulating air to escape while the line is in operation under pressure. Valves shall be ARI "Heavy Duty" combination air release valves. The size shall be specified on the plans.

2-10 STEEL FLANGES

Steel flanges shall be A.W.W.A. C207, Class D, ring type or blind type as required, sizes as shown.

2-11 GASKETS

Gaskets for flanged joints shall be ring type 1/16 inch thick for pipe 10 inches and smaller and 1/8 inch for larger pipe. Gaskets shall be Johns-Manville Type 60 or approved equal, and shall conform to applicable requirements of A.W.W.A. C207.

2-12 FLEXIBLE COUPLINGS

Flexible couplings shall be Rockwell 411 steel couplings by Rockwell International or approved equal.

2-13 FLANGED COUPLING ADAPTORS

Flanged coupling adaptors between flanged fittings and asbestos cement pipe shall be Rockwell 916 Ring Type FCA. For ductile iron pipe use Rockwell 912 Cast FCA. For steel pipe use Rockwell 913 Steel FCA or approved equal.

2-14 WATER SERVICE LINES

All water service lines 1” and smaller in size shall be Polyethylene Tubing meeting AWWA C-901 specifications. All water service lines 2” to 12” in size shall be PVC C900 CL. 200. All water service lines exceeding 12” in size shall be PVC DR-18 Class pipe. All water service lines regardless of size shall be rated for continuous pressure of 150 psi minimum.

2-15 SADDLES, CORPORATION STOPS, ANGLE METER VALVES

All service saddles, corporation stops, angle meter stops and such appurtenances shall be compatible with material selected and be equal to those manufactured by James Jones Company, Mueller Company, Ford Meter Box Company, Inc. or approved equal.

2-16 METERS

Unless otherwise specified, all meters will be provided by the Water Company at the Applicants expense. All water service meters shall be in accordance with A.W.W.A. C708 Standard for Cold-Water Meters Multi-Jet Type for Customer Service. An affidavit of compliance shall be submitted stating that all meters furnished comply with all applicable requirements of A.W.W.A. C708. Size and quantity shall be as shown on the plans or directed by the Engineer. The main casing shall be of a copper alloy as specified in A.W.W.A. C708. Casing spuds for all meters 1 inch thru 2 inch shall have external ANS pipe threads. Registers shall be straight reading and shall read in cubic feet. The registers shall be the dry type. Meters shall be Precision Meters or approved equal.

2-17 METER BOXES

Residential and commercial meter boxes housing a 1 inch service meter shall be Advanced Engineering Products (AEP) Model 1730 15P2P or equal, (See Std. Dwg. No. W-1). Meter box cover shall be marked “WATER”, in color green. Meter boxes housing service meters larger than 1 inch shall be specified on a case by case basis by the Water Company.

A workmanship and materials warranty shall be furnished requiring the manufacturer to replace without charge, those parts in which defects have developed within 15 years of installation and acceptance.

2-18 CONNECTION WITH EXISTING SYSTEM

All materials necessary to make connections between proposed and existing water systems per details shown on the Plans shall be furnished by the Contractor and shall be of the size and class shown on the accompanying Plans. Items indicated to be salvaged on the Plans but not used on this project are the property of the Water Company.

2-19 WATER MAIN STEEL CASING & JACK & BORED CROSSINGS

General - Work covered by this paragraph includes all pipe, fittings, casing, special appurtenances and materials between the stations indicated on the plans.

Installation - Before starting an excavation, the contractor shall submit drawings of jacking pit bracing, casing (or conduit) and jacking head proposed to be used for approval by the Water Company.

Materials – The Contractor shall comply with all manufacturer recommendations for the approved products. Unless approved by the Water Company, the casing shall be welded steel pipe meeting ASTM 53, Grade B, and have minimum yield strength of 35,000 p.s.i. The exterior of the casing pipe shall be coated with a bituminous asphalt, or approved equivalent.

Welding – Requirements shall be in accordance with ANSI/AWWA C206. Welding procedures shall be required for, at a minimum, longitudinal and girth or special welds for pipe cylinders, casing joint welds, reinforcing plates, and grout coupling connections. Welding shall be performed by skilled welders, welding operators, and tackers who have experience in the type of materials used.

Contractor shall utilize equipment and methods designed to install pipe casing as shown in the Contract Documents. Boring and jacking shall be performed by qualified personnel experienced in this type of work. Selected equipment shall be capable of accurate alignment and grade control, and shall protect against subsidence or other disturbance of ground, existing utilities, structures, and road surfaces. Such approval, however, shall in no way relieve the contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workers experienced in jacking operations shall be used in performing the work.

The leading section conduit shall be equipped with a jacking head securely anchored there to prevent any wobble or variation in alignment during the jacking operation.

The driving ends of the conduit shall be properly protected against spilling and other damage, and intermediate joints shall be similarly protected by the installation of sufficient bearing shims to properly distribute the jacking stresses. Any section of conduit showing signs of failure shall be removed and replaced with a new section of precast conduit, or with a cast-in-place section, which is adequate to carry the loads imposed upon it.

Sluicing and jetting with water is not permitted. Limited use of water for lubrication of drills may be permitted if approved by the Water Company.

Excavation shall not be made in excess of the outer dimensions of the conduit being jacked unless approved by the Design Engineer and authorized by the Water Company. Every effort shall be made to avoid any loss of earth outside the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted.

Once the jacking operation has commenced, it shall be continued un-interrupted round the clock until the conduit has been jacked between the specified limits.

Upon completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting. Grouting equipment and material shall be on the job site before jacking operations and drilling of grout holes are completed in order that grouting around the jacked conduit may be started immediately after the jacking operations have finished.

Should appreciable loss of ground occur during the jack operation, the voids shall be backpacked promptly to the extent practicable with soil cement (slurry) consisting of a slightly moistened mixture of 1 part cement to 5 parts granular material. Where the soil is not suitable for this purpose, the contractor shall import suitable material at his expense.

The soil cement shall be thoroughly mixed and rammed into place as soon as possible after the loss of ground.

Carrier pipe shall be installed as per manufacturer's recommendations and as per approved submittal. Closure of the casing shall be done only after pipeline tests have been completed and approved.

Steel casing pipe shall have a minimum wall thickness one-quarter (3/8) inch wall thickness for pipe 12 inch to 20 inch nominal diameters and a minimum three eighths (1/2) inch wall thickness for pipe sizes up to 36 inch nominal diameter or in accordance with the requirements of the governing agency whichever is greater, and shall be manufactured in accordance with American Water Works Association (A.W.W.A.) Standard C200, latest revision entitled "A.W.W.A. Standard for Steel Water pipe 6 inches and larger''. The casing shall be round and straight, free from protruding bolts, rivets or welds, and shall have an inside diameter of not less than the maximum diameter of the water main plus six (6) inches. The ends of the Steel Casing Pipe to be jacked or bored into place shall be prepared to withstand pressures created by jacking the pipe into place.

2-20 CONCRETE

a) Portland Cement shall conform to ASTM Standard Specification C150, latest revision, entitled "Portland Cement", and shall be Type I or II. Cement in containers that have been broken in shipment or handling, may be used only if approved by the Water Company.

b) Sand shall consist of well-graded, natural or artificially washed and that has clean, hard, strong matter. Sand shall not contain over three (3) percent clay or silt by weight.

c) Coarse Aggregate shall consist of gravel, or a combination of gravel and crushed rock, having clean, hard, tough, durable and uncoated pieces free from injurious amounts of soft, friable, thick, elongated pieces, alkali, oil, organic or other deleterious substances.

Aggregate shall be properly graded, from 1/4 inch to 1/2 inch in size, to secure the required compressive strength concrete.

d) Water shall be clean, free from injurious amounts of oil, acids, organic matter or other injurious substance.

e) Mixing - Concrete required for thrust blocks and other water system items shall be composed of the following relative volumes of materials:

1 cubic foot of cement (1 sack, 94 lbs.)
2 cubic feet of sand (dry, loose)
3 cubic feet of coarse aggregate

Only sufficient water shall be used to produce a concrete with a slump not exceeding 5 inches, as determined by ASTM Standard Method of Test, C143m latest revision. The total volume of sand and coarse aggregate measured separately shall not exceed 6 cubic feet per sack of cement. Concrete shall be placed within 30 minutes of mixing and no re-tampering will be permitted. Batch slips shall be furnished by the Contractor when requested by the Water Company, if Transit Mix Concrete is supplied. Unless otherwise specified, all concrete shall have a 28-day compressive strength of 2,500 psi minimum and shall contain 5.5 sacks of cement per cubic yard of concrete.

2-21 COAL TAR COATING

Coal tar mastic for buried ferrous metal surfaces shall be Kopper's Bitumastic No. 505, Tnemec 46-450, Pasco Pipe Wrap Primer No. 9047 or approved equal.

SECTION 3
EXCAVATION, TRENCHING AND BACKFILL

3-01 GENERAL

The work covered by this portion of the specifications consists of the furnishing of all plants, labor, equipment, appliances, and materials and the performance of all operations in connection with excavation, trenching, and backfilling for water mains and appurtenant structures, in strict accordance with the specifications and the applicable drawings.

In case of conflict in requirements for excavation, trenching and backfilling between these specifications and any statutes, laws, ordinances, rules, regulations and specifications of any

political subdivision or agency having jurisdiction, it shall be understood that the more exacting requirements shall govern. In general, these specifications will apply in Water Company right of ways and easements and the aforementioned statues, laws, ordinances, rules, regulations and specifications of any political subdivision or agency having jurisdiction will apply within the political boundaries or public rights of way to which they apply.

3-02 EXCAVATION

The Contractor shall perform all excavation of every description and whatever substances encountered, to the depths and alignment indicated on the construction drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted by the Contractor at the direction of the Water Company.

Such grading shall be done as necessary to prevent surface water from flowing into trenches or other excavations. The Contractor shall remove, by pumping or other means approved by the Water Company, any water accumulated in the trench from any source.

In accordance with the requirements of Section 6705 of the California Labor Code, the Contractor, prior to beginning any trench or structure excavation in excess of 5 feet deep, shall be in receipt of the Water Company's written acceptance of the Contractor's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation. If such plan varies from the shoring system standards established in the Construction Safety Orders of the State of California, such alternative systems plans shall be prepared by a civil or structural engineer licensed in the State of California.

Unless otherwise indicated, excavation shall be by open trench except that short sections of a trench may be tunneled if, in the opinion of the Water Company, the pipe can be safely and properly installed, backfill can be properly tamped in such tunnel sections, and the requirements for the tunneling can be waived by the State Mining office. Proof of a waiver from the State Mining office must be obtained prior to the contractor commencing his work.

All spoil shall be thrown on one side of the trench only to facilitate distribution and installation of pipe in such a manner that it will not endanger the work and will avoid obstructing roads and driveways. Adequate provisions shall be made for maintaining the flow of water courses, drains, sewers or ditches crossing the trench and, upon completion of the work, they shall be restored to their original condition.

The use of trench digging machinery will be permitted except where its operations will cause damage to trees, buildings or existing structures above or below the ground. At such locations, hand methods shall be employed to avoid such damage. Trees, fences, poles and other property shall be protected unless their removal is authorized. Any property damaged shall be restored to its original condition by the Contractor to the satisfaction of the Water Company.

Minimum cover over the pipe in areas where grade is not shown on the plans shall be forty-two (36) inches. Depth of cover shall be measured from the established street grade or the surface of the permanent improvement to the top of the pipe barrel. In the case of lines outside of the existing or proposed street right-of-way, additional cover may be average natural ground surface. Any deviation shall be subject to approval by the Water Company.

The width of the trench at the top level of the pipe shall be in accordance with the following table:

PIPE SIZE-INCHES	**TRENCH WIDTH-INCHES**	
Inside Diameter	**Minimum**	**Maximum**
4	20	28
6	22	32
8	24	32
10	26	36
12	30	36
14	32	42
16	34	42

The Contractor shall maintain a minimum clearance of seven (7) inches for pipe sizes four (4) inches through ten (10) inches in diameter and eight (8) inches for pipe sizes twelve (12) inches through sixteen (16) inches in diameter. The clearance shall be on each side of the pipe between the trench wall and the outside surface of the pipe barrel as measured at the horizontal centerline of the pipeline.

Where the bottom of the trench is in rock or hard materials, the trench shall be excavated six (6) inches below grade. Where the trench has been excavated below grade for any purpose, the trench shall be refilled to the proper trench grade with selected backfill material compacted to (90) percent of its maximum density as determined by ASTM 1556 and D 1557.

Excavation behind all fittings requiring thrust blocks shall not be machine dug, but shall be hand dug to keep the trench wall solid and undisturbed.

The Contractor shall at his own expense provide his own monuments and necessary survey work to indicate at the site of the work the alignment and grade for the pipelines to be laid in accordance with the Plans and such grade shall be uniform. No high or low points in the line shall be permitted except as shown on the Plans or to conform to the general grade of the street or contour of the terrain through which the pipe is to be laid. No deviation shall be made from the required line or grade except with the written consent of the Water Company. In event a "High Point" is created at locations other than shown on the Plans or as directed by the District, air and vacuum release valves of suitable capacity shall be installed, at no expense to the Water Company, to permit air to be released from or taken into the pipeline at said "High Point". Drainage assemblies shall be installed at low points at no expense to the Water Company.

In event blasting is necessary for excavation, the Contractor's method and procedure shall conform to all applicable laws and regulations of the State, County and/or Local authority and shall require prior approval of the Water Company.

All excavations shall be kept free of water while concrete or pipe is being placed and until concrete has attained its initial set to eliminate any possible damages from such water. The Contractor shall furnish, install and operate all necessary machinery, appliances, and equipment to keep excavations sufficiently free from water from any source during construction of the work to permit proper pipe laying and jointing and shall dispose of water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public.

Where ground water control is necessary, the contractor shall submit a dewatering method to be approved by the Water Company.

3-03 BACKFILL

a) General - Backfilling of the trench around the pipe and excavation around appurtenances shall follow the installation as closely as possible. Backfill shall be accomplished in two stages; (1) initial backfill from proper trench grade to twelve (12) inches over the pipe; (2) Final backfill from twelve (12) inches over the pipe to the surface.

b) Initial Backfill - Initial backfill should be accomplished as soon as possible after the pipe has been laid. The backfill material shall be approved by the Water Company and shall contain no particles larger than one (1) inch or other objectionable material. The material shall be sufficiently damp to permit thorough compaction on all sides of the pipe and free from voids. Initial backfill shall consist of placing the backfill from proper

trench grade to an elevation of twelve (12) inches over the top of pipe by the following procedures:

The first lift of material shall be uniformly placed on both sides of the pipeline for the full width of the trench and have a maximum loose depth of not more than six (6) inches as measured from the trench bottom. This material shall then be tamped under and around the pipe and joints until all voids underneath and around the pipe and joints have been filled.

After the voids beneath the pipe have been filled, the material between the trench walls and the pipe shall be compacted, with each layer firmly compacted, prior to placing the subsequent material, until the material has reached a minimum depth of the horizontal centerline of the pipe line to a depth of twelve (12) inches over the pipe lines, the backfill material shall be placed in horizontal layers not exceeding eight (8) inches in depth and properly compacted by tamping.

Flooding of the initial backfill may be permitted with prior approval of the Water Company. Flooding of the initial backfill will be permitted when the material contains no rocks larger than one (1) inch and has a sand equivalent value of not less than 30 as determined by Test Method No. 217 of the California Division of Highways.

c) Alternate - Initial backfill shall consist of placing saturated sand approved by the Water Company, from either onsite or off-site sources, from proper trench grade to a compacted elevation of twelve (12) inches above the top of the pipe. The sand shall be properly saturated before placement in the trench. This material may be placed in one lift provided adequate rodding or vibrating during placement is performed to assure filling of all voids under and around the pipe. Care should be taken to avoid floating of pipe in all cases. This method of initial backfill shall be used only when the native material in the trench permits adequate drainage and is suitable in the opinion of the Water Company. There shall be no free water standing on the surface of the initial backfill at the time final backfill is placed.

d) Final Backfill - The balance of backfill shall contain no particles larger than six (6) inches in its greatest dimension or such smaller dimensions as specified by the governing body having jurisdiction and shall be free from brush or any other perishable or objectionable matter than would prevent proper compaction, consolidation or that might cause subsequent settlement. Backfill in easements not subject to vehicular traffic shall be compacted to a minimum of 85 percent of maximum density as determined by ASTM D1556 and D1557. In roadways, shoulders, driveways, etc. which are subject to

vehicular traffic the backfill shall be compacted to a minimum of 90 percent of maximum density. Compaction within existing or proposed streets shall also meet any higher standard of the governing authority.

Flooding and/or jetting of the material to accomplish compaction will not be permitted without prior authorization by the Water Company. For trenches eight (8) feet in depth or less, the final backfill may be placed in compacted lifts of twenty-four (24) inches, or one half (1/2) of the trench depth, whichever is the greater depth. For trenches greater than eight (8) feet in depth, the material shall be placed in maximum compacted lifts of four (4) feet. The depth of fill lifts in trenches on slopes may be reduced by the Engineer to facilitate compaction.

Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be supplied by the Contractor. Surplus spoil shall be crowned over the trench, spread or hauled away as directed by the Water Company.

Backfill within traveled streets or highways, existing or proposed, shall meet the standards and approval of the agency having jurisdiction over same.

Trenches improperly backfilled, or where settlement occurs shall be reopened to the depth required for proper compaction, then backfilled and compacted, with the surface restored to the required grade.

Where flooding and/or jetting has been approved by the Water Company, backfill shall be thoroughly consolidated by use of water jets. The Contractor shall use water jets of at least one and one-quarter (1-1 /4) inches in diameter and of sufficient length to extend to within one foot of the top of the pipe.

Where water is not readily available in sufficient quantity and pressure, the backfill may be flooded by the following method. The water shall be allowed to flow slowly into the trench from the upper end, and shall be worked down to the bottom of the trench by "poling". Care shall be taken to insure that water does not flow through the trench before it has penetrated down to the pipe line.

3-04 PAVEMENT REPLACEMENT

When it is necessary to break pavement in order to lay the pipe lines shown on the construction drawings, the existing pavement shall be cut vertically as nearly as possible to a straight line by

an approved method. The pavement so removed shall be hauled away as directed by the Water Company and shall be replaced with like material. All pavement removal and replacement shall conform to Std. Dwg. No. W-16, and specifications of the governing body having jurisdiction and shall meet with their approval. The Contractor shall be responsible for removing and replacing all necessary pavement.

SECTION 4
INSTALLATION

4-01 GENERAL

All foreign matter and dirt shall be removed from the interior of the pipe prior to its installation. Before lowering, the pipe shall be inspected for defects. Any defective, damaged, or unsound pipe shall be rejected. The entire joint including coupling, machined sections of the pipe and the rubber gasket or ring shall be thoroughly cleaned at the time the joint is made. The entire procedure and method of installation of the pipe and making joints shall be done in a workmanlike manner and shall be in strict accordance with the pipe manufacturer's direction and recommendations.

All pipe shall be laid according to the size, class, location and grade shown on the Plan. The faces of all spigot ends and all shoulders in the hubs or sockets must be true and brought into firm contact. Rubber ring installation shall be checked with suitable gauges to insure that they are located in the proper position relative to the pipe ends.

When pipe laying is not in progress the unfinished end of the pipe shall be securely closed with a suitable water tight plug or cover to prevent the entrance of animals or foreign matter into the line.

The Contractor shall take all necessary care and precautions to prevent the pipe from floating due to water entering the trench from any source. The Contractor shall be responsible for damage caused by floating pipe and shall, at his sole expense, restore and replace the pipe to its proper condition, alignment and grade.

Where pipe is laid on a curve or at horizontal or vertical angles in the trench, the maximum deflection at the joint shall not exceed sixty (60) percent of the limitations specified by the pipe manufacturer and each joint shall be adequately blocked to take the thrust until properly backfilled.

Location tape shall be installed over all pipelines. The tape shall be securely attached to each valve box and shall be continuous between adjacent valves. The tape shall be installed 12"

below the finish grade, and in the case of two pipes in a single trench the tape shall be installed at midpoint between the pipes.

4-02 HAULING AND UNLOADING PIPE

During loading, transportation and unloading, every precaution shall be taken to prevent injury to the pipe, its lining and its coating. None of the pipe shall be dropped from cars or trucks nor allowed to roll down skids without proper restraining ropes. Each pipe shall rest upon suitable pads, strips or blocks during transportation and while awaiting installation in the field, and shall be securely wedged or tied in place. Padding shall be used on all car stakes, skids and other material to prevent damage of the coating during transportation and handling.

Where necessary to move the pipe longitudinally along the trench, it will be done in such a manner as not to injure the pipe or its coating. Pipe shall not be rolled or dragged on the ground.

Where pipe is placed in stock piles, it shall be neatly piled and blocked with strips between tiers.

4-03 PROTECTION OF WORK AND MATERIALS

The Contractor shall at all times take care to protect and preserve all materials to be used in the laying of the pipe. The pipe shall be handled in such a manner as not to injure its shape. All pipe and materials which, in the opinion of the Water Company, have been damaged shall be replaced by the Contractor at his own expense.

The Contractor shall be responsible for the safe storage of all material furnished by him until it has been incorporated in the completed project. All material damaged or broken by the Contractor, shall be replaced in exact type and kind by the Contractor at his expense. All materials received by the Contractor and not used shall be removed by the Contractor at his expense.

4-04 HANDLING OF PIPE AND ACCESSORIES

Pipe and accessories shall be loaded at the point of delivery, hauled to, and distributed at the site of the project by the Contractor at his expense. They shall at all times be handled with care to avoid damage. Whether moved by hand, skyways or hoists, material shall not be dropped or bumped against pipe or accessories already on the ground or against any other object on the ground.

In distributing material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

Pipe shall be handled in such a manner as to avoid damage to machined or special ends. When such damage cannot be repaired to the Water Company's satisfaction they shall be replaced by the Contractor at his expense.

The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times.

All pipe, fittings and accessories shall be carefully lowered into the trench in a workmanlike manner, using proper tools and equipment. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

4-05 INSTALLATION OF PVC MAINS

All pipe shall be tested in the United States in accordance with AWWA C900 and C-905 and certification of the testing shall be furnished to the Water Company and Design Engineer upon his request prior to delivery. The Water Company and Design Engineer may be present during physical testing of pipe.

4-06 INSTALLATION OF DUCTILE IRON PIPE

The ductile iron water mains shall be laid and the work incidental thereto performed in accordance with applicable requirements of A.W.W.A. C600 "Standards for Installation of Cast Iron Water Mains."

All pipe shall be carefully inspected for defects before installation. Such inspection shall include light tapping with a hammer while the pipe is suspended in the air. No pipe or fitting which is cracked or which shows defects excluded by the Specifications for such fittings shall be used. Any injuries to the protective coating of the pipe or fittings shall be carefully repaired by the Contractor with coat tar pitch varnish. The pipes, valves, and fittings shall be carefully cleaned immediately before installation. Every open end of a pipe shall be carefully plugged or capped before leaving the work.

4-07 FIRE HYDRANT ASSEMBLY INSTALLATION

Fire hydrants shall be installed by the Contractor at the locations shown on the accompanying Plans in accordance with details show on Std. Dwg. W-6 herein, and positioned to provide

complete accessibility and to minimize the possibility of damage from vehicles or injury to pedestrians. The size and type of hydrant shall correspond to the designation shown on the Plans. The entire hydrant assembly shall be plumb. Nozzles shall be at right angles to the street or as directed by the Water Company. The hydrant shall be located so that the centerline of the riser or barrel is approximately twenty-four (24) inches in back of the curb face or face of berm or the edge of the street pavement unless otherwise directed.

The Contractor shall provide and install all necessary fire hydrant bury extensions to permit installation of the hydrant assembly to proper grade. The Contractor shall be responsible for determining proper grade.

The Contractor shall make certain that the automatic drain openings of the fire hydrant are satisfactorily plugged before installation.

Upon completion of the water main installation and after the field tests have been performed, each fire hydrant shall be operated by the Contractor in the presence of the Water Company representative. Operation shall consist of opening the fire hydrant assembly and allowing water to flow freely from one or more of its outlets. Upon completion of this sequence, the fire hydrants shall be turned off and all protective caps properly placed on each outlet.

4-08 VALVE INSTALLATION

Valves shall be installed at the locations shown on the Plans and shall correspond to the size and types of ends shown on the plans. All valves shall be equipped with a valve box and cap.

The cutting of pipe for inserting into the bells of valves shall be done in a neat and workmanlike manner without damage to the pipe, its coating or lining and in accordance with the manufacturer's instructions.

Except as directed by the Water Company, the Contractor shall not operate gate valves without a Water Company representative present. During the course of water main installation, all valves shall be left completely open or completely closed unless otherwise authorized by the Water Company. Upon completion of the water mains and all appurtenances, all valves shall be operated through a complete open and closed cycle by the Contractor in the presence of the Water Company representative. After completion of this operational cycle, all valves shall be left in an OPEN position unless directed otherwise by the Water Company.

4-09 VALVE BOX AND CAPS

Valve boxes and caps to be installed in proposed pavement areas of presently unpaved street rights-of-way shall be installed ten (10) inches below finished grade of street or such greater depth as determined by the Water Company. The Contractor shall be responsible for future location of all valve boxes and caps until completion of paving. At least two properly designed witness markers shall be provided and installed by the Contractor to aid future location of valve boxes and caps.

When installed in paved areas, the valve cap shall be installed with its top one-quarter (1/4) inch above finished grade, and feathered into the existing pavement.

4-10 BLOW-OFF ASSEMBLY INSTALLATION

Blow-offs shall be installed by the Contractor at the locations shown on the plans and in accordance with the details shown on Std. Dwg. W-7A & B herein. The entire assembly shall be plumb with nozzles at right angles to the street or as directed by the Water Company.

Blow-offs shall be located to provide complete accessibility and to minimize the possibility of damage from vehicles or injury to pedestrians.

Upon completion of the water main and system installation, each Blow-off shall be operated by the contractor in the presence of the Water Company representative. Operation shall consist of opening the hydrant head on the assembly and allowing water to flow freely from its outlet. Upon completion of this sequence, the Blow-off assembly shall be turned off and all protection caps properly placed on the outlet.

4-11 AIR AND VACUUM ASSEMBLY

Air and vacuum assemblies shall be installed at the locations indicated on the Plans at sites adjacent to the roadway or on back lot lines as selected by the Water Company. They shall be completely accessible and protected from possible damage from vehicles or equipment. The assemblies shall be installed in accordance with details shown on Std. Dwg. W-8A & B herein, in a workmanlike manner and in accordance with accepted water works standards. Pipe joints shall be assembled in a proper manner to assure that they are free of leaks.

4-12 SERVICE INSTALLATION

Service connections shall be installed at the locations designated by the Water Company and per details shown on the Plans and in accordance with details show on Std. Dwg. W-4 and W-5 herein. Service stubs shall be installed in a like manner and in accordance with accepted water works standards, with a minimum cover of thirty (30) inches.

4-13 CONCRETE ENCASEMENTS

Concrete encasement shall be installed in a manner to completely surround the pipe barrel at all water course crossings to provide protection from flood flows and eliminate possible water infiltration. The entire procedure shall be in accordance with the pipe manufacturer's recommendations, and Standard Drawing No. W-15 as approved by the Water Company.

4-14 THRUST BLOCKS

Concrete thrust blocks shall be installed at all dead ends, tees, elbows, bends, crosses, blow-offs, drains and fire hydrants shown on the Plans. The thrust blocks shall be adequate in size to provide for a test pressure on the size of pipe under consideration per Std. Dwg. W-17.

Thrust blocks shall be constructed of concrete between the fitting of pipe and the trench wall. The concrete shall be placed so that it extends to the trench wall in a manner that enables the entire bearing area to be in contact with undisturbed freshly cut material.

Concrete shall be kept behind the bell of the fitting and shall not be permitted to run against the pipe. Concrete shall be kept clear of all bolts on flanged fittings to enable proper future removal of all such belts.

4-15 FLANGED FITTINGS AND CONNECTIONS

All Flanged valves and fittings shall be properly positioned and aligned in the trench in such a manner as to relieve any stress or strain on the connecting pipe or flanged and being fitted, with the pipe system resting in its final position and all fittings and valves plumb. Welding, if required, shall be made in the trench bottom, except where otherwise approved by the Water Company.

4-16 FLEXIBLE COUPLINGS WITH TIE DETAILS

Where flexible couplings are installed in steel water lines the coupling may be provided with tie rods in lieu of thrust blocks for short runs.

4-17 CONNECTION WITH EXISTING SYSTEM

Connections with the existing system will be made by the Water Company or approved licensed contractor at the locations indicated on the Plans per details shown on the Plans. All material necessary for making the system connections shall be furnished by the Contractor.

The outlet of the system connection will be flanged gate valve equipped with a blind flange. The Contractor shall remove and salvage the blind flange and make the pipe extension at the direction of the Water Company.

4-18 BAFFLES

When the natural slope of a traveled roadway or access roads is greater than 15%, baffles shall be installed at the top of the trench. These baffles shall be constructed of a 2" x 12" redwood plank set on edge at the top of the trench. The plank shall be two (2) to three (3) feet wider than the trench and shall be held in place by 2" x 4" redwood stakes driven into the natural ground on the downhill side of the baffle. These stakes shall be driven a minimum of two (2) feet into solid ground. The top of the baffle shall be set two (2) to three (3) inches above the surface of the adjacent ground and the trench backfill shall be increased so as to be flush with the top of the baffles throughout the area in which they are installed. Baffles shall start at the top of the slope with spacing based on the following schedule:

SLOPE GRADIENT	**BAFFLE SPACING**
15%	20 Feet
20% (5:1)	15 Feet
25% (4:1)	12 Feet
33% (3:1)	9 Feet
50% (2:1)	7 Feet
67% (1-1/2:1)	5 Feet

4-19 DISINFECTION

During the laying of the pipelines covered by these specifications, they shall be carefully protected against contamination, and all dirt and foreign material shall be removed. Before

being placed in service, the lines shall be thoroughly flushed out and then disinfected by the Contractor in accordance with A.W.W.A. C601 , "Standards for Disinfecting Water Mains". All necessary chlorine shall be furnished by the Contractor. The main shall be thoroughly flushed before and after chlorination. If the first application of chlorine is sufficient to clear the mains of coliform bacteria, the procedure shall be repeated until the water will meet the bacteriological drinking water standards of Riverside and San Bernardino County's Health Departments and the State Department of Health Services. The Water Company will take samples for bacteriological testing. Tests that indicate acceptable disinfection will be at the Water Company's expense. Any tests that fail will be at the Contractor's expense.

SECTION 5
FIELD TESTS

5-01 GENERAL

After the pipe has been laid, backfilled and compacted, all laid pipe shall be given a pressure and leakage test. The test section should be tested with proper bulkheads rather than against a "closed" valve to preclude the problems associated with leaking valves. In no case shall a section of pipe which is connected to a potable system, be pressurized until that entire section has been disinfected and satisfactory bacteriological test results have been received by the Water Company.

Before conducting the field tests, the pipe shall be completely filled with water, and all free air shall be expelled from the line. Any additional taps, valves or blow-offs needed to assure all air is expelled shall be provided by the Contractor. Water to be used to fill the pipelines will be furnished to the Contractor by the Water Company. The Contractor shall provide his own pumps and other equipment to properly fill the line with water and produce the required test pressures. The required pressures shall be measured at the point of lowest elevation in the line to be tested.

Should any test of a section of pipeline disclose joint leakage, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the permitted allowance. The pipe shall then be retested by the contractor at his expense.

All thrust blocks forming a permanent part of the line to be tested shall be installed in ample time prior to the test to enable the concrete to properly set. The test end of the pipe shall be adequately braced to withstand the pressures that will result during the test.

The Water Company will not accept the pipeline until backfill and pavement operations are complete, all gate valve boxes are raised to proper grade and until the pipelines are probed free

from running leaks and other defects to the satisfaction of the Water Company. The acceptance of the dedication of the water system by the Water Company of the completed work as herein specified is a subject to the written guarantee of the Contractor that any defects, excessive settlement of backfill and/or running leaks in such pipelines arising from defective workmanship or by any negligence of the contractor which may develop within one (1) year from such acceptance, shall be repaired and made good by said Contractor in accordance with the provisions of Section 6 entitled "Guarantee".

5-02 PRESSURE TESTS

The pressure test shall be performed with a Water Company approved pressure gauge prior to conducting the leakage tests set forth in 5.03 herein. The pressure test shall consist of maintaining a pressure of one hundred seventy five (175) pounds per square inch continuously for a period of at least two (2) hours.

5-03 LEAKAGE TESTS

The leakage test shall be conducted after completion of the pressure test prescribed in 5-02 above. The test pressure shall not drop below one hundred fifty (150) pounds per square inch (psi) and shall be maintained for at least four (4) hours. The leakage shall be measured by determining the quantity of water required to maintain the test pressure. Regardless of the rate of leakage, all visible leaks shall be stopped.

Unless another method is approved, measurement of leakage shall be by positive displacement measurement of water pumped out of an open container after the pipeline test pressure has been obtained and stabilized or through the use of the Water Company supplied meter. The container shall be of a size and shape to allow simple and accurate determination of capacity and change in volume.

No pipe installation will be accepted for dedication by the Water Company until or unless the leakage for the section of line tested is less that the rate of leakage specified herein.

The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula: $L = ND (P) (0.5) / 7400$

L = Allowable leakage, gallons/hour
N = No. of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, psi

5-04 COMPACTION TESTS

Compaction tests of the trench backfill is required approximately every 250 feet, or more often if tests indicate the need, along the alignment of the main pipeline. In addition, approximately 20 percent of all laterals within the street right-of-way shall be tested. Location of tests will be determined by the General Manager. Additional tests may be required at the Water Company's discretion. The tests shall be made at varying depth. Compaction tests which meet the specified requirements shall be made at the Water Company's expense through an approved soil testing laboratory. All compaction tests which do not meet the specified requirements shall be at the Contractor's expense without any compensation therefore. Any additional requirements of governing bodies having jurisdiction must be met. If the work is done under a permit, the Contractor shall obtain written confirmation that the work is acceptable to the governing body having jurisdiction.