WATER

POLICIES AND DESIGN CRITERIA

December 2005

Adopted by City Council on December 6, 2005

CITY OF WEST JORDAN
Engineering Department
8000 South Redwood Road
West Jordan, Utah 84088

THE CITY OF WEST JORDAN, UTAH

A Municipal Corporation

RESOLUTION NO. 05-207

A RESOLUTION ADOPTING
PART V - WATER POLICIES AND DESIGN CRITERIA
OF THE ENGINEERING POLICIES AND DESIGN CRITERIA MANUAL

WHEREAS, the City Council of the City of West Jordan desires to establish policies and design criteria for its culinary water system, and identify minimum requirements for these activities within the City; and

WHEREAS, it is in the best interests of the City and developers to have a current manual for water policies and design criteria for construction, and

WHEREAS, the City Council wishes to adopt Part V – Water Policies and Design Criteria of the Engineering Policies and Design Criteria Manual for the City; and

WHEREAS, the City considers these policies and design criteria necessary to safeguard life, limb, health, property, and public welfare and it is in the best interests of the City, engineers, contractors, and developers to have a current Engineering Policies and Design Criteria Manual; and

WHEREAS, all revisions to the Engineering Policies and Design Criteria Manual shall be approved by the City Manager.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF WEST JORDAN, UTAH, THAT:

Section 1. Adoption. Part V – Water Policies and Design Criteria of the Engineering Policies and Design Criteria Manual, presented herewith, are hereby adopted as the City's official Water Policies and Design Criteria portion of the Engineering Policies and Design Criteria Manual and that the December 6, 2005 edition, are hereby adopted as the City's official water policies and design criteria portion of the Engineering Policies and Design Criteria Manual.

Section 2. Severability. If any section, part or provision of this Resolution is held invalid or unenforceable, such invalidity or unenforceability shall not affect any other portion of this Resolution, and all sections, parts and provisions of this Resolution shall be severable.

Section 3. Effective Date. This Resolution shall become effective immediately upon its passage.

Adopted by the City Council of West Jordan, Utah, this 13th day of December, 2005.

BRYAN D. HOLLADAY
Mayor

ATTEST:

MELANIE S. BRIGGS, CMC
City Recorder

CITY OF WEST JORDAN Seal STATE OF UTAH

Res 05-207

Voting by the City Council	"AYE"	"NAY"
Rob Bennett	✓	
Kathy Hilton	✓	
Mike Kellermeyer	✓	
Stuart Richardson	✓	
Kim V. Rolfe	✓	
Lyle C. Summers	absent	
Mayor Bryan D. Holladay	✓	

CITY OF WEST JORDAN

Part V - Water Policies & Design Criteria Manual

December 2005

City of West Jordan
Engineering Department
8000 South Redwood Road
West Jordan, Utah 84088

WATER
POLICIES AND DESIGN CRITERIA MANUAL

ABBREVIATED
TABLE OF CONTENTS

DETAILED
TABLE OF CONTENTS

DETAILED
TABLE OF CONTENTS

DETAILED
TABLE OF CONTENTS

SECTION **TITLE** **PAGE**

SECTION 1.0

INTRODUCTION AND GENERAL POLICIES

1.1 SCOPE

The design and construction of culinary water mains and other culinary water appurtenances in the City of West Jordan shall comply with these policies, design criteria and standards herein called the "Engineering Policies & Design Criteria Manual, Part V – Water Policies & Design Criteria", or the permit requirements of various governing bodies, except where specific modifications have been approved, in writing, by the City Engineer.

This document sets forth minimum standards, policies, procedures, and design criteria for designing and preparing plans and specifications for culinary water systems built in the City. Wherever there are differences between these standards and other county, state or federal regulations, the most stringent or highest requirement shall govern. Specifications and standard drawings relating to pipelines are intended for pipes up to and including 18-inches in diameter. For pipeline of greater diameter, the design engineer shall submit complete specifications to the City Engineer for review and approval.

Other policy and design criteria standards, which are separate from these documents, also exist for land disturbance, transportation, stormwater, wastewater, parks & trails, and secondary water systems.

1.2 AUTHORITY

Titles 87, 89, and 90 of the City of West Jordan Municipal Code, establishes the legal authority for the planning, design and construction of the City's culinary water systems and appurtenances. In addition to these City ordinances, the State of Utah, Rules for Public Drinking Water Systems, most current version apply to the City's culinary water systems as well.

1.3 INTERPRETATION

The City Engineer will decide all questions of interpretation of "good engineering practice" being guided by the various standards and manuals to include those published by the American Waterworks Association (AWWA).

1.4 QUALITY ASSURANCE

All work shall be performed in accordance with City drafting/submittal requirements as described herein. Design work shall be accomplished under the direct supervision of a Utah Registered Professional Engineer. All submitted designs, specifications, reports and plans shall be signed by a civil engineer, registered in the State of Utah, and all work shall be in accordance with good engineering practice.

1.5 SUBMITTALS

A. Design Data - Provide data on maximum daily flow with fire flow demand (based on building

square footage and construction material type), number of hydrants required, peak instantaneous flow, maximum peak velocity in pipe (general rule not to exceed 8-10 feet per second), pipe materials, pipe pressure class, valves pressure class/rating, and accessories.

B. Pressure Zones - All pressure zone boundaries and elevations shall be identified with the Preliminary submittal.

C. Project Documents - Meet all checklist items required by Engineering Department before document submission.

D. Easements and Land Acquisition
   1. All easements and land acquisitions shall be submitted on the city's standard easement form and shall be included on the recorded subdivision plat.
   2. One copy of all necessary easement forms shall be submitted to the City Engineer for review.
   3. All necessary permits shall be submitted to the City Engineer for final approval. Required permits include but are not limited to state and county utility line permits, canal crossing permits, Railroad crossing permits, Army Corp. of Engineer permits, etc.
   4. All necessary permits and easements must be submitted prior to final approval being granted by the City.

1.6 DEFINITIONS AND TERMS

Whenever in these specifications or in any document or instruments where these specifications govern, the following terms, abbreviations or definitions are used, the intent and meaning shall be interpreted as follows:

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADD	Average day demand
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
Ft	Feet
GPAD	Gallons per acre per day
GPM	Gallons per minute
IBC	International Building Code
IFC	International Fire Code
IPC	International Plumbing Code
IPS	Iron Pipe Size
IRC	International Residence Code
JVWCD	Jordan Valley Water Conservancy District
MDD	Maximum daily demand
MG	Million gallons
MGD	Million gallons per day
O&M	Operations and Maintenance
PWD	Public Works Department

PRV	Pressure reducing valve
PSI	Pounds per square inch
USGS	United State Geologic Survey

Pipe Types:

AC	Asbestos Cement
CI	Cast Iron
CMP	Corrugated Metal Pipe
DIP	Ductile Iron Pipe
ML & C Steel	Mortar Lined and Coated Steel Pipe
PB	Polybutylene.
PE	Polyethylene
PVC	Poly-Vinyl Chloride
RC	Reinforced Concrete

DEFINITIONS

"Acceptance"	Field acceptance is when the Engineering Department inspector approves the physical installation of the water system, completes the required checklist for water systems, signs, and dates the checklist and also obtains the other necessary approvals indicated on the checklist form. The City Engineer acceptance or final acceptance follows field acceptance and is when the City Engineer approves both physical improvements as well as the administrative items associated with development, the public improvement bonds have been processed, and the Public Works Department accepts ownership and operations and maintenance responsibilities.
"Approved"	Unless specifically otherwise indicated, this shall mean approval by the City Engineer.
"Bedding"	A bed of small aggregate or sand used to support the piping materials prior to backfilling and sometimes a larger aggregate for encasing the pipe.
"City"	City of West Jordan, Utah
"Casing"	A steel or PVC pipe shell, placed after drilling subsoil, to a predetermined elevation.
"City Engineer"	City Engineer shall mean the City Engineer of the City of West Jordan, or the person(s) engaged by the City and authorized to perform the duties assigned to the City Engineer, and shall include any deputies and representatives.
"Consolidated Fee Schedule"	A summary document, which identifies all of the fees and charges allowed to be charged by City staff for various services, fees, requests, and documents. This document is adopted by the City

	Council and is changed upon occasion as needed, and is done so by Resolution adopted by the City Council.
"County"	Salt Lake County, Utah
"Developer"	An individual or organized group; partnership, corporation, etc.; proposing to subdivide or improve land. If we le
"Developer's Engineer"	The engineer licensed by the State of Utah as a civil engineer, employed by the developer, under whose direction construction plans, profiles and details of the work are prepared and submitted to the City for review and approval.
"Distribution Pipelines"	Waterlines which are connected to transmission pipelines and are usually of 12-inch diameter and smaller.
"Easement"	A recorded document in which the landowner gives the City permanent rights to construct and maintain improvements across private or other property.
"Engineer"	A professional engineer or firm of professional civil engineers appointed by and acting for the Engineering Department in the case of a City sponsored capital project. In the case of a developer-sponsored project, the term refers to the engineer hired by the developer and may also be referred to as "developer's engineer".
"Engineering Department"	The City department responsible for planning, designing and construction of the City's culinary water, roadways, wastewater, storm drain, and secondary water systems.
"Fire Department"	City of West Jordan Fire Department
"Fire Service Line'	A line whose sole function is to serve a particular building or property with fire protection.
"House Plumbing"	Plumbing fixtures, devices and piping within a building or structure including pipes on the property from the meter.
"Hydrant"	A valve box located at grade, with a vertical shaft connecting to a subgrade water valve stem.
"Inspector"	An employee or agent of the City engaged to observe and record field compliance with design criteria, plans and construction standards. In most cases, this refers to the Engineering Department inspector(s).
"Main Line"	Main line pipelines are also referred to as "Transmission Pipelines", which are typically larger than 12 inches in diameter.
"Master Plan"	As used in this Standard, this refers to the City of West Jordan, Water Master Plan. This plan is updated upon occasion and is

	adopted by the City Council. The use of this term shall mean the most up-to-date version of this document.
"Offsite" or "Off-Project Improvement"	An improvement beyond project boundaries connecting the development/project to the City's systems.
"Plans"	Drawings of infrastructure improvements such as transportation, water, secondary water, storm drainage and wastewater systems and their appurtenances within the City.
"Pressure Reducing Valve (PRV)"	A hydraulically controlled valve, which reduces pressure from one water pressure zone to another.
"Pressure Sensing Switch"	A switch device controlling the pump, used to sense the water pressure in the storage tank.
"Public Works Department (PWD)"	The City department responsible for operations and maintenance of the City's culinary water, roadways, wastewater, storm drainage, and secondary water systems.
"Pump"	Usually a submersible type, placed within the well casing, connected to supply water piping to building storage tank.
"Pump Controller"	An automatic switch for turning the pump on and off and is responsive to the pressure-sensing switch.
"Pump Disconnect"	A switch to isolate the pump from the power source.
"Pressure Zone"	The culinary water pressure zone within the City system as defined by the elevation, i.e., Pressure Zone 4, elevation 4,947-feet', etc.
"Required"	Unless specifically otherwise indicated, this shall mean a requirement of the City Engineer.
"Required Fire Flow"	A requirement established for each project as determined by the City of West Jordan Fire Department.
"Secondary Water"	Water used for irrigation purposes within the City within a separate secondary water system.
"Service"	A term used to identify the primary connector from the public utility to a building or site system.
"Service Lines"	The line between the distribution pipeline and the culinary water meter within the public right-of-way.
"Service Zone"	See pressure zone

"Sewer" or "Sewerage"	Wastewater main or wastewater facilities and/or appurtenances.
"Staff Engineer"	A registered civil engineer employed by the City and designated by the City Engineer to act on the City's behalf.
"Standard Drawing"	Where not specified to the contrary, this refers to standard drawings which are part of these standards.
"Storage Tank"	A storage container for the potable water.
"Subdivision Water Lines"	The system of street water lines and service lines constructed by the developer within an approved subdivision.
"Transmission Pipeline"	A pipeline that delivers water to a main section of the water service area. May also be referred to as a "main line".
"Thrust Block"	Cast-in-place concrete place at a change in pipe direction to resist pipe movement caused by water hammer or rapid change in flow rate.
"Turnout (TO)"	A connection to a City wholesale supplier (Jordan Valley Water Conservancy District) which consists of valving, a water meter and other appurtenances to measure and control flow into the City's water system.
"Valve"	A check, ball, butterfly, gate valve used to control, isolate or regulate the flow of water.
"Water Line"	A piped water service from the utility or water source to the building or structure. It can consist of the following: (1) Domestic water line – a piped water service for domestic consumption, (2) Fire water line – a dedicated piped water service for fire protection, and (3) Fire protection loop – a dedicated piped water service which circles the building or structure, from which individual fire water lines into the building or structure, are branched.
"Water Purveyor"	Agency or company supplying water to the City. In the City's case, this refers to the Jordan Valley Water Conservancy District.
"Water Well"	A vertical drilled well, with a pipe casing.

1.7 APPLICABLE CODES, MANUALS AND POLICIES

A. Ordinances and Codes - Ordinances, requirements and applicable standards of governmental agencies having jurisdiction within the City's service area shall be observed in the design and construction of water systems. Such requirements include but are not limited to current revisions of the following:
   1. The International Building Code, most current version.

2. The International Plumbing Code as amended by the Building Department, City of West Jordan, Utah.
3. The International Fire Code.
4. Municipal Code of City of West Jordan.
5. Road encroachment regulations of City of West Jordan, State of Utah, and Salt Lake County, as applicable.
6. Standard Specifications – American Public Works Association, State of Utah Chapter, Standard Specifications, current Edition.
7. City of West Jordan, Engineering Policies & Design Criteria Manual.

B. City Manuals – In addition to the Codes indicated above, the City has prepared and adopted the following manuals, which provide additional City requirements and procedures.
   1. Development Processing Manual – Describes processes, procedures and requirements for various City processes, i.e. subdivision or site plan processing, for private development projects. It contains detailed, step-by-step processes and requirements for each step to assist developers and their engineers through a particular process.
   2. Private Development Construction Inspection Manual – Prepared to describe the processes and procedures required of all construction inspection of private development projects. In addition to processes and procedures, it also includes various forms and checklists to be used with private development projects.
   3. Capital Improvement Project (CIP) Construction Inspection and Management Manual – Prepared to describe the processes and procedures required of all City CIP projects. In addition to processes and procedures, it also includes various forms and checklists to be used with CIP projects.

C. City Policies – The following policies also apply to private development projects and CIP projects alike:
   1. Minimum and Maximum Water System Pressures Policy - The distribution system shall be designed to maintain a minimum pressure of 20 psi at all points of connection, under all conditions of flow, but especially during peak instantaneous flow conditions, including fire flows. The distribution system pressure for normal operations shall be designed to maintain a minimum pressure of 50 psi. The maximum pressure for any given distribution system shall be 110 psi.
   2. Cross-Connection Control Policy - There shall be no physical connection between a public or private potable water supply system and a sewer, or other appurtenances thereto, which could permit the passage of any wastewater or polluted water into the potable supply.
   3. Setting of Fire Demands - Fire demands shall be set by the Fire Marshall in accordance with his interpretation of the latest adopted edition of the International Fire Code. All buildings must have the fire demand available at or below the maximum distribution system velocity of 8 to 10 feet per second, depending on pipe material. Number of fire hydrants required and spacing of said hydrant shall be at the discretion of the Fire Marshall.
   4. Water System Materials - All Materials shall conform to NSF Standard 61 or Standard 14, and all applicable sections of ANSI / AWWA Standards C104 / A21.4-95 through C550-01.
   5. Construction Water Use Policy – All water used for any purpose is to be metered through a City issued meter containing an approved backflow prevention device. Violation of this requirement will make the person and company subject to the City's Municipal Code and its penalties. Check with the City's Engineering Inspector for information on how to obtain the requirement meter.

6. General Meter Policy - Unless otherwise approved by the City Council, a separate culinary water meter shall be installed for each ownership. Therefore, each unit of a townhouse or condominium with separate ownership will have its own culinary water meter. A single ownership apartment building can have one meter for the building.
7. Policy on Irrigation Meters - Where the parkways or side landscaping strips along streets are to be irrigated, a separate meter must be installed on each side of the street. In such cases, running an irrigation line from the meter to the other side of the street is not allowed. Where a median strip must be irrigated, the meter may either be in the side parkway or in the median strip, providing that at either location the meter is easily accessible and protected from being covered by landscape materials or other obstructions. The Engineering Department reserves the right to select all meter locations.
8. Commercial/School Site Water Meter/Fire Line Policy - All commercial/industrial/school site projects which require a separate fire line, as determined by the City's Fire Department, shall provide a looped fire line system with 'detecta-check' valve installation(s) on the fire line and a culinary water meter installation which is separate and not connected to the fire line service. The fire line service is to be used solely for fire protection and cannot be tapped for water service for drinking or irrigation water. If the dedicated fire line provides service to a fire sprinkler system, an approved backflow prevention assembly will be required. The separate water meter installation is to be designed by the developer's engineer and then all information submitted to the City's Engineering Department for review. All design information is to be submitted by the design engineer and shall be stamped and signed by the design engineer. The City Engineer will approve or disapprove of the proposed meter installation.
9. Fire Protection within the City - Within City of West Jordan, fire protection is provided by the City of West Jordan Fire Department.
10. Confined Space Entry Policy - All Developer/Contractor and City staff is subject to the City's Confined Space Entry Program requirements and as such shall meet its requirements. Confined spaces shall not be entered until all requirements of the City's Program have been made and approved by the City's Inspector on the project and all applicable permits have been received. Also of concern is that all "Lock-out, Tag-out" procedures be complied with to provide for a safe working environment for all personnel. Personnel not complying with the City's requirements for these items is subject to penalties.
11. Material/Product Suppliers Approval Process - Materials not indicated in this manual as being approved for use in the City's water system must be approved by the City Engineer. The process for approval of these materials will be as follows:
    a. Material supplier submits a written request to the City Engineer for consideration of the material/product to be considered. The request must contain a letter making the request along with any material/product data sheets the City will need in determining its compatibility in the City's water system.
    b. The City will form a Review Committee comprising of Engineering Department engineers and Public Works Department staff to review, discuss, and evaluate the material's/product's acceptability to the City.
    c. The material/product supplier will be asked to come and make a presentation on their material/product to the City's Review Committee where additional questions will be asked of the supplier. Additional information will be required to be submitted as indicated by the Review Committee.
    d. Based upon all information, the Committee will make a recommendation to the City Engineer for his review and approval.
    e. The City Engineer will make a finding based upon the Committee's information and his own experience and render that decision to the supplier in writing.

12. Occupancy\Water Service - As a part of the clearance procedure for individual house\building occupancy, the Engineering Department must "clear" the house\building. Such clearance is given per the requirements as specified in the Municipal Code. Occupancy cannot be given until the public water system is field accepted by the Engineering Department inspector in conjunction with the City's Public Works Department's operations and maintenance personnel. For residential construction where numerous units are involved, clearances will be granted on a street-by-street basis only; individual clearances on a piecemeal basis will not be made.
13. Private Water Line Policy – The City is required to ensure the protection of its system and has therefore established a policy regarding private water lines, which limits the amount and number of private water lines connected to its water system. For apartment complexes, the City will consider designating a portion of its water system private, from the water meter on. For all other types of projects, the City requires that the water lines be public and subject to the rules and regulations for public water lines/systems. For instance, water systems supplying townhomes will be considered to be public water systems. If the street where public water lines/facilities are located in is private, the developer is to provide a public utility easement to provide for construction, operations and maintenance of theses water facilities.
14. Dedicated Fireline Policy – The design and construction of firelines in the City are required to be dedicated solely for the providing of fireflow to a given project, or buildings. No service taps for irrigation or culinary water may be taken off of a dedicated fireline.
15. Detecta-Check Valve Policy – Detecta-check valves are required on all fireline installations to ensure that water flows are detected and properly billed for.

1.8 CITY DEPARTMENTS' RESPONSIBILITIES/JURISDICTIONS

A. Engineering Department - The Engineering Department is responsible for the approval of plans and inspection of all public main water lines and service lines, within the public right-of-way of the City's culinary water service area. The Public Works Department will be consulted on these issues as well to receive their input as part of the design and construction process. The Building Department is responsible for all water systems beyond the water meter or backflow prevention device.

B. Public Works Department - The Public Works Department (PW) is responsible for the operation and maintenance of all public main water lines, valves, service lines, and other water facilities within the public right-of-way of the City's water service area. Where repairs or replacement of a service line on the City side of the meter are required subsequent to initial construction, it shall be the responsibility of the Public Works Department, except in the case of a service upgrade. In which case, the owner or customer will be billed for the work. Conversely, repairs or replacement on the customer side of the meter will be the responsibility of the property owner.

C. Community Development Department, Building Division - The Building Division is responsible for the residential and commercial building sites after final grade has been reached.

D. Fire Department – The City's Fire Department is charged with providing adequate and proper fire protection for the City and its residents and businesses. As such, they are responsible for reviewing all projects during design, City processing, construction and after construction, for ensuring proper fire protection is design and provided for. They also inspect businesses, water facilities, etc. to ensure they are operating properly.

1.9 DEVELOPER ENGINEER'S RESPONSIBILITY

These standards establish uniform policies and procedures for the design and construction of the City culinary water system. They are not intended to be a substitute for engineering knowledge, judgment or experience. These procedures shall be reviewed by the developer's engineer and shall be applied as necessary to the project. Proposed deviations to these standards shall be submitted in writing, prior to preliminary plat and or development project approval.

It is the developer engineer's responsibility to be aware of the City's culinary water system master plan for water system improvements and to indicate any main line relocations, extensions or oversizing on the project's construction plans. A copy of the Executive Summary of the Culinary Water System Master Plan is available on the City's website for information. A complete version of the master plan is available for review at the City's Engineering Department. This responsibility shall include investigating any changes from the Master Plan necessitated by development subsequent to the Master Plan, although the above shall not relieve the developer from the responsibility to provide an approved system consistent with Engineering Department requirements. Verification of the adequacy of the surrounding water system rests jointly with the Engineering Department and the developer.

All plans, specifications, reports or documents shall be prepared by a registered civil engineer, or by a subordinate employee under direction of a registered civil engineer. Each of these documents shall be signed and stamped with a professional engineer seal, to indicate responsibility for them. A wet stamp is required on all documents except reproducible plans, where a stamp on the original is acceptable.

A "Preliminary Review" and or "Plans Approved for Construction" stamp or signature of the City on the plans does not in any way relieve the developer's engineer of the responsibility to meet all requirements of the City. The plans shall be revised or supplemented at any time it is determined that the City's requirements have not been met. Generally, plans that are signed as being authorized for construction will not require revisions based upon subsequent revisions to these standards, however, when the Engineering Department's opinion, a change to the project is necessary, based upon a significant change in the standards, which significantly affects public safety, future maintenance costs, or similar concerns, such a charge may be required during construction by the City Engineer. Changes may also be required in the case where a developer does not proceed to construction within the time allowed in the agreement with the City.

1.10 REFERENCE SPECIFICATIONS

References to standards such as AWWA or ASTM shall refer to the latest edition or revision of such standards unless otherwise specified.

1.11 CITY ENGINEER ACCEPTANCE

The City Engineer will not accept the culinary water system until all applicable requirement s of these standards and of the City of West Jordan Municipal Code have been met.

1.12 METRIC UNITS

The maximum extent practicable, 'standard' units are to be used as the primary method of displaying and indicating lengths, volumes, etc.

1.13 CONSTRUCTION SPECIFICATIONS

Nothing contained in the Construction Specifications Manual or in any other part of this standard as implying the City will pay for any of these improvements. In addition to the construction specifications being used for defining private development work, they are also used for City capital improvement projects, and therefore contain some language about methods of payment.

****

SECTION 2.0

DESIGN CRITERIA

2.1 CITY WATER SYSTEM

A. General - There are two water purveyors within the boundaries of the City of West Jordan, the City of West Jordan (City) who supplies the vast majority of water to these customers, and the Kearns Improvement District who serves a small area near 6200 South and 4200 West. The map on page 2-2 shows the area provided for by the City.

The City's Engineering Department is responsible for all studies, design and construction for these facilities and the Public Works Department is responsible for all operations and maintenance of the water facilities and providing input into issues related to design and construction of these facilities.

B. Jordan Valley Water Conservancy District (JVWCD) - The City of West Jordan owns water rights to groundwater resources which amount to approximately 12,000 acre-feet per year. The remaining water supplies are supplied to the City's distribution system and are purchased from the JVWCD.

The JVWCD has a network of larger diameter pipelines that provide water to delivery points within the City called turnouts. These turnouts are metering stations through which the water flows and amounts of water tabulated, which are then billed to the City. Each turnout has a different rated capacity and is set for various pressures as indicated in Table 2-4. These turnouts typically consist of a meter, control valves and isolation valves, which allow the turnout to be operated and maintained.

The City's turnouts are supplied water by JVWCD transmission pipelines which include the JA-2 Aqueduct (78-inch diameter), a 16-inch diameter transmission pipeline, a 27-inch diameter line, and a 24-inch pipeline located in 10200 South. If a project is proposed which is affected by these JVWCD facilities, the designers need to coordinate with the JVWCD to ensure they have the correct present conditions of their facilities prior to designing any City water facilities.

C. System Description - The following subsection presents a brief description of the City's culinary water system as of October 2003. It is given for information only and does not relieve the developer's engineer from having a thorough knowledge of the City's culinary water system master plans and subsequent studies performed for various pressure zones.

Table 2-1 presents a description of the various zones, which is also schematically presented in Standard Drawing No. CW-05.

Existing System Plan
Figure 2-1 from Water Master Plan

TABLE 2-1
DESCRIPTION OF CITY WATER SYSTEM

Zone	Receives Water From	Regulatory Reservoirs	Reservoir Top	Reservoir Bottom	Zone Furnishes Water To
PZ1 (4450')	16" JVWCD Pipeline 78" JVWCD Pipeline Cemetery Tank Airport Tanks PRVs from Zone 2 to Zone 1 33" JVWCD Pipeline	Cemetery Tank Airport Tanks	 4592' 4592'		N/A
PZ2 (4590')	16" JVWCD Pipeline 27" JVWCD Pipeline Pressure reducing valves	Old Bingham Tank	4720'		N/A
PZ3 (4750')	Grizzly Pump Station 6 PRVs Well No. 5	Barney's Wash Tanks	4910'		Zone 2
PZ3A 4510'	Zone 3	Barney's Wash Tanks	4910'		N/A
PZ3B 4550'	Zone 3	Barney's Wash Tanks	4910'		N/A
PZ4 (4910')	24" JVWCD Pipeline Well No. 3 Well No. 4 Well No. 6 D-111 Pump Station	Terminal Tank U-111 Tank	5050' 5050'		Zone 3
PZ5 (5060')	24" JVWCD Pipeline D-111 Pump Station	Jordan Hills Tank	5355'		Zone 4
PZ6 (5200')	D-111 Pump Station	Jordan Hills Tank	5355'		Zone 5
PZ7 (5360')	D-111 Pump Station				

Existing System
Hydraulic Schematic
Figure 2-2 from Water Master Plan

Table 2-2 shows the various reservoirs the City has in operation, or will have in operation once the system is complete. This table indicates the reservoir number, its location, the high water level and its capacity.

TABLE 2-2
CITY RESERVOIRS

Tank No.	Location	High Water Level (ft)	Capacity (MG)
Airport No. 1 Tank		4592’	1.5
Airport No. 2 Tank		4592’	2.0
Cemetery Tank		4592’	2.5
Grizzly Tank		4720’	4.0
Old Bingham Tank		4720’	2.0
Barney’s Wash No. 1 Tank		4910’	3.0
Barney’s Wash No. 2 Tank		4910’	3.0
Terminal Tank		5050’	3.0
U-111 Tank		5050’	4.0
Jordan Hills Tank		5355’	3.0
		Total	28.0

TABLE 2-3
CITY PUMPING STATIONS

Pump Sta. No.	Location	Design Flow (gpm)	Design Head (ft)	HP	Drive
Airport					
P-Z2-1		2,500	188	200	Constant
P-Z2-2		4,250	188	350	Constant
P-Z2-3		4,250	188	350	Constant
P-Z2-4		4,250	188	350	Constant
Grizzly Zone 3					
P-Z3-1		2,400	200	200	Constant
P-Z3-2		2,400	200	200	Constant
P-Z3-3		2,400	200	200	Constant
Grizzly Zone 4					
P-Z4-1		2,300	350	300	Constant
P-Z4-2		2,300	350	300	Constant
P-Z4-3		3,200	371	400	Constant
P-Z4-3		3,200	371	400	Constant
U-111					
P 100		600	305	150	Constant
P 200		1,200	320	300	VFD
	Total	35,250			

TABLE 2-4
JVWCD TURNOUTS
TO THE CITY

Approximate Location	JVWCD Source Pipe	City Pressure Zone	Water Capacity (gpm)	Peak Recorded Flowrate (gpm)	Contract Capacity (gpm)	Max Day Usage (gpm)
6600 S. 1700 W.	33-inch	1	4,800	4,426	1,500	1,719
7000 S. 3600 W.	JA-2	1	4,200	1,046	1,500	996
7800 S. 3600 W.	JA-2	1	15,500	3,952	4,000	3,485
9000 S. 1700 W.	16-inch	1	2,600	0	200	0
9000 S. 3600 W.	JA-2	1	3,800	2,998	1,000	1,719
7800 S. 3600 W.	16-inch	1	n/a	0	678	0
6200 S. 3600 W.	27-inch	2	1,600	3,265	1,000	3.213
7000 S. 3200 W.	16-inch	2	1,000	1,410	500	1,267
7800 S. 3200 W.	16-inch	2	1,000	1,200	678	1,106
8800 S. 3200 W.	16-inch	2	3,800	1,860	500	1,907
9000 S. 2700 W.	16-inch	2	3,500	0	500	0
9000 S. 3200 W.	16-inch	2	1,600	0	0	0
10200 S. 5800 W.	24-inch	5	6,000	5,895	3,000	3,846

TABLE 2-5
WELL SUPPLY

Name	Approximate Location	City Pressure Zone	Average Production (gpm)
Well No. 3	9000 South 5600 West	4	1,350[(a)]
Well No. 4	9300 South 5600 West	4	2,450
Well No. 5	8800 South 6000 West	3	1,250
Well No. 6	9200 South 6000 West	4	1,950

Notes:
(a) This well was rehabilitated in July 2000 and now produces 1,500 gpm.

TABLE 2-6
PRESSURE REDUCING
VALVES

Zone Boundary	Location	Meter Capacity (gpm)	Meter Size, Manuf. & Type	Control Valve Setting (psi)	HGL (ft)
Zone 2 to Zone 1	9000 South 2600 West		10”	52	4586
	8600 South 2700 West		6”	50	4574
	8200 South 2900 West		6”	50	4570
	7800 South 2900 West		6”	50	4568
	7400 South 3000 West		6”	51	4570
	7000 South 3200 West		10”	50	4576
	6600 South 2900 West		6”	50	4556
Zone 3 to Zone 3a	7400 South Jordan Landing Blvd.		8”	80	4745
	7200 South Jordan Landing Blvd.		6”	80	4755
	7000 Plaza Center Drive (3800W)		6”	80	4720
	7600 South Jordan Landing Blvd.		4”	80	4745
	7800 South Jordan Landing Blvd.		4”	80	4735
Zone 3 to Zone 3b	9000 South 3600 West		10”	45	4698
	9000 South 3600 West		12”	45	4698
Zone 3 to Zone 2	7800 South 3800 West		12	64	4696
	7800 South 3800 West		6	64	4696
	8500 South 4000 West		6	44	4705
	7000 South Plaza Center Dr (3800 W.)			55	4662
Zone 4 to Zone 3	New Bingham 5200 West		10	52	4890
	Old Bingham 4800 West		10	49	4886
	Old Bingham 4800 West			49	4886
	9000 South 5200 West N		10	45	4895
	9000 South 5200 West S		10	45	4895
	7800 South 5400 West		16	49	4880
	7000 South 5400 West		8	50	4884
Zone 5 to Zone 4	9000 South 2600 West		14	Varies	5025
	8200 South 6300 West		10	54	5025
Zone 6 to Zone 5	7800 South US-111		10	62	5171

2.2 WATER MAIN DESIGN

A. Quantity of Flow - Flow rates shall be determined from maximum potential population or land use of the area served. Unless otherwise approved, the following criteria shall be used:

If the number of housing units is known:

TABLE 2-7
UNIT WATER USE RATES

Land Use Type	Unit Rate (gpad)	Unit Rate (gpm/ac)
Residential		
Rural	1032	0.72
Low Density	1873	1.30
Medium Density	2809	1.95
High Density/Multi-family Residential	3517	2.44
Commercial	1325	0.92
Professional Office	1325	0.92
Public	3705	2.57
Enterprise Park	1281	089
Industrial	1281	0.89
Open Space	0	0
Park	n/a	1.24
Vacant	0	0

For a residential project, the quantity of flow should be derived from the above values and either the known number of units or an estimated number of units based upon the particular zoning for the area. In this regard, the City of West Jordan Community Development Department should be consulted. In general, estimates based upon rough approximations using ground slope are not approved because they can be very misleading

For other projects involving commercial, industrial, greenbelt areas or schools, etc., the preferable method is to estimate the flow requirements for each building or area and then combine the results. AWWA Manual No. M22 and the International Plumbing Code can be useful tools for this work. In the absence of such definition, Table 2-7 should be used.

After calculating the average daily flow, the following peaking factors shall be used to determine the system demands during conditions other than the average daily flow:

TABLE 2-8
PEAKING FACTORS

Demand Condition	Peaking Factor
Maximum Month Demand	1.6
Maximum Day Demand	2.4
Peak Hour Demand	4.5

If and when special studies of a particular area are conducted which demonstrate that different water use or peaking factors are appropriate, then those values may be used if approved by the Engineering Department. Table 2-8 should be used for pipes within the proposed development. For the design of master planned lines, please see the Engineering Department, as a diurnal curve and model will be used.

B. Fire Flow Requirements - The City of West Jordan follows the International Fire Code, Appendix B in determining fire flow requirements. Developers and their engineers must also comply with AWWA M31-Distribution System Requirements for Fire Protection in designing City water systems. Developers and engineers need to discuss this issue with the City's Fire Marshall in order to obtain the most current information.

C. Pressure - Water mains shall be designed to provide for maximum day service pressures between 50 psi and 130 psi with the following provisions:
   1. Service pressure shall mean the pressure at the house or building and shall be interpreted to be the static pressure available with the service reservoir at no more than one-half full.
   2. There is a strong desire to keep pressures between 50 and 80 psi since above that value the International Plumbing Code requires individual pressure regulators at the house or building on the customer side of the meter.
   3. Where there are no other alternatives and where pressures would exceed 130 psi, special approval is required from the City Engineer, and the developer will most likely have to install separate pressure regulators ahead of the meters, or a pressure regulating station on the main line, or pressure regulator on the meter setters, if there are six homes or less affected.

D. Velocity - Water mains shall be designed to provide a mean velocity not more than 5-feet per second under maximum day flow conditions. Under fire flow conditions, 10-feet per second will be allowed.

E. Hydraulics - Pipe analysis shall be performed with an understanding of both existing and future development. Hydraulic calculations shall assume a Hazen-Williams coefficient "C"=120. This analysis must be stamped and signed by a licensed civil engineer in the State of Utah and submitted to the Engineering Department for review. For reference, the following can be used:

TABLE 2-10

Pipe Size (inch)	Headloss (Ft/Ft)	
8	0.00483 Q1.85	
10	0.00163 Q1.85	
12	0.000670	Q1.85
14	0.000317	Q1.85
16	0.000165	Q1.85
18	0.0000932	Q1.85

*Using $h_L = \frac{(2.31Q)}{(Ch\ d\ 2.63)} \times 1.85$ where Q is in c.f.s. and d is in feet

F. Sizing of Mains - All water lines shall be subject to the City Engineer's sizing requirements. The lines may be increased in size to accommodate future development or to provide adequate fire flow protection. In general, water mains shall be a minimum of 8-inches in diameter. Fire hydrant runs serving more than one fire hydrant are to be included in this category (see Section 3.11). Exceptions are as follows:
   1. Dead end mains past the last fire hydrant must be a minimum of 8-inches in diameter. A dead end line is one, which cannot and will not be extended in the future.

2. Dead-end mains are to end with a fire hydrant.
3. Dead end mains over 1,000-feet in length are not allowed. Dead end mains, which are between 600 to 1000-feet in length, are to be a minimum of 10-inches in diameter for their entire length.
4. For commercial and dead-end lines, the size of the pipe shall be determined by the fire flow demand recommended by the International Fire Code for any structure served by the line plus "maximum day demand" or "peak hour demand", whichever is greater. The Fire Marshall may reduce the fire flow demand if a fire suppression system is installed inside the design structure.
4. Larger size mains may be required, particularly for transmission pipelines.
5. The design engineer is to review the City's Water Master Plan to determine sizes of pipes.

G. Pipe Networks - The City encourages the use of "looped" pipe systems while recognizing that not all lines can or should be looped. Most often this exception occurs on cul-de-sac streets where it is not feasible or practical to tie the main to another pipeline. Nevertheless, the developer's engineer shall strive to provide multiple sources of water for any subdivision or major commercial/industrial project.

2.3 SELECTION OF PIPE TYPES AND CLASS

A. General - These standards cover main lines up to and including 18-inches in diameter. See Section 2.2 for proper sizing of mains.

B. Main Pipelines – In general, all water lines up to 10-inch shall be class 52 ductile iron pipe or PVC C-900. All water lines larger than 10-inches shall be class 52 or better ductile iron pipe. In general, main lines, which are 14-inches and greater, shall be ductile iron pipe in accordance with Sections 3.0 and 4.0 of these standards. All Ductile Iron Pipe shall have polyethylene encasement conforming to AWWA C105/A21.5-99.

Where PVC (AWWA C900) pipe is selected, the following head classes shall be used:

Static Pressure	Class of PVC Pipe*
0 - 125 psi	150
126-175	200

*Of course, where pipes are laid in deep trenches, then the class size should be determined using AWWA C-900 or C-401.

Where Class 200 pipe is used for a portion of a project, the separation between Class 200 and Class 150 shall be at a valve; all fire hydrant runs are to be Class 200.

Steel pipe thickness shall be sufficient for the static pressure in accordance with Section 3.3, although the minimum thickness specified in that Section are for welding and corrosion purposes and in all normal cases govern the thickness selected.

Ductile iron pipe shall be selected with a thickness, which will be suitable for the pressure and laying condition in accordance with Tables 12 and 13 of AWWA C150 as approved by the Engineering Department.

C. Service Lines - These shall be ¾ or 1-inch or larger except as described below. In the 1-inch size, IPS polyethylene pipe is approved as described in Sections 3.5 and 4.7. The next larger size service line should be 2-inch which shall be type K copper. Larger service lines shall be steel pipe or PVC pipe. Service lines shall be capable of taking pressure up to the same level as the main line.

In instances where service pressures exceed 110 psi, it may be desirable to use ¾-inch service lines in lieu of 1-inch service lines to increase pressure losses at high flow volumes and promote water conservation. This decision should be discussed with and approved by the Engineering Department.

2.4 LOCATION OF LINES AND FIRE HYDRANTS (Streets)

A. Water Mains - The water centerline, wherever possible, shall be located 5-feet off back of curb in public right-of-way. See Standard Drawing No. CW-21 for separation requirements between any wastewater line and the water lines.

Water main lines shall be placed in the park strip on the low side of the street, which the City of West Jordan has defined as the north and on the east side of all public streets.

However, where storm drains or other facilities are in the center of the street, the water lines should be located to provide a minimum of 48-inches clearance between the outsides of pipe (measured on a horizontal plane). This pertains as well to any case of paralleling lines. Culinary water lines shall have 48 to 66-inches of cover, unless otherwise approved by the City Engineer. Special care is required where storm drains or other pipes cross above flexible pipes to avoid deflection problems when the other lines are installed. No joints are allowed in the water pipe within 10-feet of such a crossing.

Water mains shall be laid at least ten-feet horizontally from any existing or proposed sewer line. Separation distances shall be measured pipe edge to pipe edge.

Water lines shall not be installed at side or rear lot property lines. All lines will be installed within a public right-of-way.

Megalug, as a thrust restraint system for mechanical joint fittings, will be required on all lines 6-inch or larger at loops, bends, tees, valves, crosses, etc.

If the water line needs to be looped to pass another line or structure, the minimum clearance between the two utilities (except a sewer line) shall be 12-inches.
Pipe installation shall conform to AWWA C 600-99 through C606-97.

C. Fire Hydrants - The City of West Jordan Fire Department generally locates fire hydrants. The Engineering Department does recommend that where possible, a fire hydrant location corresponds to that required for a blowoff structure. That is because a fire hydrant will serve as and actually perform better than a blowoff assembly. Please refer to the International Fire Code for spacing of hydrants within various types of developments.

Fire hydrants shall be located a minimum of 2.0-feet behind the face of any curb as shown on Standard Drawing No. CW-20. In residential areas the hydrant should be placed at the center of the lot.

Where right-of-way widths exceed 80-feet, fire hydrant spacing shall be independent from one side of the street to the other side of the street. A fire hydrant on one side of the wide street will not be included in determining the fire hydrant spacing on the other side of the street.

Fire hydrants shall be installed at the entrance to all cul-de-sac streets.

D. Criteria for the Separation of Water Mains and Wastewater (Sewer) Lines

1. General - Proper separation of wastewater and water systems is necessary to reduce the potential for an outbreak of waterborne diseases. Sanitary sewers may leak and saturate the surrounding soil with sewage. This is caused primarily by structural failure of the sewer line, improperly constructed joints, and subsidence or upheaval of the soil encasing the conduit. A serious public health hazard exists when the water mains are depressurized and no pressure or negative pressures occur. The hazard is further compounded when, in the course of installing or repairing a water main, existing sewer lines are broken. Sewage spills into the excavation and hence enters into the water main. Additionally, if a water main fails in close proximity to a sewer line, the resultant failure may disturb the bedding of the sewer line and cause it to fail. In the event of an earthquake or man-made disaster, simultaneous failure of both conduits often occurs. The discussion below is excerpted from criteria established by the State of Utah Department of Environmental Quality, Division of Drinking Water.
2. Basic Separation Standards
   a. Parallel Construction: The horizontal distance between pressure water mains and sewer lines shall be at least 10-feet.
   b. Perpendicular Construction (Crossing): Pressure water mains shall be at least 18-inches above sanitary sewer lines where these lines must cross.
   c. Common Trench: Water mains and wastewater lines shall not be installed in the same trench.

   When water mains and sanitary sewers are not adequately separated, the potential for contamination of the water supply increases. Therefore, when adequate physical separation cannot be attained an increase in the factor of safety should be provided by increasing the structural integrity of both the pipe materials and joints.
3. Exceptions to Basic Separation Standards - Local conditions such as available space, limited slope, existing structures, etc., may create a situation where there is no alternative but to install water mains or sewer lines at a distance less than that required by the Basic Separation Standards. In such cases, alternative construction criteria as specified in Standard Drawing No. CW-21 should be followed, subject to the special provisions outlined below, and shall be preapproved by the City Engineer prior to finalization of design. Standard Drawing No. CW-21 contains a thorough discussion of various cases where less than 10-feet separation would be allowed.

4. Special Provisions
   a. The Basic Separation Standards are applicable under normal conditions for wastewater (sewage) collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist as determined by the engineer and/or Engineering Department.

b. Wastewater lines shall not be installed within 25-feet horizontally of a low head (5 psi or less pressure) water main.
c. In the installation of water mains or sewer lines, measures should be taken to prevent or minimize disturbances of the existing line. Disturbance to the supporting base of this line could eventually result in failure of this existing pipeline.
d. Wastewater Force Mains
   (1) Wastewater force mains shall not be installed within 10-feet (horizontally) of a water main.
   (2) When a wastewater force main must cross a water line, the crossing should be as close as practical to the perpendicular. The wastewater force main should be at least one-foot below the water line.
   (3) When a new wastewater force main crosses under an existing water main, all portions of the wastewater force main within 10-feet (horizontally) to the water main shall be enclosed in a continuous sleeve approved by the City Engineer.
   (4) When a new water main crosses over an existing wastewater force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.
   (5) In each of the four above cases, the water main shall be free of joints for 10-feet on either side of the crossing.

2.5 LOCATION OF WATER LINES (Easements)

A. General - Installation of culinary water lines within easements should be avoided where a reasonable alternate solution exists. Unless there are either physical limitations or extreme economic penalties, water lines should be installed within public rights-of-way, unless approved by the Engineering Department. Another acceptable instance would be where a looped system of benefit to a particular zone can be gained through the use of an easement. When easements are required, there shall be careful consideration of how the line is to be maintained and/or replaced, if necessary. Where easements are necessary and where the side slope (perpendicular to the pipe) exceeds 25 percent (1 vertical to 4 horizontal) then the plans shall clearly indicate appropriate contours within the easement.

   In general, the line within an easement shall be accessible by conventional maintenance vehicles traveling over paved roads or driveways unless otherwise approved. Service lines should not be connected to a main line within an easement unless specifically approved.

B. Width - Water easements for pipes up to 18-inches in diameter should normally be a minimum of 20-feet wide. However, additional easement width shall be required where the depths of pipe are excessive or where deemed necessary. The plans should clearly indicate any known block walls, pavement, trees or other obstructions within a proposed easement. Such items are contrary to Engineering Department policy and require special approval. Included with such approval may be a monetary obligation towards the operation and maintenance of the water line within the easement; also, the "as-built" drawings shall indicate such approval and such installations.

C. Pipeline Location - Pipelines shall generally be placed in the center of easements; only in unusual circumstances will a line be approved which is closer than 5-feet from the easement edge. Unless specifically otherwise approved, the line shall be straight without horizontal bends or deflections.

D. Easement Location - The full easement width shall be on one lot or property in such manner that access to the pipeline will not be obstructed by walls, trees or permanent improvements.

Where this requirement cannot be met without interfering with existing buildings, easements may straddle lot lines providing special approval is received and the water pipeline is not located on the lot lines.

E. Deeds - Deeds for easements shall provide for restrictions of permanent construction within easement to provide ingress and egress for maintenance.

F. Easement Provisions - Easements shall be provided as follows:
   1. For subdivisions - The owners of land included within the subdivision shall offer to dedicate, for public use, the water easements so designated on the final plat. Standard language is included in the City's Development Processing Manual.
   4. For other than subdivisions - Dedication of water rights-of-way shall occur by means of deeds of conveyance to City of West Jordan for all dedications other than those dedications created by subdivision plats on a standard City form, and as approved.

2.6 DEPTH OF WATER MAINS

The standard minimum depth of cover to the top of the pipe is 48-inches for all water lines. Projects constructed in higher elevations within the City may require a deeper minimum burying depth and will be determined by the Engineering Department. The standard maximum depth of cover to the top of pipe is 66-inches for all water lines, unless approved by the City Engineer prior to construction.

In achieving the above depths it must be recognized that numerous grade changes to achieve 48-inch depths of cover are not desirable and the designer shall blend the requirement for a reasonably straight pipeline with those for a relatively uniform depth.

Increases in depth may be required where future road improvements could potentially remove some of the existing cover or where there are other conflicting utilities. Pipelines placed in open, unpaved terrain shall generally have a minimum cover of 48-inches.

2.7 VALVE DESIGN

A. Materials - Valve materials shall conform to the following:
   1. Gate valves (3 inches to 12-inches) shall be no-rising stem, resilient seat, with ductile iron bodies. Valves from 14-inches to 24-inches shall be butterfly valves.
   1. Acceptable valve manufacturers are Clow and Mueller. All valves require specific submittal and approval.

B. Location - Isolation valves shall be placed:
   1. At the entrance to a cul-de-sac.
   2. At intervals not to exceed 800-feet in residential areas and 500-feet in commercial areas.
   3. At intersections on all branches of the system.
   4. At mainline connection for private fire lines and other private service line larger than three (3)-inches.
   5. Within 10-feet of the upstream and downstream ends of an augured or trenched casing.
   6. If valves are located in an undeveloped area, a vertical valve marker is required.

C. Construction Requirements - See Standard Drawing No. CW-155 for construction requirements.

2.8 LOCATION AND SIZE OF VALVES

Valves shall be located to allow for the isolation of particular pipe segments in the event repairs or replacements are needed, without being in the middle of intersections, it at all possible. In general, the following shall apply:

A. Valves shall be flanged at all branches at major intersections unless otherwise approved.

B. Valves are to be placed on all three legs on a "T" junction of piping.

C. Branches at minor intersections shall be valved to facilitate future repairs without causing multiple streets to be without water.

D. For distribution piping, longer reaches of pipelines shall require an in-line valve at intervals of no more than 800-feet except for lines 10-inch or larger, where valves shall be at intervals no greater than 600-feet.

E. Transmission pipe (20-inch diameter and above) valving is to be determined on a case-by-case basis and approved by the City Engineer.

F. Drain valves are to be placed where they can be drained. For instance, if a canal or storm water detention basin is close by, the engineer must consider using the facility to drain into.

G. All pipeline valves shall generally be the same nominal size as the pipeline.

H. Valves shall be placed near fire hydrants, points of curve, points of tangent, or common property lines.

I. Valves shall be placed at the mainline connection for private fire lines and other private service lines larger than 3-inches.

J. Valves shall be placed within 10-feet of the upstream and downstream ends of an augured or trenched casing.

K. Additional valves, beyond that shown above will be required if the pipeline(s) beyond the branch might continue in service when the adjacent valves are shutdown.

The general guidelines indicated above may apply in most cases, however, the City reserves the right to alter these general rules to provide for project specific requirements, as deemed necessary by the City.

2.9 AIR AND VACUUM ASSEMBLIES

A. Types of Valves

1. Air release valves allow the discharge of air, which accumulates at high points along the pipeline. The air is entrained in the water and when it accumulates at the high points, it creates a throttling effect similar to a partially closed valve.

2. Air and vacuum valves allow large quantities of air to be expelled during line filling and allow air to re-enter the pipeline during draining of the pipeline, whether planned or due to a rupture. These valves are located at high points along the line.
3. "Combination air release valves" combine both the air release and air and vacuum valves as described above and it is this type of valve, which is generally specified in the City system.

B. Location - Combination air release valves shall be located at all significant high points along the pipeline, as approved or required by the Engineering Department. Where feasible, the slope of the waterline shall be adjusted to place the high point and air release valve on a lot line, rather than matching the high point of the street centerline. On larger transmission lines, combination air release valves are to be placed on each side of the valve for air release and draining purposes.

C. Sizing - In order to somewhat simplify the selection of the combination air release valves, the following is provided as guidelines for determining the size:
1. Determine the maximum rate of flow which can occur in the line:

$$\text{Rate in CFS} = \frac{\text{GPM}}{7 \times 60} \quad \text{under filling conditions}$$

Rate in CFS = 0.087 (SD5)1/2 under draining conditions

S = Slope or gradient (ft. per foot)
D = Diameter of pipe in inches

2. Using the value in "1" above, the size should be:

CFS Rate	Valve Size
0-5	1-inch
5-15	2-inch

3. For most installations involving 8-inch pipelines, the valve will be 1-inch size.
4. For steel pipelines a further consideration is the collapsing pressure and the designer should investigate this in accordance with manufacturer instructions.

2.10 BLOWOFF ASSEMBLIES

A. General - Blowoff assemblies are placed at low spots in the line to facilitate line draining and to allow the removal of sediments, which accumulate in low areas of the pipeline. Standard Drawing Nos. CW-180 and CW-185 show 2 and 4-inch assemblies, respectively. Also, fire hydrants perform the same functions as a Blowoff, and therefore can substitute for them, providing a bottom outlet tee is used to connect to the main line (see Section 3.11). Design engineers are to use only blow-off valves when the use of a fire hydrant is not feasible.

On dead end lines (i.e., cul-de-sacs) fire hydrants need to be specified at the end of the line to provide for a blow-off and to clear the line. Final determination of location is to be made by the City Engineer.

B. Sizing - Blowoffs should be sized according to the following criteria:

1. In general, a particular section of pipeline should be capable of being drained within 2 to 4 hours.
2. The blowoff should be capable of creating a velocity of not less than 2.5-foot per second (fps) in the pipeline for the removal of sediments. For typical pressures between 45 and 100 psi, the following can create this velocity:

TABLE 2-11

Pipe Size (inch)	Blowoff Size (inch)
8	2 or 4*
10	4
12	4
Above 12	By special design

Notes:
*2-inch blowoffs can be used unless the reach being drained is extensive where a 4-inch blowoff is desirable.

2.11 DESIGN FOR PROPER FLUSHING

Proper flushing of water mains and the prevention of sediment buildup are important aspects of the City's maintenance program. Therefore, the following should be considered:

A. Unnecessary intermediate low points in the lines should be eliminated wherever possible to prevent spots for sediment accumulation.

B. The flushing techniques mentioned in Sections 6.3 and 6.5 should be followed.

C. Fire hydrants are encouraged as a replacement for blowoffs.

D. Looped systems are preferable to dead end systems providing unacceptable easements are not required for the looping.

E. Locate close to storm drain box or other conveyance.

F. Use diffusers whenever flushing the water system to reduce the water velocity and possible damage to the surroundings.

2.12 HORIZONTAL AND VERTICAL CURVES

A. General - In curved streets, the water line shall generally follow the street curvature, but not cross the centerline. Allowable joint deflections shall be the more stringent of those set forth below and the manufacturer's recommendations. Where there is a grade break exceeding the allowable deflections in a coupling or joint, then appropriate fittings will be required or a vertical curve should be used in lieu of the grade break.

B. PVC (AWWA C 900) Pipe - The standard laying lengths for PVC pipe is 20-feet. The pipe must not be bent to a lesser (tighter) radius than the minimum shown below. No or little deflection can be achieved at the joints.

TABLE 2-12

Normal Pipe Size (inch)	Minimum Radius Of Curvature (ft)
8	225
10	275

C. Steel Pipe - With bell and spigot type steel pipe, the maximum allowable deflection per joint shall be limited to 2-1/2 degrees. Using that value and standard lengths as follows, the minimum radius of curvature would be:

TABLE 2-13

	Minimum Radius of Curvature	
Normal Pipe Size (inch)	For 40-foot Lengths (feet)	For 20-foot Lengths (feet)
8-10	920	460

Obviously, for a tighter radius either shorter lengths must be used or fittings must be installed.

D. Ductile Iron Pipe - Eight-inch through 12-inch couplings are allowed up to 2-1/2 degrees of deflection on each side of the couplings for a total of 5-degrees. Couplings for 13-inch through 18-inch permit 1-1/2 degrees per side for a total of 3-degrees deflection. However, for the purposes of design, the following should be used:

Pipe Size (inch)	Total Deflection (degrees)
8-12	4
14-18	3

If less radius is needed or if the degree of curvature is tighter than can be achieved with standard length pipe and with the coupling limitations outlined above, then shorter lengths may be used. The following table illustrates this:

TABLE 2-14

		Minimum Radius of Curvature in feet Without Using Deflection Couplings For Pipe Length, L of:		
Nominal Pipe Size (inch)	Max. Allow. Deflection (Angle)	3.25-foot	6.25-foot	13-foot
8-12	4 degrees	45	90	180
14-18	3 degrees	67.5	135	270

If changes in grade or alignment cannot be accomplished with the use of couplings, then standard fittings are available with bends of 90, 45, 22-1/2 or 11-1/4 degrees.

2.13 WATER SERVICE CONNECTIONS

A. General
   1. All connections to a City main line must be accomplished without taking said main out of service, unless otherwise approved by the City Engineer.
   2. All connections shall comply with the International Plumbing Code.
   3. All connections shall not be closer than 3-feet, measured edge to edge of tee or tap.
   4. All connections shall be tapped at the center of the lot, and the service is to be perpendicular to the main to the individual lot.

B. Residential Lots – The complete service connection includes the corporation stop at the main, 3/4-inch IPS polyethylene tubing service line to the meter yoke, an angle stop, backflow angle valve, 18 and 21-inch diameter PVC meter box, and a cast iron frame and cover.
   1. The minimum depth of cover shall be 42-inches.
   2. The water meter shall be installed as follows:
      a. Between the curb and gutter, and sidewalk if a park strip is provided; or
      b. 18-24-inches behind the curb where only curb and gutter are provided; or
      c. At the center of the lot, where no curb and gutter, and sidewalk are provided.
   3. No meter shall be installed under the driveway approach.

C. Polyethylene Tubing – The poly tubing shall extend 17-feet beyond the top, back of curb into the lot. The dept of cover shall be at least 48-inches.

D. Water Meter – The water meter shall be installed as follows:
   1. Between the curb and gutter and sidewalk, if a park strip is provided; or
   2. Eighteen to 24-inches behind the curb where only curb is provided; or
   3. At the center of the lot, where no curb, gutter and sidewalk is provided
   4. No meter shall be installed in the driveway approach.

E. Multi-Family Units - Multi-family units shall be sized by determining the maximum fixture count as established in the International Building Code. The meter size shall be increased to accommodate outdoor watering.
   1. All multi family units consisting of 12 or more units shall not be allowed to individually meter each unit but must install a master meter.
   2. All condominium units shall be metered as determined by the Engineering Department. As a rule, individually owned units shall have an individual meter, however, based upon the number of total units, a master meter may be required as well.
   3. Apartment complexes shall be required to install a master meter.

F. Commercial Connections – Commercial connections shall be sized according to the peak domestic fixture count and outdoor use as determined by the Engineering Department. If the connection is required to be a 2-inch or larger, the service must be installed as a copper service.
   1. Commercial meters shall be installed within the right of way, at a location acceptable to the Utility Engineer.
      a. A water line service may not be connected to a fire line system.

G. Commercial Unit Ownership – All commercial connections shall have individual connections based on unit ownership.
   1. If one building site has one or more buildings and has one owner or one group of owners, such as a partnership or a condominium venture, but is divided into two or more units, only one connection will be allowed. An example may be a strip center, which is built on one lot but contains several stores. Only one service is provided.
   2. If several buildings are built on separate lots as part of an overall development scheme, one connection per unit will be required.
      a. A water service line may not be connected to a fire line system.

H. Construction Requirements - See Standard Dwg. Nos. CW-120, CW-135, CW-140, CW -145, CW-205, and CW-210 for construction requirements.

2.14 PROPER SIZING OF WATER METERS AND SERVICE LINES

A. General - The American Water Works Association (AWWA) publishes two excellent references for discussion of water meter sizing as follows:

AWWA Manual M6 – "Water Meters - Selection, Installation, Testing and Maintenance"
AWWA Manual M22 – "Sizing Water Service Lines and Meters"

As a guide, the information below has been excerpted from those publications.

B. Meter Types - The City provides the customer meters, which may change, based upon City needs and experience.

TABLE 2-15

SUGGESTED USES FOR EACH TYPE OF METER CLASSIFICATION (AWWA)

Meter Type	Suggested Use
¾-inch short 1-inch 2-inch compound	Customer with normal demands Residential, small to medium apartments Small businesses (barber shops, small hotels & motels) Filling stations Restaurants
Compound meters: 2 – 6-inch Fire Service Meters: 4-inch to 6-inch	Large hotels and motels Customers requiring high demands, or continuous flows Some manufacturing, refineries, petrochemical Public irrigation (no leakage) Pump discharge Large government installations
Compound meters: 2 – 6-inch Fire Service Meters: 4-inch to 6-inch	Most commercial & industrial Medium hotels & motels Special customers having high and low demands Schools Public buildings Laundries Large apartments

C. Meter Sizing - Water meters are designed to deliver a maximum flow for short periods of time with a lower flow capacity for sustained usage without damage or above normal wear occurring to the meter. The selection of the type and size of the meter should be based only on the flow requirement and the type of use not on the pressure loss through the meter. It should be noted however, that if the tap to the main line is a certain size, the meter is required to be that same size.

If there is a known expansion program or increased meter usage can be anticipated in the future, then provision should be made for larger facilities in the future. When this occurs, the meter should be installed for the needs at the time but also with a meter box and connections that are adequate for future requirements.

It should be remembered that the Engineering Department will select the meter type, which will meet the following requirements:

1. AWWA recommends that continuous flow service in the meter not exceed 30 percent of the maximum capacity.
2. AWWA further recommended that for design purposes the maximum capacity be valued at 80 percent of the rated capacity.
   Pressure losses through the meters may be illustrated as follows:

TABLE 2-16

Meter Type	Pressure Loss (psi) @ 30% of Max Capacity	at Designated Flow @ 80% of Max. Capacity
Displacement	0.5-1.1	6.3-8.6
Compound	2.5-4.2	5.8-8.9
Current (Turbine)	0.7-1.2	2.0-3.0

The sizing of the meter is dependent upon the correct establishment of a maximum flow rate. In this regard, Chapter 4 of AWWA Manual No. M22 can be consulted. In general, the meter should not be oversized and for all but residential or small commercial structure, the developer's engineer should check such items as fixture units and landscape irrigation in arriving at the proper meter size.

D Service Line Sizing - Proper service line sizing is a function of the maximum anticipated flow rates and the allowable pressure loss for adequate pressure. If pressure to the structure is questionable or if flows are anticipated to increase in the future, it is better to oversize the service line than to oversize the meter. As a guideline for the smaller installations the following service lines should be used with the respective meters:

TABLE 2-17

Meter Size (inch)	Service Line Size (IPS)(inch)*
¾	¾-inch poly**
1	1-inch poly
2	2-inch copper***

*Of course, larger sized than that shown can be used if justified hydraulically.
**See Section 2.3 discussing use of ¾-inch service lines in high-pressure areas.
*** 2-inch meters require a large meter box.

In order to judge the pressure loss through the service line, the following Table can be used:

TABLE 2-18
PRESSURE LOSS IN PSI PER 100 FT. FOR INDICATED FLOW

	Flow Rate (gpm)			
Service Line Size (inch)	5	10	20	50
¾-inch poly				
1-inch poly	1.12	4.04	14.51	79.0*
2-inch copper	0.04	0.15	0.54	2.93

*Obviously excessive, but shown for illustration.

In using the above table, remember that the losses are for 100-feet of pipe and that most service lines will be shorter.

2.15 FIRE HYDRANTS

A. Placement
1. Fire hydrants shall be placed according to the guidelines established by the International Fire Code.
2. A fire hydrant will be required at the end of all lines.
3. Additional fire hydrants may be required by the City Fire Marshal.
4. Where streets are wider than eighty (80)-feet, fire hydrant spacing shall be independent from one side of the street to the other side of the street.

B. Fire Flow Amount - The maximum number of fire hydrants required on site for any developer will depend on the existing flow conditions determined on site and the minimum flow requirements shown in the International Fire Code. Any variances from the code must be subject to the approval of the City Fire Marshal.

C. Materials - All fire hydrants shall be 54-inch bury, 6-inch barrel, 4 ½- inch steamer and 2 - 2 ½ nozzle hydrants, fire hydrants shall be Mueller Super Centurion or Clow Medallion.

D. Construction Requirements - See Standard Drawing No. CW-165, and CW-170 for construction requirements.

2.16 LOCATION OF METER BOXES, FIRE HYDRANTS, AND AIR RELEASE ASSEMBLIES

A. Meter Boxes - These installations shall be done according to Standard Drawing No. 3098 or other subsequent drawings for larger meters. The critical factor in all types of installations is to keep the service lines, and meters in the parkstrip between the sidewalk and the curb, and out of driveways.

B. Fire Hydrants - These shall be located at least 2-feet behind the curb per (see Section 2.4.B). Care must be taken to ensure that obstructions are not present which hamper the operations and/or maintenance of the hydrant.

C. Combination Air Release Assemblies - Locate these with particular attention to minimize the visual impact by locating them near property lines rather than in the middle of the front yard area.

D. Trees - Trees placed in the vicinity of a meter box, fire hydrant or air release assembly must be placed at least 10-feet from the facility.

2.17 STRUCTURAL REQUIREMENTS

A. Under Roads - All structures, joints, and pipe placed under public roads shall be of sufficient strength to support with an adequate factor of safety the backfill, road surfacing and H-20 loading per AASHTO Standard Specifications (truck loading with impact). Higher loadings may be as specified by the Engineering Department or as required by good design. Flanged joints are to be avoided and no mechanical joints will be allowed.

B. Other Pipes and Structures - Water lines designed to cross under or over other pipes or structures shall be protected from damage and shall be welded fabricated steel loops to prevent endangering the other pipe or structure. These fabricated steel lines shall be epoxy lined and tape wrapped. In this regard, particular attention should be given to the possibility and prevention of settlement caused damage. Also, where future replacement of any line may be extremely difficult due to the pipe or structure, special design consideration may be required. Any of the standard drawings, which detail various encasements or other protection, may be required in such instances.

C. Flexible Joints - Flexible joints, which will allow for differential settlements or other movement of water pipe lines or structures, adjacent pipe and adjacent structures, shall be provided where waterlines enter encasements or other structures. Flexible joints shall be within a minimum of 24-inches of such structure unless otherwise approved.

D. Thrust Blocks - These are required in the following locations:
   1. At abrupt changes in grade or alignment requiring tees or elbows
   2. At changes in pipe size
   3. At dead ends of lines
   4. At locations subject to sudden thrust, such as valves and fire hydrants

   Standard Drawings Nos. CW-75, CW-80, and CW-85 present dimensions and details for thrust blocks. Restrained joints may be used in the place of thrust blocks where blocks are impractical. In this case, the City Engineer must approve the installation, after review of the restraint design, and the minimum restraining length must be shown on the plans.

E. Steep Grades - Water lines laid on grades steeper than 10-percent, which are not under, nor intended to be under pavement should be examined for possible erosion protection. Where the slope exceeds 35-percent (1.43 horizontal to vertical) a redwood check dam (Standard Drawing No. CW-45) shall be installed across the trench line at 20-foot intervals to reduce erosion.

Slopes above 35 percent (1.43 horizontal to 1 vertical) shall require sand \ cement bags be placed along the trench line to reduce the flow of water within the pipe trench.

Where steep grades are present, ML&C steel pipe with welded joints may be preferable because of thrust considerations. Pipe without welded joints would require substantial anchorage to prevent separation.

F. Design for Earth Loads - Generally, because of the pipe materials specified and the relatively shallow depths of cover, specific design for earth loads is not necessary. Therefore, the subject will not be covered in any detail in these standards. However, the engineer should be aware of the following sources of information:
1. AWWA Manual No. M-11 covering steel pipe in all size ranges
2. AWWA Standard C900 covering PVC pipe in sizes 4-inch through 12-inch

G. Design for Soil Conditions - For steel pipes, 24-inches and larger, the design engineer must also consider the soil and backfill conditions to determine its corrosive strength.

2.18 SPECIAL CONSIDERATIONS FOR WELDED STEEL PIPE

Where joints are welded, it is possible to eliminate or reduce thrust blocks providing that the steel is not over stressed or the shear resistance by the soil to pipe movement is less than the thrust it is trying to resist. The subject matter is rather complex and will not be discussed in detail in this document.

As a special note, with steel pipe the deflection must not exceed 2-percent of the diameter as a result of both live and dead loads. This is to prevent the mortar lining and coating from cracking.

2.19 FIRE SERVICE LINES

Fire service lines are those lines from the water main to a building intended solely for fire suppression systems. No service line connections are allowed off of fire lines. The Engineering Department has jurisdiction for the design and inspection up to the double detector check backflow prevention assembly, which must be placed at any connection of the fire service line to the main line. The materials for these lines should be either PVC Class 900 pipe underground or ductile iron pipe above ground. The most commonly used sizes are 4, 6, or 8-inch. Above ground assemblies must be adequately treated to prevent freezing.

Section 7.0 – Cross Connections and Backflow Prevention, covers the requirements for the backflow prevention devices (approved ABPA approved detector check device).

2.20 SPECIAL REQUIREMENTS

A. Pressure Reducing Valve Stations

1. If a development crosses a pressure zone boundary, the developer may be required to construct a pressure reducing valve station (including SCADA controls), with prior approval subject to Engineering Department approval and Public Works Department input.
2. All pressure reducing valve station construction plans and specifications must be approved by the City Engineer.

B. New Transmission Lines
1. If a development is located in an area not currently served by the city culinary water system, the developer may be required to construct storage facilities, pumping facilities, and transmission lines. The ownership and maintenance of these improvements will become the cities upon completion of the work and the acceptance by the city. Private ownership of these types of improvements is not allowed.

C. Combination Air Suction and Release Vents
1. At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of air release valves. Automatic air relief valves shall not be used in situations where flooding may occur. Air suction is also desired at the same high point for line draining as required for maintenance.
2. See Standard Drawing No. CW-180 for typical Air Valve Structures construction requirements.

D. Air Suction and Relief Valve Vent Piping
1. The open end of an air relief vent pipe from an automatic valve shall, where possible as determined by the public water system manager, be extended to at least one foot above grade and provided with a screened (#14 mesh, non corrodible) downward elbow. Blow-offs or air relief valves shall not be directly connected to any sewer.
2. Piping of the vent pipe out of the street area to a vent riser (park strip or behind sidewalk location) will be required when the air vent is installed in an underground vault in the street.
3. See Standard Drawing No. CW-205, and CW-210 for typical Air Valve Vent construction requirements.

E. Chamber Drainage
1. Chambers, pits, or manholes containing valves, blow-offs, meters or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer. They shall be provided with a drain to daylight. Where this is not possible, underground gravel filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage. Where a chamber contains an air relief valve, and it is not possible to drain to daylight, the vent pipe from the valve shall be extended to at least one foot above grade. The vent pipe shall comply with 1.09 D.2. above. Only when it is both impossible to extend the vent pipe above grade, and impossible to provide a drain to daylight may gravel filled sump be utilized to provide chamber drainage (assuming local ground conditions permit adequate drainage without ground water intrusion.)
2. See Standard Drawing No. CW-180 for typical Buried Vault Accessories construction requirements.

F. Backflow Prevention Devices - If a developer intends on using culinary water for irrigation purpose an appropriate backflow prevention device must be installed.

G. Detecta-Check Valves
   1. Detector-Check valves or fire line meters shall be installed at all connections of a private fire line to the public culinary water system, and shall be subject to review and approval by the Engineering Department.
   2. See Standard Drawing No. CW-225 for typical check valve construction requirements.

H. Manhole and Cover - See Standard Drawing CW-230 for construction requirements.

I. Water Sample Station - See Standard Drawing No. CW-200 for typical water sample station construction requirements.

2.21 OTHER DESIGN CONSIDERATIONS

The designer/contractor will also need to take the following items into consideration when designing or constructing City water facilities:

A. Reservoirs and pumping stations are covered in Section 9.0.

B. The Public Works Department is required by the Utah Department of Environmental Quality to sample and analyze the potable water within its distribution system for bacteriological quality. Each potable water sample is collected from a sampling station (Standard Drawing No. CW-200). If the number of active service connections increase within the City's distribution system, such that another sampling station is required, a developer may be required to install at no cost to the City the sampling station at an approved location within the development. Water sample stations are currently required with all new subdivisions and every 150 lots thereafter, i.e. 400 lot subdivision would require 3 sample stations. These sample stations are to be provided at locations approved by the City Engineer.

C. The impact of the proposed system on the existing system will be reviewed by the Engineering and Public Works departments as part of the private development process. The developer may be required to construct additional water lines off of the project in order to provide adequate water supply.

D. The areas to be supplied through the proposed development will be considered and the method of service to those areas determined. An increased pipeline size may be required in order to provide for future development.

E. The water system storage requirement will be considered for each development.

****

SECTION 3.0

MATERIALS

3.1 GENERAL REQUIREMENTS

This section discusses the materials involved in culinary water pipeline distribution systems and associated construction activities. The materials selected have been chosen for their strength, durability and ease of maintenance. All materials, unless specifically approved otherwise, shall be new and unused.

Where applicable, American Water Works Association (AWWA) or other standards have been referenced and it shall be the responsibility of the developer/engineer/contractor to be familiar with those standards to insure compliance. Titles corresponding to the specific numbers are given in the reference section of the standards.

In some instances, particular manufacturers and product names have been mentioned as being approved. Other products may also meet the requirements, but must be first be approved by a Products/Materials Committee consisting of Engineering and Public Works staff and any other affected departments. The Committee will meet and make a recommendation to the City Engineer who will issue a decision in writing. One factor, which may be considered by the Engineering Department in any consideration of other products, is the need for some degree of standardization.

If at any time the Engineering Department believes that the use of a specific product must either be halted or changed, the City Engineer has the authority to make the change providing the decision is based upon an engineering, performance or maintenance evaluation.

3.2 TESTING AND FINAL ACCEPTABILITY OF MATERIAL

The Engineering Department will require such tests and certifications as deemed necessary to show that the specified materials have been employed. Notwithstanding prior factory or yard inspections, the City Engineer will have the right to reject any damaged or defective materials found on the job, which will affect the durability or performance of the installation and order its removal from the site.

3.3 MAIN LINE PIPE MATERIALS

General accepted main line pipe materials consist of either polyvinyl chloride (PVC), steel or ductile iron pipe (DIP) as described in this section. All materials which may contact drinking water shall be ANSI – certified as meeting the requirements *of 'NSF Standard 61, Drinking Water System Components'*. All pertinent water system components should be appropriately stamped with the NSF logo for field verification. The following pipe materials and sizes apply to work within the City of West Jordan water service area:

Pipe Diameter (inches)	Pipeline Type
8,10, 12	PVC or Ductile Iron
16,18,20,24	Ductile Iron
24 and above	Ductile Iron & Steel (ML&C)

A. PVC Pipe – All materials which may contact drinking water, including plastic pipes, gaskets, lubricants and O-rings shall be ANSI – certified as meeting the requirements of *'NSF Standard 61, Drinking Water System Components'*. All pertinent water system components should be appropriately stamped with the NSF logo for field verification. Please refer to the City's *'Construction Specifications Manual'* for detailed information regarding this pipe type.

B. Steel Pipe.

1. Pipe. Steel pipe shall conform to the quality and strength requirements of AWWA C200 or as specified below. That standard pertains to electrically butt-welded straight-seam or spiral-seam pipe and to seamless pipe 6-inch in diameter or larger.

   The steel pipe shall conform to one of the following:

TABLE 3-2

Specification	Grade	Min. Yield Point (psi)
ASTM A238	Grade C	30,000
	Grade D	33,000
ASTM A570	Grade 30	30,000
	Grade 36	36,000
	Grade 40	40,000
	Grade 45	45,000

The stress in the steel pipe shall not exceed the higher of 15,000 psi or one-half the designated working pressure except that the following minimum thickness shall be used:

TABLE 3-3

Normal Inside Diameter (inch)	Minimum Thickness (inch)	Minimum Pressure* For Thickness Specified (psi)
8	0.105 (12 gage)	394
10	0.135 (10 gage)	405
12	0.135 (10 gage)	338
14	0.135 (10 gage)	289
16	0.135 (10 gage)	253
18	0.179 (8 gage)	298

*Assuming 15,000 psi stress and the formula below:

$P = \frac{2ST}{D}$ where

P = Pressure (maximum working)
S = Allowable stress (15,000 psi or one-half yield)
T = Pipe wall thickness (inches)
D = Outside diameter (inches)

The gages specified above consider the thickness required for welding as well as that required for external loads and a corrosion allowance. Another factor for consideration in some steel lines is earth loads. AWWA Manual M-11 should be consulted in this regard.

The pipe shall be essentially round. The outside circumference shall not vary more than (plus or minus) 1.0 percent from the nominal outside circumference based upon the diameter specified (except for the ends that are discussed below).

The pipe shall not deviate by more than 1/8-inch from a 10-foot long straight edge held against the pipe.

The pipe lengths, generally 40-feet long, shall be furnished with a tolerance of (plus or minus) 2-inches. Random lengths shall be furnished in lengths averaging 29-feet or more, with a minimum length of 20-feet.

2. Pipe Ends. Various end treatments can be supplied as discussed in AWWA C400 and briefly listed below:
   a. Ends for mechanical coupled field joints – These are either plain, grooved or banded.
   b. Ends for lap joints for field welding – These shall have a bell end pressed or rolled without hammering. The services shall be ground smooth. Joints shall permit a lap when the joint is assembled of at least 1½-inches.
   c. Plain end pipe – These shall have a plain end right angle cut.
   d. Beveled ends for field butt welding – These, where specified, shall have a bevel with is 30-degrees (+50 degrees – 0 degrees) when measured from the pipe axis.
   e. Ends fitted with butt straps for field welding – The butt straps may be made in halves or as complete cylinders.
   f. Bell-and-spigot ends with rubber gaskets – These shall have bell ends that are made without hammering. Spigot ends shall be formed or fabricated to the required shape to retain the gasket. The gasket shall be designed and fitted as the sole element dependent upon to make the joint watertight. The gasket shall meet the requirements of AWWA C400.
   g. Plain ends fitted with flanges

   The allowable tolerance at pipe ends is discussed in AWWA C400 and summarized below.

   a. For bell and spigot – Clearance between O.D. of spigot and I.D. of bell shall be between 0.2 – 0.06-inches.
   b. For lap joint – I.D. of bell shall be 1/32 – 3/16-inches greater than O.D. of spigot.
   c. For plain ends (incl. Beveled or butt straps or flanges) – O.D. within 4-inches of end shall be –1/16-inch or +1/8-inch from specified O.D.

3. Hydrostatic tests. Each pipe shall be tested by the manufacturer to a pressure not less than that determined by:

$$P = \frac{2ST}{D}$$

Where S = 0.75 times the minimum yield strength of the steel and the other items are as discussed earlier.

4. Mortar Lining and Coating (ML & C). Unless otherwise approved or as revised below, all steel pipe shall be mortar lined and coated in accordance with AWWA C205 which covers shop applied lining and coating. Cement shall be type II, ASTM C150.

Cement Mortar Lining

Cement mortar lining shall be uniform in thickness except at joints or other discontinuities. Ends of lining shall be left square and uniform and the lining holdback shall be as specified for the particular type of joint.

TABLE 3-4
CEMENT MORTAR LINING THICKNESS

Normal Pipe Size (inches)	Lining Thickness (inches)	Tolerance (inches)
8 - 10	5/16	-1/16 + 1/8
12 - 16	3/8	-1/16 + 1/8
18	1/2	-1/16 + 1/8

It should be noted that the City requirements for thickness exceed those of the AWWA standard. Also, it should be noted that no wire fabric reinforcement is required for any lining of specials less than 24-inches in diameter.

Cement Mortar Coating

Cement mortar coating shall be a reinforced coating over all outside surfaces of the pipe and specials. The coating shall be of a uniform thickness except at joints or other discontinuities in the pipe. Ends of coating shall be left square and uniform and the coating holdback shall be as specified for the particular type of joint.

TABLE 3-5
CEMENT MORTAR COATING THICKNESS

Nominal Pipe Size (inch)	Coating Thickness (inch)	Tolerance (inch)
8 –10	½	- 0 + 1/8
12 – 16	¾	- 0 + 1/8
18	1	- 0 + 1/8

It should be noted that the City requirements exceed those of the AWWA standard.

Reinforcement for the coating of pipe section shall be one of the following as specified by the supplier:

a. Spiral wire - 15 gage @ max. 1-1/4-inch spacing with wire meeting ASTM A82.
b. Wire fabric - 2 x 4 steel wire mesh, 13 gage each way meeting ASTM A185.
c. Ribbon mesh - 1 x 1 mesh of 18 gage wire or 1-1/2 x 1-1/2 mesh of 17 gage wire, all meeting ASTM A82.

Field Joints

The materials and construction methods for field joints shall be as discussed in Section 4.

5. Electrically Bonded Connections. Two metal jumper rods are required to form an electrically bonded connection between all steel pipe joints that are not welded, except at insulating couplings called for on the plans.

   The jumper rods shall be either 3/8-inch diameter rods or 1/4 x ½-inch bars. They shall be at least 7-inches long with an offset of ¼-inch in the middle 3-inches. No welding shall take place in the middle 3-inch section.

6. Factory Tests and Inspection. All materials shall be inspected and tested in a normal air-dry condition by the manufacturer prior to shipment for conformance to the stated requirements. The Engineering Department shall at all times have the right to inspect the work and materials in the course of manufacture and to make or witness such tests as required in these specifications, or as deemed advisable. in lieu of the preceding, the manufacturer shall upon request submit a certificate certifying that the materials meet the requirements of this specification. All testing will be done in recognized testing laboratories within the State of Utah approved by the City Engineer.

7. Welded Joints. One of each section shall be swaged out to form a female or bell end which shall permit the male or spigot end to enter approximately one-inch with a clearance of approximately 1/32-inch. The spigot end shall be "sized" to permit it to enter the bell end of the adjacent section and the weld bead shall be ground flush for the distance it is to enter the bell end.

8. Butt Strap Closures. The butt straps shall be the same thickness as the pipe wall but not less than 10-gauge, at least 10-inches wide and rolled to fit the outside cylinder diameter, and shall be centered over the ends of the pipe sections they are to join. A standard 5-inch pipe half coupling shall be shop welded to the top section of the butt strap to permit access for mortar lining the inside of the joint. The coupling shall be sealed with a standard 5-inch plug field welded to the coupling.

C. Ductile Iron Pipe. – The City allows the use of this pipe type for main lines which meet the following requirements:
   1. Pipe. The pipe shall conform to AWWA C151 for both quality and strength. Each pipe shall include the letters "DI" or word "DUCTILE" to indicate the pipe material.

2. Joints. These shall be of the rubber gasket push-on joint type conforming to the requirements of AWWA C111 and being of the "tyton" type.
3. Fittings. All fittings shall conform to AWWA C110.
4. Lining and Coating. Unless otherwise approved, the internal surfaces shall be lined with a uniform thickness of cement mortar and then sealed with a bituminous coating in accordance with AWWA C104.

   Outside protective coatings are dependant upon the soil type in which the pipe will be buried. The engineer is to evaluate this issue and provide a recommendation along with backup information to the City Engineer for review and approval.

Construction of this pipeline type may require full-time inspection from off loading of the material to completion of testing.

3.4 MAIN LINE FITTINGS

A. Ductile Iron Fittings. These fittings shall meet the requirements of AWWA C110. All fittings shall be rated for 250 psi. This standard covers but is not limited to fittings with combinations of ends including mechanical joints, plain end, flange, push joint. The fitting types are as follows:

   90, 45, 22-1/2, and 11-1/4 degree° bends

   Tees and crosses, reducers, caps and plugs, connecting pieces (MJ sleeve and MJ adapters), flanged bends, flanged tees and crosses, flanged reducers.

   Ductile-iron compact fittings, per AWWA C153, are allowed.

   It should be understood that care must be exercised to not mix mechanical and flange joint ends since they will not mate. Bolt ends shall be coated with Poly FM grease and each fitting wrapped in 10-mil Polyethyleen sheeting after installation.

B. Flanges, Bolts and Gaskets. They shall be flat-faced and meet the requirements of AWWA C207 and should be AWWA standard steel hub flanges, Class E (275 psi) (these flanges meet ANSI B-16.5). The flanges shall be marked with the size, name or trademark of manufacturer and with the AWWA class, i.e. “E".

   Bolts and nuts are to be provided as indicated in the City’s *‘Construction Specifications Manual’*. Gaskets shall be of the drop-in gasket type, 1/8-inch thick.

TABLE 3-5

Pipe Size (inch)	Bolt Hole Dia. (inch)	Bolt Dia. and Length (inch)	No. Of Bolts
8	7/8	¾ x 3-1/2	8
10	1	7/8 x 4	12
12	1	7/8 x 4	12
14	1-1/8	1 x 4-1/2	12
16	1-1/8	1 x 4-1/2	16
18	1-1/4	1-1/8 x 5	16

The inherent problem with flanges is that they are rigid and do not provide flexibility. Two keys to their installation are (1) uniform tightening of the bolts, and (2) prevention of bending or torsional strains. Proper anchorage is important to meet the latter objective.

C. Mechanical Joint Fittings. This is a bolted joint of the stuffing box type. Each joint has a bell provided with an exterior flange having bolt holes or slots, and a socket with gaskets to receive the plain end of the pipe or fitting. The joint also has a sealing gasket, follower gland with boltholes and tee head bolts with hexagonal nuts.

The mechanical joints shall meet AWWA C111. That standard covers the joint as well as gaskets and bolts.

TABLE 3-6

Pipe Size (inch)	No. Bolts	Bolt Diameter & Length (inch)
8	6	¾ x 4
10	8	¾ x 4
12	8	¾ x 4
14	10	¾ x 4-1/2
16	12	¾ x 4-1/2
18	12	¾ x 4-1/2

D. Flexible Couplings. These are designed to connect plain end pipes with a mechanical compression joint to provide a stress relieving, flexible, leak proof joint. They can be ordered in steel or cast iron pipe sizes (note: C900 PVC pipe has same O.D. as cast iron).

E. Transition Couplings. These are used to connect pipes of the same nominal size but different materials. Steel and PVC pipes can be connected to one another.

F. Flanged Coupling Adapters. These are used to connect plain end pipe to flanged valves, pumps, meters, etc. They eliminate the need for both a flanged spool and coupling. Generally, they are available in sizes through 12-inches.

G. Insulating Couplings. These are used to stop the flow of electric current across the joint by means of an insulating boot.

H. Special Steel Pipe Fittings. AWWA C208 covers special fittings such as elbows, tees, crosses, reducers, etc., and should be consulted for a specific application.

3.5 SERVICE LINE MATERIALS AND FITTINGS

The materials covered in this section include the service line pipe, corp stops, and saddles as well as the valves inside the meter box. Where specific manufacturers' products are listed, it should be understood that other products that are equivalent may be used if approved in writing. Also, see Standard Drawing Nos. CW-100, CW-105, CW-110 for typical installations and Sections 2.13 of these standards for design and construction considerations. This section is written as if the minimum

service line size is 3/4-inch. However, in certain high pressure areas ¾-inch service lines, with approval, may be used. In those cases, the fittings shall be selected accordingly.

A. Polyethylene Pipe (IPS). Polyethylene pipe material is approved for all service lines from ¾-inch to 2-inches.

B. Copper Pipe. Copper pipe material is approved for all 2-inch service lines and above. The pipe shall be Type K soft copper tubing. Solder fittings shall be soldered with solder containing no lead; instead, it shall be a blend of copper, phosphorous and silver.

C. Service Saddles. These shall be of the double strap type made of bronze with bronze nuts. The thread shall be iron pipe size. They shall be Mueller or Fordor approved equal See Standard Drawing No. CW-105).

D. Corporation Stops. These shall be bronze with a IPS male thread, both ends. Three-quarter (3/4)-inch stops and 2-inch corporation stops shall be of the ball valve type. The outlet for the pipes shown below shall be as shown on Standard Drawing No. CW-105.

D. Meter Yokes. These shall be bronze and in the one-inch size they shall be a standard angle meter stop. Refer to Standard Drawing No. CW-130 for additional information.

3.6 METER BOXES AND VALVES

The meter boxes for ¾-inch and 1-inch meters are to be ABS, cut-to-length boxes with a cast iron lid as shown on Standard Drawing No. CW-130. Traffic lids are not required or approved since the meter boxes are required to be placed outside the traveled right-of-way, including driveways.

The meter boxes for 2-inch meters (4x4 box) shall be concrete with a concrete cover and rectangular concrete reading lid according to Standard Drawing No. CW-130. Traffic lids are not approved since the meter boxes are required to be placed outside the traveled right-of-way, including driveways.

3.7 WATER METERS

Water meter types and manufacturers will be specified by the Public Works and Engineering departments and provided and installed by the Developer/Contractor for ¾-inch meters. Meters larger than ¾-inch shall be installed by the contractor with an onsite inspection by the Engineering Department inspectors.

3.8 MAIN LINE VALVES

A. Butterfly Valves
   1. General. Butterfly valves shall be tightly closing, rubber-seated valves conforming to AWWA C504. Valves must be Class 150-B designed for tight shut-off up to 150 psi. Valve disc shall rotate 90 degrees from fully open to tightly closed position.
   2. Valve body. Shall be cast iron with intregally cast mechanical joints, ends for the pipe or flanged ends.
   3. Valve operators. Shall be of the manual traveling-nut type. Operators shall be equipped with a 2-inch AWWA square operating nut. They shall be sealed and gasketed and lubricated for

underground service. The operator shall be capable of withstanding an input torque of 450-foot-pounds (ft.-lbs.) at extreme operator position without damage.

4. Painting. See Section 3.16.
5. Marking. The manufacturer shall show on the valve the valve size, manufacturer, class and year of manufacture.
6. Approved valves. Shall be AWWA approved M & H 450, tested up to 250 psi.
7. Number of turns. The number of turns to open or close is as follows:

B. Resilient-Seated Gate Valves. This specification pertains to resilient-seated gate valves for underground service 3-inches to 12-inches in size where design-working pressures are less than 200 psi. Resilient-seated gate valves shall meet the requirements of AWWA C509 specifications and shall generally be of the same size as the main in which they are installed. All such valves shall be of the non-rising stem type, with O-ring seal, equipped with 2-inch square operating nut, which shall turn to the left in a counter-clockwise direction to open the valve. Valve bodies and gates are to be epoxy coated and shall be manufactured of ductile iron with internal working parts machined from the grades of bronze specified as follows:

Part	Grade of Bronze AWWA C509, Table I
Stem	E
Stem Nut	A

Currently approved valves are manufactured by the Clow Corporation and the Mueller Company.

See Section 3.16 for painting and coating requirements.

C. Plug Valves. Special approval required.

1. General. This is a special type of valve which must be reviewed by the Engineering Department prior to receiving approval for its installation. The Engineering Department will consult with the Public Works Department on issues related to this type of valve. Plug valves are to be used where the water main pressures are expected to exceed 150 psi or where required by the Engineering Department. They shall be pressure lubricated, venturi pattern type with flanged ends and are to be epoxy coated.
2. Valve operators. When located below ground, they shall be spur gear operated with watertight gear housings, lubricant pipe and road box; then located above ground or in vaults, they shall be worm gear operated. Outside locations shall include watertight gear housings.
3. Painting. See Section 3.16.

D. Tapping Saddles (Service Saddles) and Valves. Special approval only. Must be reviewed by the City Engineer prior to approval. The Engineering Department will consult with the Public Works Department on issues related to this type of material. Contractors are not allowed to hot-tap the City's water lines. The City Engineer will consider how many people will be affected, outage problems, night time shut-downs, etc. in his/her consideration of this approval.

1. Tapping saddles. Tapping saddles shall be of material specifically designed to withstand the strains and vibrations of the tapping machine. Saddles smaller than 2-inches shall be double strapped brass. Saddles of 2-inches or larger are to be stainless steel. The tapping sleeve must have gaskets at each end of the sleeve. Sleeves with only a O-ring around the tapped hole are not approved. The City reserves the right to have hot-taps performed, or cut in tee, where line size is the same size as the hot-tap.

Approved tapping sleeves are as follows:

Sleeve	Use
Smith Blair 665	Stainless steel flange 6-inch to 12-inch

Note: Larger sizes require special approval.

Six-inch hot-taps are only allowed on existing mains and only at the City's discretion.

2. Tapping valve. These shall meet all of the requirements under "gate valves" in the preceding section with the exception of items such as oversized seat rings to allow entry of the tapping machine cutter.
3. See Section 3.16 for painting and coating requirements.

F. Valve Box and Cover. The valve stack shall be cast iron, 8-inches in diameter (See Standard Drawing No. CW-155.

The valve box cap shall be of the heavy duty, long body type.
Approved is:

1. D&L Supply M-8040. Sixteen (16)-inch top, 36-inch base, waer lid (gate valves).
2. D&L Supply M-8042. Twenty-six (26)-inch top, 36-inch base, water lid (butterfly valves).

Developer/Contractor bury depths may require an extension, depending upon the depth of the valve: These shall be:

1. D&L Supply M-8062. (24-inch)
2. D&L Supply M-8064. (36-inch)

The valve box caps shall be painted the same as the hydrant materials.

3.9 COMBINATION AIR RELEASE ASSEMBLIES (Standard Drawing No. CW-180)

A. Mechanical Assembly. As discussed in Section 2.9, the combination air release assembly has both the features of an air release valve and an air and vacuum valve. Both units shall be housed in a cast iron body and all internal parts such as the float, bushings, level pins, seat and baffle shall be either stainless steel or brass as furnished by the manufacturer. All assemblies shall be rated at 300 psi maximum operating pressure. Approved assemblies are as follows:

Size (inch)	GA Industries Valve No.	Height (inch)	
1	945	10	FIPS x FIPS
2	945	12	FIPS x FIPS
3	945	15	FIPS x FIPS
4	945	17	FIPS x FIPS

*Used only where working pressure under 125 psi for one-inch and 165 psi for large sizes.

The inlet threads shall be iron pipe threads of the same size as the valve.

B. Metal Housing or "Can". Shall be per Standard Drawing No. CW-180.

C. Service Lines. Type K soft copper per Section 3.5. There shall be a corporation stop at the main per Section 3.5.

D. Ball Valves. Watts FBV-3L, ¾-inch to 3-inch, with a female iron pipe thread on each end and tee head.

E. Guard Posts. See Section 3.17.

3.10 BLOW-OFF ASSEMBLIES (Standard Drawing Nos. CW-185, CW-190 and CW-195)

A. 2-inch Blow-Off. Reference Standard Drawing No. CW-195. Materials shall be as follows:
1. Service line - Type K copper Section 3.5 with a corp stop and saddle at main per Section 3.5.
2. 2-inch Ball valve - James Jones 1900 or Ford B11-777 with female iron pipe thread on each end and tee head.
3 Vault - The same as for a meter installation up to one-inch, see Section 3. 6.
4. Plastic plug - This shall protect top of ball valve.

B. 4-inch Blow-Off. Reference Standard Drawing No. CW-190. Materials shall be as follows:
1. Service line – 4-inch PVC per Section 3.8. There shall be a bottom outlet tee on the main per Section 3.4, which also discussed other miscellaneous fittings.
2. 4-inch valve – Gate valve per Section 3.8.
3. Flanged spool - Made of ductile iron per Sec. 3.4.
4. 4-inch brass nipple.
5. 4-inch Angle Meter Valve - Approved is Clow/Rich No. 125 all bronze wharf hydrant with 4-inch iron pipe thread inlet and one 4-inch outlet.
6. Vault - Concrete box with cast iron cover. Approved are Brooks 72 PB which is 17x 41-inch or Quikset 1444 which is 16x 44-inch. Both shall have cast iron covers.
7. Guard Posts - Required where an above ground blowoff is located in undeveloped areas.

3.11 FIRE HYDRANT ASSEMBLIES (Standard Drawing No. CW-165 and CW-170)

A. Hydrant Type. Fire hydrants for all areas shall meet AWWA C502, and have a 6-inch flanged inlet with two 2-1/2-inch and one 5-inch nozzle outlets with National Standard fire hose threads. The outlets shall be protected with caps attached to the hydrant head with a chain. Other specific requirements are:
1. The hydrant upper portion (above ground) may consist of either one or two sections.
2. Hydrant materials are listed in AWWA C502.
3. Hydrants shall be designed for a minimum working pressure of 150 psi (per AWWA C502).
4. Hydrant flanges shall contain six equally spaced boltholes of 7/8-inch diameter on a 9-3/8-inch diameter.
5. All hydrants shall be permanently marked with the manufacturer's name and the year of manufacture.
6. Caps shall be metal-type, unless the standard product of the manufacturer is plastic.

Approved fire hydrant manufacturers are Clow or Mueller. Fire hydrant type and location are to be approved by the Fire Department and Public Works Department.

B. Hydrant Lateral. Six-inch ductile iron pipe shall be used. Hydrant laterals shall be ductile iron. See Section 3.3 for material specifications. Also see Section 3.4 for fittings description. Thrust block sizes are covered in Standard Drawings 3080, 3085 and 3090. Where the fire hydrant also serves as a blowoff, the tee in the line shall be a "bottom outlet tee" specially made so that the flow will scour the bottom of the main line.

C. Hydrant Valve. Shall be a 6-inch valve (see Section 3.8) with flange x ring-tite ends for Ductile Iron pipe. The valve shall be stacked to the surface using materials discussed in Section 3.8.

D. Painting. See Section 3.16.

E. Spools and Bury. A 6x6 flanged extension spool shall be used between the bury and fire hydrant. The spool shall be made of cast or ductile iron and it shall be painted in accordance with Section 3.16.

Hydrant buries shall be a 6-inch inside diameter and made of cast iron conforming to ASTM A-126. The burys shall be one piece with the top having a flange drilled with 6 holes to receive the extension spool or hydrant. The bottom shall have a 90 degree bend with a "ring-tite" end for meeting the horizontal pipe. Burys are generally available in 30-inch, 36-inch, 42-inch and 48-inch lengths.

F. Bolts. Notched break-off bolts shall be used to attach the fire hydrant to the extension spool.

3.12 PIPE TRENCH MATERIALS

Refer to Standard Drawing No. CW-25 for trench cross section terminology.

A. Within Pipe Zone. The pipe zone extends from the bottom of the trench to 12-inches above the top of the pipe. The material within this zone shall be clean, well-graded imported sand with sizes within the following ranges:

Sieve Size	Percent Passing
No. 4	100
No. 8	80 – 95
No. 200	0 - 10

The material supplied within the pipe zone shall be compacted to a minimum 95-percent density.

B. Above Pipe Zone. The materials shall conform to the requirements of the City's *'Construction Specifications Manual'*. In the absence of stricter requirements, the material above the pipe zone shall be native material that does not contain rocks larger than 6-inches and shall be made so graded that at least 40 percent of the material passes the No. 4 sieve. The material supplied for the area above the pipe zone shall be compacted to a minimum 95 percent density.

C. Special Slurry Backfill. For pipelines, which are laid in an already paved street, the Engineering Department may require the backfill above the pipe zone to be one sack slurry mix in lieu of

compacted soil backfill. The slurry mix shall have no less than one sack cement per cubic yard. Test results will be required to be given to the Engineering Inspector to verify the proper mix was provided.

3.13 ROADWAY MATERIALS

Pavement materials for resurfacing of trenches cut into existing pavement shall comply with the requirements of the City's *'Road and Bridge Design and Construction Standards'* adopted by the City Council and all subsequent amendments thereto (for information, Standard Drawing No. CW-50 contains portions of those requirements). Asphalt, aggregate base and aggregate sub-base specifications are those set by the latest published edition of City's *'Construction Specifications Manual'*.

3.14 CONCRETE MATERIAL

Approved concrete material shall be based on the 28-day compressive design strength and shall be chosen according to the City's *'Construction Specifications* Manual' and the following chart showing its intended use:

Class	Application	28-Day Compressive Strength (psi, min.)	Maximum Aggregate Size, (inch)	Slump Min.	Inches Max.
A	Walls, structures and reinforced encasements	4,000	1-1/2	3	6
B	Thrust blocks, non-reinforced pipe encasement, non-structural use	3,500	1-1/2	2	6
C	Pump-mix for abondoning lines	1,000	3/8	Adequate for pumping	Adequate for pumping

3.15 REINFORCING STEEL

A. Bar Reinforcement. Shall be Grade 40 minimum deformed bars conforming to ASTM A615, accurately placed securely in position. Where bars are spliced they shall be lapped at least twenty diameters or butt welded, except where otherwise shown on the plans.

B. Mesh Reinforcement. Mesh reinforcement shall conform to the requirements of ASTM A185; wire gauge and mesh dimensions will be as shown on the plans.

3.16 PAINTING

A. General. Please refer to the City's *'Construction Specifications* Manual' for full information on this item. Paints shall be delivered to the job site in original, unopened cans or packages bearing the brand name and manufacturer's name. Paints specified shall be used unless specific written approval is obtained from the City Engineer in advance to use other products.

B. Epoxy Coating. All valves shall be epoxy coated as indicated in the City's *'Construction Specifications Manual'*.

C. Plastic Film Wrap. This wrap shall be used around all buried valves, bolted flanges and other fittings. The polyethylene film shall be of virgin polyethylene as produced from DuPont Alathon resin and shall meet the requirements of ASTM Designation D 1248 for Type 1, Class A, Grade E-1, and shall have a flow rate or nominal melt index of 0.4 g/min. maximum.

The polyethylene film shall be 8 mils in thickness. The length shall be sufficient to firmly attach the film to the pipe on either side of the valve, flange or fitting. The following minimum flat sheet widths shall be used for the specified valve sizes:

Nominal Valve or Flange Size (inch)	Minimum Flat Sheet Width (inch)
4	24
6	24
8	24
10	30
12	36
16	48
18	48

At the contractor's option, tubular material may be purchased and cut with one side to fold out to the required width.

Tape for securing the polyethylene wrap shall be 2-inches wide adhesive tape such as Polyken No. 900 (Polyethylene), Scotchrap No. 5 (Polyvinyl), or approved equal. The tape shall be such that the adhesive will bond securely to both metal surfaces and polyethylene film.

3.17 MARKER POSTS

In easements or where required on the plans, marker or guard posts shall be installed per the requirements of the Engineering Department. Where no vehicular traffic could be anticipated, the posts shall be 4x4-inch by 5-foot, 6-inch dense structural grade redwood surfaced on all four sides and chamfered on the top. They shall be set into the ground 30-inches.

Where vehicular traffic could disturb the post or where its primary function is as a guard post, the material shall be 4-inch diameter, standard weight galvanized steel pipe, 5-foot, 6-inch in length. Set the post 30-inches below ground in a concrete base of not less than 18-inches in diameter. Unless otherwise approved, marker posts shall be painted "school bus yellow" per Section 3.16.

Marker posts are to be considered in areas of open terrain to mark pipeline locations, and especially above ground features or vaults. These markers are to be placed no more than 100-feet apart in open terrain to mark underground piping. Please refer to the ballard and sign detail in the *'Standard Drawings Manual'*.

SECTION 4.0

CONSTRUCTION

4.1 GENERAL REQUIREMENTS

This section describes the use of materials and workmanship to be employed in construction of the culinary water system. The developer/ engineer shall prepare such general and special specifications as are necessary to define the nature and location of the work, contractual arrangements, payment for work and any other matters concerning the owner or his contractor; these items are not discussed within the standards presented here.

A. Use of This Section. The construction section is intended to highlight the features of construction, which are deemed to be most significant. In any construction activity, the recommendations of the manufacturer of a product, especially where more stringent, should apply. Also, the omission of a particular practice, which is not considered to be a good construction technique common to the construction industry, should not be construed to mean that it is not required.

There are a number of construction activities, which pertain to all pipe types, and these will be presented first. Specialized activities unique to a particular pipe type will be covered separately.

Specific references that are incorporated into this section include:

1. AWWA C206 "Field Welding of Steel Pipes"
2. AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe, 4-inches through 12-inches"
3. AWWA Manual M11 "Steel Pipe - Design and Installation"
4. AWWA Manual M14 "Installation, Operation and Maintenance of Fire Hydrants"
5. AWWA Manual M23 "PVC Pipe - Design and Installation"
6. AWWA Manual M41 “Ductile-Iron Pipe and Fittings”

Finally, Section 3.0 of these Standards contains material descriptions and the developer/contractor should use that section along with this section and the respective standard drawing as a reference. Section 6.0 describes testing and disinfection procedures and requirements.

B Protection/Operation of Existing Water Systems. A primary concern of the Engineering and Public Works departments is the protection and operation of the existing water system. *No developer or contractor will be allowed to operate any existing water valves, or will not be allowed to shutdown of any portion of the City's water system without prior approval from a Public Works Department Water Superintendent.* The Public Works Department personnel will do all operation of valves in a planned shutdown. Any planned shutdown should be discussed at the preconstruction meeting or at least 3 working days in advance. Shutdowns will only be allowed if no other reasonable alternative exists. When shutdowns are required in a part of the City system, the City will expect evaluation of whether the shutdown should be done during the day or during the night. Contractor/developer economics shall be weighed less heavily in the decision than in the interruption and inconvenience to existing customers. Any shutdown shall involve a thorough notification plan for existing customers as well as the provision of bottled water, water tanks, etc., where appropriate.

C. Quality of Materials. Materials and equipment to be incorporated into the work shall be new. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used. When construction bids are received directly by the City such bids shall show the proposed pipe material and the manufacturer's name, if more than one type is allowed.

Contractor shall have at the job site or be able to supply upon request, certified copies of factory or laboratory test reports showing the strength characteristics of any materials used in the work. For all reinforced concrete work, the contractor shall furnish in advance of pouring concrete and, if requested, the mix design and calculated concrete strength as prepared by the concrete supplier.

D. Substitutions. Where articles or materials are specified by brand or trade name, alternate materials or articles equal to those specified may be approved provided the request for approval is in writing accompanied by supporting data, and 2 weeks review period is allowed to permit investigations. Unless substitutions have received prior approval, no deviation from the Standards will be allowed.

E. Quality of Workmanship. All work will be done by persons experienced in the specific work, under competent supervision and in a first class manner to the City's complete satisfaction. When work is being done directly for the City, the contractor in the proposal shall name each subcontractor and no substitutions will be permitted without prior approval.

F. Defective and Incomplete Work. Any defective materials or workmanship, which shall become evident within twelve months after field acceptance of completed work shall be replaced or repaired without cost to the City. Refusal of the contractor to correct defective work which is clearly his responsibility will be considered just cause for exclusion from performing future work to be connected to the City's system. Such exclusion does not impair the City's right to bring legal action to correct the deficiencies as well as to withhold release/exoneration of bonds held.

G. City Inspection, Field Acceptance and Guarantee Period. The Engineering Department is responsible for inspection of all excavation, pipe laying including appurtenant structures, trench backfill within the pipe zone and testing. All such work shall be available for inspection at all times. It will be the contractor's responsibility to provide 5 working days notice to the Engineering Department prior to the start of any work. Such notification will allow for scheduling a preconstruction meeting between interested parties. Failure to provide proper notification may delay the starting date since the Engineering Department may not be able to inspect the work and cannot accept any work for which inspection has not been arranged. It must be emphasized that the primary responsibility for compliance with all City requirements and standards rests with the developer and/or contractor. Any acceptance of a portion of the work by a construction inspector does not relieve the developer/contractor of this basic responsibility or liability.

Field acceptance is made by the inspector and will not coincide with the date of City Engineer acceptance of the work. However, the twelve month guarantee period for all work shall begin as of City Engineer acceptance. As mentioned in Section 4.I.E., any defective work discovered during this period shall be repaired or replaced and a new one year period will begin for that corrected work.

All holiday or weekend inspection will be subject to additional charges.

H. Public Relations. The contractor shall conduct its affairs in a manner which will lessen the disturbance to residents in the vicinity of the work. In this regard, standard working hours as specified in the Municipal Code (currently 7:00 a.m. to 7:00 p.m., Monday through Friday) shall be observed unless prior approval is received, which also includes City observed holidays. The job site shall be maintained in a condition which shall bring no discredit to the City or its personnel, and all affected private improvements shall be restored to at least their original condition.

4.2 PUBLIC WORKS DEPARTMENT NOTIFICATION

The Public Works Department requires that it be notified a minimum of 72 hours, or 3 working days, prior to the date when their services may be required for inspections, shut-downs, or changes in water system operation. This notification period will allow the Department to adequately prepare for the work being requested and allow residents to be notified of changes in their water service. This is a non-negotiable notification period.

4.3 PERMITS

The contractor is to review the City's *'Development Processing* Manual' to ensure that all permits have been applied for and approved.

4.4 SHIPMENT AND DELIVERY

All pipe shall be braced and stulled to prevent damage during shipment. Any damaged pipe or fittings delivered and unloaded at trench side shall be removed by the contractor from the work site. An Engineering inspector must be in attendance to inspect the pipe prior to its removal from the transport vehicle. The inspector must also be in attendance when the pipe is being offloaded from the transportation vehicle or the City may reject the pipe.

With steel ML & C pipe (mortar lined & coated), the offloading of the pipe as well as placement in the trench shall be done with straps at each end. Chains shall not be allowed to come into contact with the pipe.

4.5 CONSTRUCTION WATER

The developer/contractor shall not take unmetered water from the City's culinary water system. Instead, he or she will sign up at the Public Works Department for one or more construction meters after receipt of a deposit amount. The Developer/Contractor is to bring the construction meter in to the City's Finance Department, Utility Billing Division to have the meter read monthly. The developer/contractor is not to move the construction meters. Charges for construction water are covered by City Council Resolution. The developer/contractor is put on notice that unpaid invoices will result in removal of the construction meter.

4.6 SAFETY

Wherever the contractor is aware of unsafe operations, such should be discontinued immediately. Also, if the inspector is aware of such conditions and informs the contractor of it, it will be the contractor's responsibility to comply. In such instances, the advice shall not be construed as implying any City liability.

Essential to proper safety is adherence to all MUTCD work area traffic control requirements and as specified by the Engineering Department. 3M Diamond Grade sheeting, or an approved equivalent, is required for all construction signage.

Contractor is to submit to the City a copy of their annual OSHA permit and the letter notifying OSHA of their work on the City's project.

4.7 ALL OTHER CONSTRUCTION - CONSTRUCTION SPECIFICATIONS MANUAL AND STANDARD DRAWINGS MANUAL

All additional detail regarding clearing and grubbing, utilities construction, facilities and concrete removal, excavation and trenching, etc. are all contained in this manual. Details regarding standard drawings for all City related construction are contained in the *'Standard Drawings Manual'* for the City.

****

SECTION 5.0

ABANDONMENT

5.1 GENERAL

The design engineer is to indicate all existing water lines, structures or other facilities, which are to be abandoned, on the approved-for-construction drawings and in the project specifications. In general, abandoned water lines, which are in service, will be replaced with a parallel line of equal or larger size, and the design engineer is to demonstrate in any case, that the abandonment does not adversely affect the water system.

All abandonment and construction techniques shall be reviewed and approved by the Engineering Department review/project engineer and is to be discussed with the Engineering Department Inspector and approved, prior to any such work moving forward.

5.2 WATER LINES

Water lines to be abandoned shall be entirely filled by pumping concrete into them or they are to be removed. The pump mix shall be a mixture sufficiently workable for the purpose intended and shall be a concrete mix of 200-psi minimum. The design engineer is to show on the drawings the approximate number of cubic yards of concrete, which will be required for any particular reach or structure. Please refer to the City's *'Construction Specifications Manual'* for the technical specification regarding 'Abandonment'.

Water lines or other underground structures, which are to be under future buildings, are to be completely removed and the void properly compacted and tested. All existing asbestos cement pipe (ACP) encountered as part of the project is to be removed and properly disposed of. The Contractor is to certify to the proper disposal.

5.3 STRUCTURES

Structures associated with water facilities to be abandoned shall be removed by the contractor and given to the City, if salvageable. The Engineering Inspector will coordinate with the Public Works Department regarding their needs.

****

SECTION 6.0

TESTING AND DISINFECTING WATER MAINS

6.1 GENERAL

This section applies to new water main construction as well as the repair of or connection to existing water mains or other water facilities within the City.

All completed water lines, as well as the service lines and appurtenant structures will be tested by and at the expense of the contractor in the Engineering Department inspector's presence prior to field acceptance of the work. The contractor must correct all defects in workmanship or materials that become evident by inspection or testing at any time during the work. Testing will be done after the complete installation and compaction of all underground utilities, except as modified below.

6.2 HYDROSTATIC TESTING

A. General Requirements. In this section, the procedures used for testing cement mortar line and coated steel pipe will first be presented and then any differences for PVC or ductile iron pipe will be presented under a separate subsection. The purpose of the hydrostatic test is both to test for the ability of the pipeline to withstand pressure and to test for an acceptable leakage.

   After the pipe and all appurtenances have been laid and backfilled and compacted sufficiently for required restraint, they shall be subjected to a 2 hour hydrostatic pressure test. This test shall consist of subjecting the pipeline to a hydrostatic pressure of 50 psi greater than pressure class designation of the pipe, as shown on the plans. This value for the test pressure shall be used for most installations. However, where the operating pressure exceeds 125 psi as called out on the cover sheet of the drawing then the test pressure shall not be less than 125 psi for Class 150 pipe or 150 psi for Class 200 pipe. This test pressure shall be at the low point in the section being tested and shall be corrected to the elevation of the test gauge. Test locations shall be designated by the Engineering Department. The pressure test or retest shall be conducted any time after trench backfill compactive effort with heavy-duty compacting equipment having an overall weight in excess of 125 pounds.

   The maximum length of pipe to be included in any one test shall be not more than 2,500-feet or the distance between valves, whichever is less. The contractor shall provide suitable test bulkheads, blocking and fittings to permit such sectionalizing.

B. Preparation. The line shall be filled with water at least 24 hours prior to testing; this allows the pipe material to become saturated. During this period no pressure need be maintained on the line although some pressure, say 50 psi, will help to saturate the line and remove the air. While filling and immediately prior to testing, all air shall be expelled from the pipeline and whenever practical, water should be introduced from the low end of new system to facilitate the elimination of air in the pipeline prior to testing. Where air valves or other suitable outlets are not available for releasing air before applying the test, approved taps and fittings shall be installed and later securely plugged.

C. Procedure. The pipeline pressure shall be pumped up to the specified test pressure. Then the pumping shall be discontinued until the pressure in the line has dropped 10 to 15 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until 2 hours have elapsed from the time the specified test pressure was first applied. At the end of this period, the pressure shall be pumped up to the test pressure for the last time.

D. Leakage. Shall be considered as the total amount of water pumped into the pipeline during the 2-hour period, including the amount required in reaching the test pressure for the final time. If leakage is observed, repairs will be made and the 2-hour test will be restarted. Leakage shall not exceed the rates given in the Table below. If leakage exceeds this rate, the weak points shall be located and stopped, and all defective pipe, fittings, valves and other accessories discovered shall be removed and replaced with sound material and the test shall be repeated until the leakage test is passed. All perceptible leaks shall be similarly repaired.

TABLE 6-1
ALLOWABLE LEAKAGE FOR 4 HOURS PER 1,000-feet OF PIPE*

Pipe Size (inch)	Test @ 200 psi	Test @ 250 psi
8**	1.5 gal	1.7 gal
10**	1.6 gal	2.2 gal
12***	2.3 gal	2.6 gal
14***	2.7 gal	3.0 gal
16***	3.1 gal	3.4 gal
18***	3.5 gal	3.6 gal

*Based upon L = ND÷P-7400 where L = leakage in gal/hr, N = # joints, D = nominal diameter in inches and P = test pressure in psi. Of course, where the joints are welded, there should be no leakage allowance. Assumes 40-foot standard lengths of pipe.
** See E. below.
*** See F below.

E. Differences for PVC Pipe. The soaking period requirement is not as critical for PVC pipe since the walls do not absorb water and become saturated. Although AWWA Manual M23 recognizes a 2-hour leakage and pressure test, the City requires the same 4-hour test as for steel pipelines. Since the standard joints are 20-feet long instead of steel's 40-feet, the leakage allowance is twice that given in Table 6-1 (Source AWWA Manual M-23, page 76).

F. Differences for Ductile Iron Pipe. As with PVC pipe, the soaking period is not critical unless the pipe is mortar lined. Then a minimum 24-hour period is required. A 4 hour pressure test shall be used and the limits will be 2.2 times the values in Table 6-1 assuming lengths of pipe are 18-feet instead of the 40-feet the Table was set up for (Source AWWA C600). If using 20-foot lengths of pipe, the allowances are twice that in Table 6-1.

G. Possible Causes for Test Failure. For information, the following is provided:
1. Dirt or foreign material under the coupling gasket
2. Pipe not sufficiently covered in trench
3. Fittings and valves in test section not sufficiently blocked
4. Corporation cocks not open
5. Air in line (no relief valve)

6. Leakage through valve at end of test section
7. Valve bonnet plug leaking
8. Packing on valves and hydrants leaking
9. Test pump leaking. Check valve as well as gate valve
10. Curves not sufficiently thrust blocked
11. Testing too long a section of pipeline
12. Ruptured pipe - cracked, blown out
13. Broken couplings
14. Faulty accessory equipment - valves, fittings, hydrants, saddles, corporation stops, relief valves
15. Faulty test gauge
16. Test pump suction line drawing air
17. Fish-mouthed gasket

6. 3 ROLE OF FLUSHING

All mains shall be flushed with potable water after completion of construction and prior to disinfection. The primary purpose of this function is to remove the sediments and miscellaneous products of construction. After the lines have been chlorinated, they are to be flushed again per Section 6.5 – Final Flushing.

When the lines are placed into service or flushed adjacent to occupied houses or buildings, an effort should be made to visually observe and taste water from those homes or buildings (i.e., from a hose bib) or from a nearby fire hydrant to insure that no adverse tastes, odor or color problem has been created.

6.4 DISINFECTING WATER MAINS

A. General. This section presents essential procedures for disinfecting new and repaired water mains. All new mains shall be disinfected before they are placed in service. All water mains taken out of service for inspection, repair, or other activities that might lead to contamination of water shall be disinfected before they are returned to service. All work is to be done in conformance to AWWA C651.

B. Purpose. Disinfection consists of the following:
   1. Preventing contaminating materials from entering the water mains during construction or repair and removing, by flushing, materials that may have entered the main.
   2. Disinfecting any residual contamination that may remain.
   3. Determining the bacteriologic quality by laboratory test after disinfection.

C. Procedure. All mains shall be flushed with potable water after completion of construction and prior to disinfection. Included shall be service lines, fire hydrants, valves and all other accessories. The contractor shall provide a sufficient number of suitable outlets at the end(s) of the line(s) being sterilized, in addition to those required by the plans, to permit the main to be flushed with water at a velocity of at least 2.5-feet per second (fps) over its entire length. The outlets provided shall meet the requirements for fittings as specified for the type main constructed. Drainage facilities shall be constructed such that the water lines cannot be contaminated through the flushing outlet. It should also be noted that certain contaminants, such

as caked deposits, resist flushing at any velocity. Therefore, 2.5 fps should be considered a minimum.

TABLE 6-2
MINIMUM FLUSHING FLOW

Pipe Size (inch)	Flow Rate to Produce 2.5 fps
8	360 gpm
10	610 gpm
12	880 gpm
14	1,200 gpm
16	1,565 gpm
18	1,680 gpm

After flushing, the water mains shall be disinfected with one of the following:

1. Liquid chlorine (gas at atmospheric pressure)
2. Calcium hypochlorite - It is either granular or tabular in form and a chlorine water solution is prepared by dissolving the granules in water.
3. Sodium hypochlorite - Packaged in liquid form. Adding water makes a chlorine water solution.

Three different application methods are discussed in AWWA C651.

1. Continuous Feed Method. This is the standard method in the City and should be used unless one of the other two methods is approved because this method is not practical. In the continuous feed method, water dosed with chlorine is fed continuously into line at a constant rate such that the chlorine concentration in the water in the pipe is maintained at minimum 50 mg/L available chlorine. The chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall then be retained in the main for a minimum 24-hour period during which time all valves and hydrants shall be operated in order to disinfect the appurtenances. At the end of the 24-hour period, the chlorine residual shall be no less than 24 mg/L throughout the main. The following Table should be useful in determining the amount of chlorine:

TABLE 6-3*
CHLORINE REQUIRED TO PRODUCE 50 MG/L CONCENTRATION
IN 100-feet (30.5M) OF PIPE

Pipe Size (inch)	100-Percent Chlorine	1-Percent Chlorine Solution
8	0.108 lb	1.30 gal
10	0.170 lb	2.88 gal
12	0.240 lb	2.88 gal

*g = grams; L = Liters; Source is AWWA C651

2. Slug Method. This method is generally not approved. It involves dosing the line with a moving slug of no less than 300 mg/L of chlorine and maintaining that concentration in any one section for at least 3 hours.

3. Tablet Method. This method is generally only used in instances such as a fire line where the continuous feed method may not be practical. The tablets shall be placed in the top of the pipe and care must be taken to fill the line at no more than 1-foot/second. AWWA C601 lists the number of tablets per section of pipe required to achieve a dose of 50 mg/l. For example, an 8-inch pipe, 13-feet long requires 2 tablets per section; whereas, a 12-inch pipe requires 5 per section.

6.5 FINAL FLUSHING

A. Clearing the main of heavily chlorinated water. After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main. This shall be done until chlorine measurements show that the concentration in the water leaving the main is less than one mg/l.

B. Disposing of heavily chlorinated water. Water discharged is to be dechlorinated as it leaves the City's water system. The Contractor is not to allow the heavily chlorinated water used for disinfecting of City was facilities to be discharged into the environment without properly dechlorinating the water and the City's Inspector is to be present as the water system is being flushed. The environment into which the chlorinated water is to be discharged shall be inspected. If, in the opinion of the Engineering Department inspector, there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residential remaining in the water. Federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

6.6 BACTERIOLOGICAL TESTS

A. General. After final flushing and before the main is placed in service, the Public Works Department will sample the water and test for bacteriologic quality. Tests will not be allowed after 12:00 p.m. on Thursdays, or on Fridays, as there is not sufficient time to receive the test results before the weekend. As-built drawings are required to be given to the Engineering Inspector, with a copy to the Water Superintendent of the Public Works Department, as part of the bacteriological testing to ensure that an appropriate location can be determined for the test and to ensure that all of the water system has been properly flushed prior to testing.

B. Standard conditions. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200-feet of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and shall show the absence of coliform organisms.

C. Special conditions. If trench water has entered the new main during construction or, if in the opinion of the Engineering Department inspector, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200-feet and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 24 hours after final flushing has been completed.

D. Sampling procedure. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by *Standard Method for Examination of Water and Wastewater*. No hoses shall be used in the collection of samples.

E. Record of Compliance. The record of compliance shall be the bacteriological test results certifying the water sampled from the new water main to be free of coliform bacteria contamination, and to be equal to or better than the bacteriological water quality of the distribution system. The Public Works Department is responsible for conducting the bacteriological testing for the project. Once the Public Works Department receives the results, they will send a copy of the test results to the Engineering Department for their records and will also transmit a copy to the State of Utah, Division of Drinking Water.

6.7 REDISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological results, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.

6.8 FINAL CONNECTION TO EXISTING MAINS

Water mains and appurtenances must be completely installed, flushed and disinfected and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Sanitary construction practices must be followed during installation of the final connection, so that there is no contamination of the new or existing water main with foreign material or groundwater.

A. Connections equal to or less than one pipe length. The new pipe, fittings, and valve(s) required for the connection may be spray-disinfected or swabbed with a minimum one percent solution of chlorine just prior to being installed, if the total length of connection from the end of a new main to the existing main is equal to or less than 18-feet.

B. Connection greater than one pipe length. The pipe required for the connection must be set up aboveground, disinfected, and bacteriological samples taken, as described above if the total length of connection from the end of a new main to the existing main is greater than 18-feet. After satisfactory bacteriological sample results have been received for this ‘predisinfected’ pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time that satisfactory bacteriological sample results are received and the time the connection piping is installed, the ends of this piping must be sealed with plastic wraps or watertight plugs or caps.

6.9 DISINFECTION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water present little danger of contamination and require no disinfection.

A. Trench treatment. When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby wastewater lines. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

B. Swabbing with hypochlorite solution. The interior of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.

C. Flushing. Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

D. Slug chlorination. When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described previously in this Section, except that the dose may be increased as much as 300 mg/L and the contact time reduced to as little as 15 minutes. After chlorination, flushing shall be resumed and continued until discolored water is eliminated, and the water is free from noticeable chlorine odor.

E. Sampling. Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, then the City who will determine corrective action shall evaluate the situation, and daily sampling shall be continued until two consecutive negative samples are recorded.

6.10 SPECIAL PROCEDURE FOR CAULKED TAPPING SLEEVES

Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned and wiped down with a one percent hypochlorite solution. The interior surface of the sleeve, the annulus and other portions of the sleeve, which might come in contact with drinking water, shall also be lightly dusted with calcium hypochlorite powder prior to its installation.

6.11 TESTING FOR FIRE FLOW OR PRESSURE

In selected cases, the Engineering Department may require a check of the fire flow or pressure following construction. In such instances, the developer/contractor shall assist either the Public Works and Engineering departments or the City of West Jordan Fire Department, as appropriate.

****

SECTION 7.0

CROSS CONNECTIONS AND BACKFLOW PREVENTION

7.1 GENERAL

According to AWWA definition, "cross connection means any connection or structural arrangement between a public or a consumer's potable water system and any non-potable source or system through which backflow can occur. Bypass arrangements, jumper connections, removable sections, swivel or change-over assemblies and other temporary or permanent assemblies through which, or because of which, backflow can occur are considered cross connections. "

Cross connections may be regarded as direct or indirect. A direct connection is an arrangement whereby a safe water system is physically joined to a system containing unsafe water, wastewater or other waste. An indirect connection is an arrangement whereby unsafe water in a system may be blown, pulled by vacuum, or otherwise diverted into a safe water system.

To understand cross connection and backflow prevention, several other terms need definition. "Backflow" is generally defined as the flow of any foreign liquids, gases or other substances into the distribution pipelines of a potable supply of water from any other source or sources than the intended one. For backflow to occur, two conditions must be present: (1) a link must exist between the potable and the nonpotable system; (2) the resultant flow produced by the differential pressure must be toward the potable system. If both systems are at pressures greater than atmospheric (positive pressure), backflow due to "back-pressure" occurs. A pump, elevated tank or boiler can create a backpressure that is greater than the pressure in the potable system.

If the potable system is at a pressure less than atmospheric (negative pressure), the atmospheric pressure on the foreign liquid will force it toward the partial vacuum and "backsiphonage" occurs. A more explicit term for backflow when subatmospheric pressure exists is back-siphonage. Back-siphonage is the drawing up, or siphoning, of a foreign liquid into a potable water system.

7.2 JURISDICTION, AUTHORITY, REFERENCES

The City of West Jordan’s requirements for backflow prevention are covered in Title 90 of the Municipal Code, and by reference in that section, the City has adopted the regulations of the Department of Public Health of the State, Title 17 of the Utah Administrative Code. The developer/contractor should be familiar with the applicable sections of the Municipal Code.

The Water Superintendent for the City is an individual within the Public Works Department, who is responsible for ensuring that the assemblies are properly installed, maintained and tested. The various protective assemblies are to be installed, maintained and tested by and at the expense of the property owner.

A source of general information is a booklet titled “Recommended Practice for Backflow Prevention and Cross-Connection Control (M14)” as published by AWWA.

7.3 TYPES OF BACKFLOW PREVENTION

As described below, there are several different types of protection assemblies. The "Reduced Pressure Principle Assembly" and "Double Check Valve" are used to prevent backflow and the former also prevents back-siphonage. The "Air Gap" and "Pressure or Atmospheric Vacuum Breakers" are used for prevention of backsiphonage. Descriptions of each assembly is as follows:

A. Reduced Pressure Principle Assembly (RP): Commonly referred to as an RP or RPP, this assembly consists of two independently acting check valves, together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve reduces the supply pressure at a predetermined amount so that during normal flow, and at cessation of normal flow, the pressure between the two check valves shall be lower than the supply pressure. If either check valve leaks, the relief valve will discharge to atmosphere. This will maintain the pressure in the zone between the two check valves lower than the supply pressure. The unit also has two shutoff valves (one upstream and one downstream of the checks) and properly located test cocks for field-testing.

B. Double Check Valve: The double check valve assembly is composed of two single, independently acting check valves. The unit also has two tightly closing shutoff valves located at each end of the assembly and four test cocks for the testing of the check valves.

   The Double Check Detector Valve is specifically designed for use on fire protection system pipeline installations. The assembly protects potable water supplies from possible contamination through cross connection to fire service pipelines by preventing the return of "degraded fire system waters" into street supply mains which could happen when a Fire Department "pumper" connects to the system. This unit is also used to detect leakage or unauthorized use of water from fire system lines, which usage is immediately registered on the low flow meter on the unit.

C. Air Gap: An air gap is a physical separation between the free flowing discharge end of a potable pipeline and an open or non-pressure receiving vessel. To have an acceptable air gap, the end of the discharge pipe has to be at least twice the diameter of the pipe above the topmost rim of the receiving vessel, but in no case can this distance be less than one inch.

   This may seem to be the simplest, most effective and least expensive type of protection. However, the chance for future cross connections, the cost of additional pumps to pressurize the system often makes this an expensive protection system.

D. Pressure Vacuum Breaker: The pressure vacuum breaker (or PVB for short) is an assembly that contains within a single body, a single loaded check valve and a loaded air-opening valve, which opens to admit air whenever the pressure within the body of the assembly approaches atmospheric. The body of the assembly has two tight closing shutoff valves and it is fitted with test cocks, appropriately placed, for testing the assembly.

E. Atmospheric Vacuum Breaker: An atmospheric vacuum breaker which has a moving element inside, which during flow prevents water from spilling from the assembly and during cessation of flow, drops down to provide a vent opening. This assembly should not remain under pressure for long durations and it cannot have any shutoff valve downstream from it.

7.4 REQUIREMENTS

Title 90 of the Municipal Code lists requirements indicating locations where the various assemblies are to be installed. In addition, the following is provided:

A. Reduced Pressure Principle Assembly (RP).

General: Use where cross connections are known or probably will exist which cannot be eliminated and where the degree of severity is judged by the Water Superintendent to warrant more than a double check valve.

Specific Examples:

1. Water service to industrial or commercial facilities where chemicals are used within the premises, which could potentially be harmful to the City system.
2. Water service to hospitals and doctors' offices for humans and animals.
3. Irrigation systems such as median or park strips along streets or landscape areas within projects, which are subject to backpressure.
4. Fire sprinkler systems using chemical additives.
5. Water service to mortuaries.

Use where there is an auxiliary water source to the premises handled in separate piping systems.

B. Double Check Valve.

General: Use where there is an auxiliary water source to the premises handled in separate piping systems. Use where a cross connection possibly exists where the substance would be objectionable, but not necessarily hazardous to health.

Specific Examples:

1. Service connections to homes or buildings, which are also furnished water from wells.
2. Water service to buildings, which use products, which might impart an objectionable taste, odor or color but would not be hazardous.
3. Food processing plants.
4. Community or project swimming pools.

C. Double Check Detector Valve:

General: Use where there is no other meter between the water source and the building such as a fire service line for a sprinklered building. This may be used as long as there is no chemical injection into the sprinkler system.

Specific Example:

1. Fire service line for sprinklered building.

D. Air Gap.

General: Use where there is a connection to any premise using a dangerous or toxic substance in toxic concentrations. The air gap shall be located as close as practicable to the service cock and all piping between the service cock and receiving tank shall be entirely visible. If these conditions can't be met, then use an RP assembly as directed by the Water Superintendent.
Specific Example:

1. A commercial installation where an air gap is approved.

E. Pressure Vacuum Breaker (PVB) Assembly.

General: This unit can only be used where there can be no backpressure - only where there can be back-siphonage. The unit can have shutoff valves downstream of the assembly. The PVB must be installed at least 12-inch above the highest outlet or tank.

Specific Example:

1. Lawn irrigation system where outlets are situated well below the assemblies and where there may be a shutoff valve downstream (or past) the assembly such as a hose bib.

F. Atmospheric Vacuum Breaker Device.

General: As with the pressure type, there should be no possibility of backpressure. This assembly cannot have any shutoff valves downstream of the assembly. It must be installed at least 6-inch above the highest outlet or tank.

Specific Example:

1. Typical residential sprinkler system.

7.5 INSTALLATION

A. General: In terms of installation, there is an essential difference between "service" and "internal" protection. Service protection is a backflow assembly installed outside of tile building, but on the customer side of the meter (with the exception of the detector check valve, which doesn't have a meter). These assemblies are specifically intended to protect the City water system regardless of other protective assemblies inside the building.

Internal protection assemblies are installed within the building or facility.

B. Service Protection Assemblies. The owner/developer submits drawings of the building to the Building Department, which may require an outside or service protection assembly. Also, the Public Works Department's Cross Connection Control officer may require service protection after a survey of the facility once under construction or occupied unless internal cross connections are abated to the satisfaction of the Cross-Connection Officer. In either case, the owner/developer should make arrangements with the Cross Connection Control officer for inspection.
Once installed, the assembly will be recorded on Public Works Department records and tested.

C. Internal Protection. The installation of these assemblies falls under the jurisdiction of the Building Division and as approved to the satisfaction of the Engineering Department.

7.6 APPROVED ASSEMBLIES AND DEVICES

The listing of the current approved backflow prevention assemblies and devices is issued by the Utah Department of Environmental Quality, Division of Drinking Water and is available through their office. The City's Water Superintendent may also be consulted for the currently approved list.

Standard Drawing Nos. CW-240 through CW-280 covers typical installations and should be consulted.

7.7 TESTING AND MAINTENANCE

All backflow prevention assemblies are to be tested annually by a certified tester with repairs or maintenance as needed. Owners of all assemblies that have been recorded on Public Works Department records will be notified yearly of this responsibility and a form must be completed by the tester and returned to the Public Works Department.

****

SECTION 8.0

RESERVOIRS AND PUMPING STATIONS

8.1 GENERAL

Reservoirs, or storage tanks, work in conjunction with the pipeline and pumping stations to supply water for both the domestic and fire fighting purposes. These facilities must be designed for reliability. They must also be designed to be aesthetically pleasing with emphasis on minimization of their visibility, particularly with regards to any visual corridor. This section is not a design document. Rather, it is a limited discussion of a few key points.

8.2 RESERVOIR STORAGE

Reservoir storage is made up of two components; emergency storage and regulatory storage. Emergency storage includes a sufficient volume to supply the highest anticipated fire flow within a particular zone. Regulatory storage is the volume required to supply the withdrawals from the system, which exceed the average rate of water production (or inflow).

For purposes of design, the City Standard as originally presented in the October 2003 Master Plan is for the following:

Emergency storage maximum fire flow for specified duration.

Regulatory storage 80 percent of the maximum daily demand of the system.

Total storage = Sum of emergency + regulatory storage.

The emergency storage can be calculated by identifying the single highest fire flow demand in accordance with the guidelines of the City of West Jordan Fire Department.

Regulatory storage is a function of the ultimate population served and the conversion of average uses to maximum daily uses using Table 2-8.

8.3 RESERVOIR STRUCTURAL DESIGN

Reservoirs (tanks) must be designed to withstand all expected forces internal pressure, wind load, earthquake load, the dead load of the structure and the live loads of the water when completely filled.

For steel tanks, AWWA D100 is the applicable standard for the welded tanks and AWWA D103 is the applicable standard for factory coated bolted steel tanks.

Reinforced concrete or prestressed concrete reservoirs are to be designed to the standards of the American Concrete Institute (ACI).

8.4 GENERAL RESERVOIR DESIGN PARAMETERS

A. Wherever possible, the entire reservoir shall be fully located on a pad, which only involves cut grading. An alternate is to locate the reservoir on a pad, which at all locations has at least 10-feet of compacted fill.

B. All new steel reservoirs shall have ring beams.

C. Unless otherwise determined, all steel reservoirs shall have a knuckle corner between the shell and roof.

D. All aboveground reservoirs shall have a "dog house" or flush cleanout in addition to an access manway.

E. All reservoirs shall have an altitude valve with a bypass.

F. All new reservoirs shall have ladders with safety cages.

8.5 PUMPING STATION DESIGN

Pumping stations shall be designed with at least two pumps so that at least one unit can be considered a standby unit. Furthermore, in any station, the required pumping capacity must be met with one pump of the largest size out of service.

Each pump station shall be capable of supplying the maximum daily flow plus that flow necessary to replace one full fire flow storage in a period of 72 hours (3 days). Each pump station will have one standby pump with a capacity of the largest undivided pump at that station. At every pump station it is required that a control system be set up so that each pump operates approximately the same amount of time in any given period. Pump motors shall be of the high efficiency variety wherever it can be shown that the extra cost for the motor is less than the present value of 15 years of reduced energy costs.

8.6 SYSTEM CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

All reservoir levels and key pumping station parameters (i.e., pump run, pump call, pump off, flow rate, pump hours, valve malfunctions, etc.) are telemetered to the Public Works Department office which houses the SCADA computer and central control.

****

APPENDIX C

WATER SYSTEM MASTER PLAN
Executive Summary
(To be Prepared)

APPENDIX D

CULINARY WATER ORDINANCE

APPENDIX E

STANDARD QUIT-CLAIM DEED
AND EASEMENT FORMS