9.01 WATER MAINS AND APPURTENANCES

9.01.01 Description of Work

The work to be done under this contract consists of construction of installation of ductile cast iron pipe water mains with appurtenances. The Contractor shall furnish all of the labor, materials, equipment and tools to do all of the work required in excavating, hauling and laying of pipe and special castings, setting valves, valve boxes and hydrants; constructing valve chambers; backfilling all trenches, tunnels, and holes; reconstructing parts of pavements, curbs, sidewalks, ditches, outlawns, sewers, drains and other utilities removed or damaged during construction of the water main; removing and disposing of all surplus excavation. All such items of work are to be done in accordance with the plans and specifications.

9.01.02 Materials

The Contractor shall furnish all water line materials including pipe, fittings, valves, hydrants, valve boxes, joint accessories and joint lubricant. All materials including pipe, fittings, valves, hydrants, valve boxes and joint accessories shall be manufactured in North America.

The Contractor shall furnish all miscellaneous materials such as concrete, reinforcing steel, and other necessary materials to the installation of the water main. The cost of all materials to be furnished by the Contractor are to be included in the Contract unit prices. Unless otherwise noted, materials shall meet the following requirements:

Pipe - Class 50 Ductile Iron Pipe in full accordance with A.S.A. A21.51-02 or AWWA C151, with ANSI/AWWA C104/A21.4-95 standard thickness cement mortar lining and push-on joint. All flanged pipe shall conform with C115/A21.15-99.

Fittings - To be either cast or ductile iron, mechanical joint in accordance with ASA 21.10-98 or AWWA C110, with ANSI/AWWA C104/A21.4-95 standard thickness cement mortar lining suitable for use with class 50 Ductile Iron Pipe.

Gaskets – All Rubber Gasket Joints shall conform to AWWA C111/A21.11-00.

Mechanical Joint Gate Valves - To be AWWA C509-01 or AWWA C515 standard for resilient seated gate valves. All valves shall open to the left, have a 2" square operating nut and be the NRS type O-ring stem seals as manufactured by American, Clow, Kennedy, and Waterous. All valves shall be assembled with stainless steel bolts and nuts.

Mechanical Joint Butterfly Valves - To be AWWA-C504-00. All valves shall open to the left, have a 2" square operating nut, have corrosion resistant discs, Type 304 SS shaft full length through disc, Buna-N rubber seats with a minimum 30 turns from the open to closed position, suitable for direct burial and of the short body style, as manufactured by the Henry N. Pratt Company or equal. All valves shall be assembled with stainless steel bolts and nuts.

Valve Boxes - To be 3 piece, Size "D", 5 1/4" shaft-screw type with lids marked "WATER", as manufactured by TCIW, EJIW, Central Foundry, or equal.

9.01.02 Materials (Cont'd.)

Fire Hydrants - Shall conform to AWWA-C502-94, for 5 1/2' bury length, 6" flange pipe inlet, shall have 1" square operating nut (tapered) for opening left, minimum 5¼" valve openings, shall have two (2) - 2 1/2" hose nozzles (National Standard Thread) and one (1) - 4 1/2" pumper connection (National Standard Thread). Hydrants shall have the upper barrel painted red and the port caps painted white with heavy duty exterior enamel. All fire hydrants shall be non-drain traffic model variety.

Water Services– Services and Service Valves shall conform with AWWA C800-01.To be Type K copper or HDPE SIDR-7 meeting AWWA C901-96 with min. 160 PSI. Fittings for services shall conform with AWWA C153/A21.53-00.

Sampling/Chlorinating Lines--

Polyethylene Encasement – Polyethylene encasement shall conform to AWWA C105. Film shall be Class "C", black with a nominal thickness of 8 mils, minimum tensile strength of 1200 PSI, elongation of 300%, and dielectric strength of 800 V/mil thickness. Tape for securing the film shall be a thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, bituminous coating and polyethylene. Tape shall have a minimum thickness of 8 mils and a minimum width of 1".

Blow-off Assemblies – Fittings shall conform to AWWA C800-01 consisting of 2" Type K copper. Temporary blow-offs shall be a minimum 2' above grade with a 90º male iron pipe thread fitting. Permanent blow-offs shall be 2" male iron pipe thread straight coupling set in a Ford Double Lid Cover meter box with standard size pentagon bolt or equivalent and installed flush with a lawn or cement surface. All fittings shall conform with AWWA C153/A21.53-00. All blow-off assemblies shall become property of the City of Midland Water Department.

In the interest of system uniformity, the hydrants shall be limited to one of the following types:

1. Waterous Pacer
2. Mueller - Centurion
3. East Jordan - 5-BR

Water Main pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such material be dropped. Pipe handled on skid ways shall not be skidded or rolled against pipe already on the ground. In distributing the material at the site of work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be handled so that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

9.01.03 Excavation

The excavation for the water main shall be done in open trench or in tunnel as herein specified, as shown on plans. All work shall be done to true line and grade as established on the plans, and the line and grade stakes set by the Engineer. The Contractor must

9.01.03 Excavation (Cont'd.)

protect the line and grade stakes and be held responsible for any defective work occasioned by his negligence in this regard. The Contractor shall remove all rubbish and

encumbrances which may be in the proposed line of the water main and the cost for doing said work shall be understood as being included in the contract unit price per lineal foot, for laying water main.

A trench width of not less than 20 inches or more than 26 inches shall be excavated for laying six inch, eight inch, ten inch, or twelve inch pipe. For larger sizes of pipe the trench width shall be not less than one and one-half times the diameter of the pipe to be laid. Bell holes shall be excavated at each joint.

Rock or stones found in the bottom of the trench shall be removed for a depth of at least six inches below the bottom of the pipe and the holes thus created and all other irregularities in the trench bottom shall be filled to grade with sand before the pipe is laid and the cost of doing such work is understood as being included in the contract unit price per lineal foot for constructing water main.

All new water main piping shall be placed on 4 inches of sand bedding.

All sheeting and bracing necessary, in tunneling or for supporting the sides of the trench and shafts, shall be furnished by the Contractor. Said sheeting and bracing shall be removed by him as the work progresses, and the space occupied by the sheeting filled solid with earth, sand or concrete as directed by the Engineer. When ordered in writing by the Engineer, that sheeting is to remain in place, it shall be estimated and paid for as an extra at the price agreed upon.

The Contractor shall at his own expense pump out or otherwise remove any water which may gather in the trenches or tunnels, and shall form all dams, cofferdams or other works necessary for keeping the excavated trenches or tunnels clear of water during the progress of the work. In case of quicksand or other bad and treacherous ground the work shall proceed day and night without intermission, if the Engineer so directs.

In excavating for open trench in parks, parkways and lawns. If suitable sod is in place, the Contractor shall remove and store to be replaced over and along the trench work, to a proper condition. Otherwise four inches of topsoil loam shall be placed over excavation.

Whenever the water main crosses the street, permanent sidewalks, crosswalks, or pavements, work shall be performed in tunnel, unless otherwise stated on plans, without disturbing the surface or structure. Whenever it becomes necessary to remove sidewalks, cross-walks, approaches, curb and gutters, sewer basins, sewer connections or any fixed or permanent improvements shown on the plans, the Contractor shall be required to replace same with new materials to the satisfaction and acceptance of the Engineer; and the cost of doing said work shall be understood as being included in the contract unit price per lineal foot, for laying water main.

When and where portions of the pavement have been disturbed or removed by the Contractor as required under these specifications, the Contractor shall relay the same in accordance with standard specifications for Street Improvement of the City of Midland.

9.01.03 Excavation (Cont'd.)

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade or arrange with the owners of the Structures for the removal, relocation or reconstruction of the obstructions. If the change in plans result in a change in the amount of work by the Contractor, such altered work shall be done on the basis of payment to the Contractor for extra work or credit to the City for less work.

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of existing underground structures, the Contractor shall make explorations and excavations for such purposes. If the Contractor is required to perform additional work in making the explorations and excavations, extra compensation will be allowed for such additional work.

9.01.04 Turning On or Off Valves and Hydrants

No valve or other control on the existing system shall be operated for any purpose by the Contractor. The city will operate all valves, hydrants, and curb stops.

9.01.05 Laying Pipe

Installation of pipe and appurtenances shall be completed in conformance to AWWA C600-99. After the trench or tunnel has been excavated and the bottom has been graded and prepared, the pipe shall be carefully laid making sure that at least two thirds of the length of the body of the pipe is resting firmly on the prepared grade. Blocking under the pipe shall not be permitted. The interior of all pipe and special castings must be thoroughly cleaned by brushing, swabbing or washing out all dirt before laying. Pipe shall be laid with bell ends facing in the direction of laying. The inside of the bell and the outside of the spigot end shall be cleaned of foreign matter.

A thin film of gasket lubricant shall be applied to the spigot end of the pipe. Gasket lubricant shall be supplied by the pipe manufacturer or approved by the Engineer. All branches or other openings shall be stopped up with wooden plugs or heads until either capped or connected. The Contractor shall take every effort to prevent ground water or other forms of contamination from entering the pipe.

Polyethylene wrap shall be provided and installed as part of the water main installation. The wrap shall be 8 mil thick Class "C" (black) polyethylene conforming to AWWA standard specification for Polyethylene Encasement for Ductile Iron Pipe, AWWA C105/A21.5-99. The wrap shall overlap the joint by 12" to either side and be secured to the pipe with polyethylene adhesive tape. All piping and fittings shall be wrapped and taped.

9.01.05 Laying Pipe (Cont'd.)

The purpose of the polyethylene wrap is to isolate the pipe from contact with corrosive environments and no attempt is made for complete sealing to prevent ground water intrusion. The standard backfilling procedure specified in 9.01.15 will provide adequate protection for the polyethylene wrap. The cost for the wrap shall be considered incidental to the unit price bid per lineal foot of water main.

When extending water mains, a 1" corporation shall be tapped into new water main within the first 6 feet of new main. When ending water mains, a 1" corporation with 1" copper line extending 1 foot above ground elevation shall be tapped into new water main within the last six feet of new main. All water mains shall end with a valve and mechanical joint plug, which shall have a 2" blow-off assembly. All blow-off assemblies shall become property of the City of Midland Water Department. 1" copper sampling lines shall be installed every 1000 feet on all new water mains for chlorination and sampling. Following pressure testing and disinfection, the Contractor shall remove all sample lines and plug the corporation with a copper disk.

When extending water mains, the Contractor shall install a polyurethane foam pig at the beginning of the new main for the purpose of cleaning items from inside the pipe and for removing air during the filling process.. To ensure sanitary conditions the polyurethane pigs must be new and unused. Pigs shall be identified by a number in a way that identification can be made upon exit of the swab from pipe. The position and number of the polyurethane foam pig shall be noted on the project's print and a copy sent to City of Midland Water Distribution Department. Foam pigs shall become property of the City of Midland Water Department. All fittings used to flush and remove the pig from the pipe shall be restrained.

9.01.06 Hydrants, Valves and Special Fittings

All hydrants, valves, gate valves, Tee's, curves, crosses and connections are to be laid as shown on plans, and as directed. All hydrants leads shall be constructed of D.I. pipe and shall be paid for at contract unit price for six inch D.I. pipe. All bolts and nuts used to assemble valves shall be stainless steel. All hydrants shall be wrapped with black plastic until put into service by the City of Midland. All hydrant leads, valves, gate valves, Tee's, curves, crosses and connections are to be wrapped in polyethylene plastic to grade.

9.01.07 Special and Connecting Mains

Special castings, all valves, all hydrants leads and accessories and all connections to other mains shall be placed at the location shown on the plans. The contract unit price, per lineal foot, for laying water main shall be understood to include the cost of furnishing and laying all special castings and connections to other mains and the testing thereof.

9.01.08 Valves and Water Mains

Valves and water mains shall, where possible, be located on the street property lines extended unless shown otherwise on the plans. A valve box or masonry pit shall be provided for every valve. A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a cast iron grease case.

9.01.08 Valves and Water Mains (Cont'd.)

The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush to grade. All valve boxes are to be encased in polyethylene plastic to grade.

Pits shall be so constructed as to permit minor valve repairs and afford protection to the valve and pipe from impact where they pass through the pit walls. The cost of placing or setting of all masonry valve pits and valve boxes is understood as being included in the contract unit price, per lineal foot, for laying water main.

9.01.09 Cross Connection

The Contractor will be required to make all cross connections where required, with water mains crossing or branching from said pipe line as shown on plans, and the capping of all openings left in said pipe line and not connected. The cost of doing such work shall be understood as being included in the contract unit price for laying water mains.

9.01.10 Hydrants and Auxiliary Valves

All hydrants shall be set plumb at the location and grade as given by the Engineer; and payment for setting the hydrants shall be understood to be the contract unit price per each, for setting hydrants. A drainage bed consisting of one third yard of pea gravel shall be provided at the base of each hydrant before backfilling. All hydrants and auxiliary valve boxes shall be encased in polyethylene plastic to grade.

9.01.11 Blocking Pipe

All bends, curves, tees, hydrants, and dead ends of pipe and special castings shall be blocked with retainer glands or mega-lugs. All bends, curves, tees, and dead ends of pipe and special castings over ten inches in diameter shall also be blocked with concrete in accordance with the detail plans. Retainer glands shall not be used to restrain PVC pipe. Mega-lug for PVC, pipe clamps, concrete blocking are approved methods to restrain PVC pipe and fittings. The cost thereof is understood to be included in the contract unit price, per lineal foot, for laying water main or per each for setting hydrants.

9.01.12 Pipe Cutting

Whenever it becomes necessary to cut a ductile cast iron pipe to make a connection or closure in either old or new work, the pipe shall be cut on the shortest outside circumference. Flame or electric arc cutting shall not be permitted. Sharp outside edges on pipe ends at cuts shall be ground smooth to prevent damage to the joint gaskets.

9.01.13 Pressure Leakage Test

Prior to filling new water mains with water, the Contractor shall install a polyurethane foam Poly-Pig into the main for the purpose of cleaning items from inside the pipeand for removing air during the filling process. After the entire water main, or any part of the water main located between two gate valves has been constructed and approved by the Engineer, the City Water Department shall flush, disinfect and sample the new portion of water main. Once it is determined that the main is bacteriologically "safe", (by process of two concurrent clean samples taken 24 hours apart) the installed main and appurtenances shall be capable of meeting the requirements imposed by a pressure leakage test given as follows:

9.01.13 Pressure Leakage Test (Cont'd.)

AWWA Standard C600-99

WARNING: The testing methods described in this section are specific for water pressure testing. These procedures should not be applied for air pressure testing because of the serious safety hazards involved.

Test Restrictions:
The hydrostatic test pressure shall be 150 PSI
The hydrostatic test shall be of a least 2 hours duration.
The test pressure shall not vary by more than + or - 5 PSI for the duration of the test.

Pressurization:
Water pressure testing shall be completed between two valves. This will limit the amount of water main which can be tested at one time and isolate leaks if present. The completed pipe line valves shall be slowly filled with disinfected water until all air has been expelled. When certain that all air has been expelled from the pipe line, the water pressure shall be raised to 150 pounds per square inch and shall be maintained at this pressure for a period of at least two hours.

Testing Allowance Defined:
Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 PSI of the specified test pressure after the pipe has been filled with water and the air has been expelled. Testing allowance shall not be measured by a drop in pressure in a test section over a period of time.

Testing Allowance:
No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula or table 1.1

$$L = \frac{SD\sqrt{P}}{715{,}317}$$

Where:

L= Testing allowance (makeup water), in gallons per hour
S= length of pipe tested, in feet
D= nominal diameter of pipe, in inches
P= average test pressure during the hydrostatic test, in pounds per square inch (gauge)

Table 1.1

Pipe Size (dia.)	4	6	8	10	12	14	16	18	20	24	30	36
Allowable Leakage gal/1000 l.ft. (2 Hour Test)	0.74	1.1	1.48	1.84	2.2	2.58	2.94	3.32	3.68	4.42	5.52	6.62

9.01.13 Pressure Leakage Test (Cont'd.)

If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. If the pipe line does not meet the requirement, the pipe line may be allowed to stand under normal City pressure for twenty-four hours to three days, and the test again repeated. During this time if a joint or joints indicate an undue amount of leakage by either showing up on the surface or by indicated on sound testing equipment, said joint or joints shall be uncovered and repaired before other tests are made.

Note: All equipment used in the pressure leakage test shall be properly disinfected so as to not allow introduction of contaminants into the water main during testing procedures.

9.01.14 Disinfection

The City of Midland Water Distribution Department will handle all of the disinfection process of the new water main. The following process steps are for information only. Upon completion of the main construction the City of Midland Water Distribution Department will take two consecutive samples with a 24 hour separation between both. These samples must both pass. After two consecutive samples pass, the water main can then be pressure tested following the above guidelines. When the new water main has passed the pressure test the City of Midland Water Distribution Department will again take two consecutive samples with a 24 hour separation between them. These samples must both pass. When two consecutive samples have passed, the Contractor may then remove all sample lines. After all sample lines have been removed the City of Midland Water Distribution Department will then assume possession of the water main

9.01.15 Live Connections

The City Water Department shall make all live connections into the City's pressure distribution system.

9.01.16 Backfilling Open Trenches

An acceptable grade of clean sand or fine gravel shall be placed and tamped along the sides of the pipe line up to at least one foot above the top of the pipe for the full width of the trench before any other backfill material is placed over the pipe. The remaining portion of the trench shall then be backfilled with material excavated; but care shall be given to make sure that all stones, pieces of concrete and other materials which might damage the pipe are not placed in the backfill. Fly ash or cinders shall not be permitted to be used as backfill. When a machine is used to place the backfill material, no material shall be dropped into the trench but shall be placed on the sloping end of the completed backfill and allowed to roll into place to the bottom of the trench.

Should any deficiency in the backfilling occur, in either quantity or quality of excavation materials taken from the trench, the Contractor shall supply the deficiency without extra charge to the City. No foreign or perishable materials shall be used in the backfilling.

9.01.16 Backfilling Open Trenches (Cont'd.)

All trenches between the sidewalk line and the shoulder of the road shall be left with a sufficient mound of earth above the original surface, as is deemed necessary by the Engineer, to take care of future settlement.

All backfill in trenches between the shoulders of the roadway or in driveways and gravel streets shall be resurfaced to equal the original amount of gravel before construction.

9.01.17 Backfill in Tunnel

A good grade of clean river sand or concrete sand mixed in the proportions of one sack of Portland Cement to one cubic yard of sand shall be slightly dampened and tamped in and around the pipe and all the way to the roof of the tunnel. Shoring and bracing used to support the tunnel roof shall be removed as the backfill material is tamped in place. The cost of furnishing materials and making backfill in tunnel or in cuts through existing structures shall be understood to be included in the contract unit price, per lineal foot, for laying water main.

9.01.18 Backfilling under Roadways, Etc.

Trenches excavated through cuts in existing pavements, curbs, sidewalks, cross walks, approach walks, all roadway and right-of-ways, shall be backfilled with good clean sand.

When water main is constructed under existing pavement curb sidewalk, crosswalk, or in the parkway or lawn area, the Contractor, at his own expense, shall for a period of one year from the payment of the final estimate make additional fills wherever settlements have taken place and restore the pavements, curbs, lawn and other public fixtures wherever settlement or displacements have taken place, along the line of work.

9.01.19 Surplus Earth

Surplus earth is understood to mean the excess of earth excavated and remaining after the required backfill hereinbefore specified is completed.

The unexcavated portions of the roadway surface shall be left in its original condition, graded free of any clay deposits. All ditches shall be cleaned to grade set by the Engineer. No surplus earth will be left in the road ditches except by permission of the Engineer. If such permission is granted the earth shall be graded in accordance with grade stakes set by the Engineer.

9.01.20 Miscellaneous

All sidewalks and crosswalks are to be left in as good condition as that in which they were found.

All trees shall be protected from any and all damages and shall be boxed at least six feet high in a substantial manner and any damages or injury to any tree shall be treated and repaired by a tree specialist at the expense of the Contractor.

All lawns disturbed or damaged by reason of the operations shall be replaced by the Contractor at his expense in equally as good condition as found and in a manner satisfactory to the Engineer.

9.01.20 Miscellaneous (Cont'd.)

Whenever any pavement curb, sidewalk, or other public fixture is removed without authority or damaged by reason of the operation and construction of the work to be done under this contract, the same shall be replaced to the satisfaction of the Engineer without expense to the City.

The City Water Department shall be responsible for the flushing, disinfection testing for bacteria, and placing into service of the newly installed main.

Following pressure testing and disinfection, the Contractor shall remove all sample lines and plug the corporation with a copper disk.

9.01.21 Method of Measurement

Measurement of water main constructed will be made in lineal feet on the axis of the pipe laid from the beginning to the end and shall include measurements through special castings and valves. Hydrant leads will be measured in lineal feet through valves and special castings from the center of the supplying water main, on the axis of the pipe, to the center of hydrant. Branches will be measured in lineal feet from the center of the tee or cross, on the supplying water main, to the end of the pipe or special casting including the cap and plug in the case of a dead end.

Setting of hydrants will be measured in units.

Pavement replaced will be measured in square yards of surface.

9.01.22 Basis of Payment

"Construction of Water Mains" will be paid for at the Contract unit price, per lineal foot, for each size of pipe, which price shall be payment in full for furnishing the necessary materials as specified, excavating, laying, blocking, testing, backfilling, cleaning up, grading, and completing the water main all in accordance with the detailed specifications.

"Setting Hydrants" will be paid for at the contract unit price per each, which shall be payment in full for furnishing the necessary material, excavating, setting, blocking and backfilling in accordance with the detailed specification.

"Pavement Replaced" will be paid for at the Contract unit price, per square yard, which shall be payment in full for furnishing the necessary concrete materials, reinforcing steel, mixing and placing the pavement replacement complete in accordance with the detailed specifications.

9.03 SPRINKLER SYSTEM

9.03.01 Description of Work

The sprinkler system shall be constructed using the sprinklers, valves, piping, fittings, controllers, wiring, pumps, etc., of sizes and types as shown on the drawings and as called for in these specifications. The system shall be constructed to grades and conform to areas and locations as shown on the plans.

Contractor shall be responsible for all sprinkler work beyond the Tapping of the water main. OWNER WILL MAKE LIVE CONNECTION AND FURNISH AND INSTALL WATER METER. Control cabinet with will be installed by the City as indicated on the drawings.

9.03.02 Description of System

Sprinkler lines shown on the drawing are essentially diagrammatic. Locations of all sprinkler heads, valves, piping, wiring, etc. shall be established by the contractor at the time of construction. Spading of the sprinkler heads or quick coupling valves are shown on the drawing and shall be exceeded only with the permission of the Owner's Authorized Representative.

Unless otherwise specified or indicated on the drawings, the construction of the sprinkler system shall include the furnishing, installing, and testing of: all mains, laterals, risers and fittings, sprinkler heads, quick coupling valves, gate valves, control valves, controllers, electric wire, pumps, controls and all necessary specialties. The removal and/or restoration of existing improvements, excavating and backfill, and all other work in accordance with the plans and specifications shall be included as required for a complete system.

9.03.03 Description of Material

The contractor shall use material as specified on the irrigation Plan. Material other than specified will be permitted only After written application by contractor and written approval by the owner prior to bid opening. Substitutions will only be allowed when in the best interst of the owner.

9.03.04 Equipment, Tools, and Labor

The contractor shall furnish all such equipment, tools, and labor necessary to pursue work in a n acceptable manner, to a speedy completion. This contract is based on the contractor furnishing and using his own equipment, tools, and labor which are suitable to carry out this contract in a first class manner, unless otherwise herein specified.

9.03.05 Equipment, Tools, and Labor

The contractor shall keep the premises free from rubbish and debris at all times and shall arrange his material storage so as not to interfere with the owner's operation of the job. All unused materials, rubbish, and debris shall be removed from the site.

9.03.06 Examination and Verification of Drawings and Site

It shall be the contracting installer's responsibility to report to the owner's authorized representative any deviations between mechanical drawings, specifications and the site. Failure to do so prior to the installing of equipment and resulting in replacing, and/or relocation equipment shall be done at the contractor's expense.

9.03.07 Excavation and Backfill

Trenches for plastic pipe or sprinkler lines shall be excavated of sufficient depth and width to permit proper handling and installation of the pipe and fittings. The piping may be installed by any other method the contractor may desire if approved by the owner and the pipe manufacturer. The backfill shall be thoroughly compacted and evened off with the adjacent soil level.. All areas shall be completely backfilled with granular material and compacted to 95% of its maximum unit weight. All trenches that are opened during any particular working day shall be closed and backfilled the same day. No open trenches or partially backfilled trenches shall be left overnight. All sod shall be removed and restored. If sod is not restorable, it shall be contactor's responsibility to repair and reseed damaged areas. Any or all lines may be installed without sod removal by use of a vibratory plow, providing sufficient depth of cover is maintained.

9.03.07 Excavation and Backfill (Cont'd.)

1. Depth of cover from finish grade shall be as follows:

Main/line		3" and smaller
	Min:	12" of cover
Lateral Line		2" and smaller
	Min:	10" of cover
Sleeving		All sizes
	Min:	18" of cover

9.03.08 Unclassified Excavation

Excavation shall be unclassified and shall include all materials encountered. Al materials or matter that cannot be excavated by normal mechanical excavation means shall be brought to the attention of the owner's representative and an adjustment in price agreed upon before excavation of these areas proceeds.

When additional backfill materials are needed to replace rock and/or other unsuitable materials, it shall be the contractor's responsibility and expense to supply such material for backfill to the irrigation contractor. It shall also be the contractor's responsibility to dispose of the unsuitable materials removed from the ranch that cannot be used in the backfill operations, unless otherwise agreed upon by the owner and contractor.

9.03.09 Existing Utilities and Structures

The exact location of all existing utilities, structures, and underground utilities, which may not be indicated on the drawings, shall be determined by the contractor and he shall conduct his work so as to prevent interruption of service or damage to them. The contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him, or to make necessary adjustment in their location if required in order to complete the work of this contract.

9.03.10 Ordinances and Regulations

All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made part of these specifications, and their provisions shall b carried out by the irrigation

9.03.10 Ordinances and Regulations (Cont'd.)

contractor. Anything contained in these specifications shall not be constructed to conflict with any of the above mentioned rules or regulations. However, when these specifications and/or drawings call for or describe materials, workmanship, or construction of a better quality, higher standard or larger size, these specifications and/or drawings shall take precedence over the requirements of said rules, regulations, or codes.

9.03.11 Permits and Inspections

Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspection and examination required by these authorities.

At the request of the owner's representative, the irrigation consultant will inspect the installation and make recommendations to the owner's representative for any necessary changes, corrections, etc. The contractor shall pay all federal, state, or local taxes, sale and/or use taxes, applicable to all materials, processes or devices purchased or used in connection with the work under this contract.

9.03.12 Changes or Additional Work

The owner may, without invalidating the original contract, order such changes or additions as may from time to time be deemed desirable or necessary. In so doing, the contract price shall be adjusted to the mutual agreement of the contractor and owner. Extensions of completion time will be adjusted as necessitated by changes. The contractor shall bring to the attention of the owner's authorized representative, and they shall together work out an agreeable change, which may be necessitated by deviations in construction from original plans by other contractors on the job. Any change in price brought about by such deviations in construction over original plans by other contractors shall be agreed upon by both the contractor and the owner before work proceeds.

Any changes deemed necessary by the contractor concerning sprinkler head placement or zoning, controller or pump location, etc. shall be submitted to the owner's authorized representative before such work is begun.

9.03.13 Record Drawings

The owner will furnish the contractor with one set of blueline prints, showing all sprinkler work required under this contract, for the purpose of having the contractor record on these prints all changes that may be made during actual installation of the system. Immediately upon installation of any piping, valves, wiring, sprinkler heads, etc., in locations other than shown on the original drawings, or of sizes other that indicated, the contractor shall clearly indicate such changes on the set of drawings, (see also Changes or Additional Work). After final acceptance of the completed installation, the contractor shall be responsible for having complete drawings prepared showing all such changes and these shall be turned over to the owner for recording purposes. (See also Owner's Acceptance.)

9.03.14 Guarantee

It shall be the contractor's responsibility to insure and guarantee complete coverage of the areas shown on the drawings to be irrigated. He shall also guarantee the satisfactory operations of the entire system and the workmanship and restoration of the area. Adjustment of the sprinkler heads and automatic equipment will be done by the contractor, upon completion of installation, to provide optimum performance. The entire system shall be guaranteed to b complete and perfect in every detail for a period of one year from the date of its acceptance, and he HEREBY AGREES to repair or replace any such defects occurring within that year, free of expense to the owners.

The irrigation contractor shall be responsible for blowing out the system by air compression in the fall following installation and turning on the system in the following spring.

9.03.15 Notice of Completion

The completion of the contract will be accepted, and Notice of Completion recorded only when the entire contract is completed to the satisfaction of the owner's authorized representative.

9.03.16 Owner's Acceptance

The contractor will furnish the owner with two (2) sets of: (1) a product folder showing all major components of the system, and (2) an instruction manual explaining how the system operates.

9.03.16 Owner's Acceptance (Cont'd.)

Within ten (10) days of the contractor's notification that the installation is complete, the owner will inspect the installation and, if final acceptance is not given, will prepare a "punch list" which, upon completion by the contractor, will signify acceptance by the owner.

In lieu of final acceptance punch list, the job shall be considered accepted when the owner takes over full operation of the system.

Final payment will not be made without the receipt of an accurate as-built drawing by the owner. The as-built drawing should have dimensions from stationary points as they relate to valves, (electric, manual, drain, and quick coupler) main lines, and wire. After completion, testing, and acceptance of the system, the contractor will instruct the owner's personnel in the operation and maintenance of the system. Contractor shall provide owner with two sets of parts lists and instructions.

9.03.17 Materials

All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of this system. All material averages at the completion of the installation are the property of the contractor and are to be removed from the site.

1. Pipe and Fittings.

   Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger size may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

   a. Mainline Piping

      Mainline piping shall be rigid unplasticized PVC-Class 160 PSI working pressure extruded from virgin parent material of the type specified on the drawings. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign material, blisters, deleterious, wrinkles, and dents.

9.03.17 Materials (Cont'd.)

b. Lateral Piping
All lateral pipe shall be flexible, non-toxic polyethylene pipe bearing the NSF seal. All sizes shall have a mini8mum of 80 PSI working pressure rating. All stainless steel clamps shall be used to secure joints. Joints 1 ¼" and larger shall b double-clamped. All plastic pipe shall be continuously and permanently marked with the manufacturer's name, material, size, and schedule type.

c. Sleeves
(1) Pipe sleeves shall be PVC Class 160 BE.

(2) The above sleeve or polyethylene may be used in zone section piping.

2. Plastic Pipe Fittings and Connections.

All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be used except brass saddle tees and crosses as hereinafter specified.

Slip fitting socket taped shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only Schedule 80 pipe may be threaded.

9.03.18 Installation of PVC Pipe

Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

Plastic pipe shall be cut with a hand saw or hacksaw with the assistance of a square in sawing vice, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

All plastic-to-plastic joints shall be solvent-weld joints or slop seal joints. Use only the solvent recommended by the pipe and fittings manufacturer, and it shall be the contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary.

9.03.18 Installation of PVC Pipe (Cont'd.)

The contractor shall assume full responsibility for the correct installation. All pipe shall be treated with the recommended primer before solvent welding.

The solvent weld joints shall be made in the following manner:

1. Thoroughly clean the mating pipe and fitting with a clean, dry cloth.

2. Apply primer.

3. Apply a uniform coat of solvent to the outside of the pipe with a non-synthetic bristle brush.

4. Apply solvent to the fitting in a similar manner and quickly insert it into the fitting.

5 Give the pipe or fitting a quarter turn to insure even distribution of the solvent and make sure the pipe is inserted to the full depth of the fitting socket.

6. Hold in position for 15 seconds.

7. Wipe off excess solvent that appears at the outer shoulder of the fitting.

Care should be taken so as not to use an excess amount of solvent, thereby causing a burr or obstruction to form on the inside of the pipe. The joints shall be allowed to set at least 24 hours before pressure is applied to the system.

9.03.19 Installation of Polyethylene Pipe

Polyethylene pipe shall be cut with a hand saw or a hack saw with the assistance of a square in vice or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation of fittings so that a smooth unobstructed flow ill b obtained.

All Polyethylene joints shall be made using ASTM-D-2609; insert fittings should be put in the pipe all the way up to the stop.

A very slight heating of the pipe eases insertion of the fittings; use of hot water is recommended. Overheating or using lubricants negates pipe warranty.

Clamp all fittings on barbed surface of fittings.

9.03.20 Installation of Sleeves

Sleeves shall be installed as indicated on the drawings. Joints shall be installed in accordance with manufacturers recommendations. After water main is installed through sleeve, the ends of sleeves shall be positively sealed with an expandable foam to prevent infiltration into the sleeve. Sealed ends shall have weep holes to allow moisture to escape from the sleeve.

9.03.21 Sprinkler Heads

Full or Part Circle High Pop-Up Spray Sprinkler Model 1804

The full or part circle pop-up spray sprinkler shall be capable of covering 12 to 5 feet radius (FT.RAD.) at 30 pounds per square inch (PSI) with a discharge rate of 1.8 to 4.3 gallons per minute (GPM).

The sprinkler body, stem, nozzle, and screen shall be constructed of heavy duty plastic.

The sprinkler shall have a soft elastomer pressure activated co-molded wiper weal for cleaning debris from pop-up stem as it retracts into case to prevent sprinkler from sticking up.

The sprinkler shall have a matched precipitation rate (MPR) plastic or brass nozzle with an adjusting screw capable of regulating the radius and flow.

The sprinkler shall have a strong stainless steel retract spring for positive pop-down. Pop-up height shall be no less than 4 inches.

The sprinkler shall have a ratcheting system for easy alignment of pattern.

The sprinkler shall have a screen under the nozzle to protect it from clogging and for easy removal for cleaning and flushing system.

The sprinkler shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California.

9.03.22 Sprinkler Connections

The sprinkler heads shall be connected to the lateral or main as indicated on the drawings.

All quick coupler valves shall be connected to the main by use of the three (3) elbow PVC Schedule 80 swing joints.

9.03.22 Sprinkler Connections (Cont'd.)

All sprinkler heads shall be positioned to prevent contact with lawn mowers.

9.03.23 Electric Remote Control Valve Model 100-PGA

The remote control valve shall be a normally closed 24 VAC 50/60 cycle solenoid actuated globe/angle pattern with a balanced pressure diaphragm design capable of having a flow rate of 30 gallons per minute (GPM) with a pressure loss not to exceed 5 pounds per square inch (PSI). The valve pressure rating shall not be less than 150 PSI.

The valve body and bonnet shall be constructed of high impact weather resistant PVC with stainless-steel screws. The valve shall have the following recommended continuous pressure ratings at the temperature indicated.

Temperature	Pressure (continuous)
73 F.	150 PSI
80	132
90	112
100	93
110	75

The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall be actuated by .41 amps inrush current (9.9 VA) and .25 amps holding current (5.5 VA).

The valve shall have a flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less that 1 minute at 150 PSI, and less than 30 seconds at 20 PSI.

The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ring plug for installation in either globe or angle configuration.

The valve shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California.

9.03.24 Electric Valve Installation

Electric valve installation shall be as indicated in the specifications or drawings. All electrical valves shall be enclosed in a minimum ten (10) inch width valve box or pit.

9.03.25 Controllers Model ESP-16LX

Hybrid Controller

The controller shall be of a hybrid type that combines electro-mechanical and micro-electronic circuitry capable of fully automatic or manual operation. The controller shall be housed in a wall-mountable, weather resistant, plastic cabinet suitable for either indoor or outdoor installation.

The controller shall have 12 stations, with each station capable of an operating time of 0 to 99 minutes in 1 minute increments. The controller shall have a 365-day calendar and shall feature a range of operating day cycles or odd day, even day, variable day or custom schedules.

The controller shall have four separate programs (A, B, C, & Drip) which can have different start times, watering days, and station timing. Each program shall have up to 6 start times available per day. The controller shall be capable of operating two 24 VAC solenoid valves per station plus a master valve or pump start relay.

The controller shall have a water budget feature adjustable from 10% to 200% of actual time set on the stations in 10% increments. The controller shall be capable of stacking start times between programs.

The controller shall have a 12 hour AM/PM clock with a midnight day changeover. The controller shall have a 9-volt Ni-Cad rechargeable batter backup feature to maintain program memory during power outages. The controller shall have a diagnostic circuit breaker that skips stations with overloaded or shorted circuits and displays the station.

The controller shall be manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California.

9.03.26 Control Wire

Control wire shall be type UF for direct burial underground and shall be size 14-1.

Joining of underground wires shall be by use of 3MDBY connectors.

9.03.27 Backflow Prevention- Watts 800M 2QT – 1" Pressure Vacuum Breaker

Approved backflow prevention shall be provided as called for on the plans. In automatically controlled system, one pressure-type vacuum breaker shall be permitted when installed upstream of all automatic zone control valves. The pressure vacuum breaker shall be installed a minimum of 14" above the highest sprinkler. If an automatic master control valve is used, it shall open at the beginning of the sprinkling cycle and shall close at the end of the sprinkling cycle.

9.03.28 Cathodic Protection

Cathodic protection shall be provided in the piping system by installing insulating type couplings, flanges, or unions between copper tubing and steel pipe.

9.03.29 Flushing and Testing

Testing of the system shall be performed after completion of each section and at completion of the entire installation. The final testing shall be in the presence of the owner's representative. Any necessary repair shall be made, at the contractor's expense, to put the system in good working order before final payment by the owner.

9.03.30 Basis of Payment

"Sprinkler system" will be paid for at the contract lump sum price for each phase installed, which price shall be payment in full for furnishing and installing the necessary materials as specified, excavating, laying, backfilling, cleaning up, testing, and completing the sprinkler system in accordance with the detailed specifications.